



Real-Time Performance Monitoring Services



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About the Documentation

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- Documentation Conventions on page ix
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Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at <http://www.juniper.net/techpubs/>.

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Using the Examples in This Manual

If you want to use the examples in this manual, you can use the **load merge** or the **load merge relative** command. These commands cause the software to merge the incoming configuration into the current candidate configuration. The example does not become active until you commit the candidate configuration.

If the example configuration contains the top level of the hierarchy (or multiple hierarchies), the example is a *full example*. In this case, use the **load merge** command.

If the example configuration does not start at the top level of the hierarchy, the example is a *snippet*. In this case, use the **load merge relative** command. These procedures are described in the following sections.

Merging a Full Example

To merge a full example, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration example into a text file, save the file with a name, and copy the file to a directory on your routing platform.

For example, copy the following configuration to a file and name the file **ex-script.conf**. Copy the **ex-script.conf** file to the **/var/tmp** directory on your routing platform.

```
system {
  scripts {
    commit {
      file ex-script.xsl;
    }
  }
}
interfaces {
  fxp0 {
    disable;
    unit 0 {
      family inet {
        address 10.0.0.1/24;
      }
    }
  }
}
```

2. Merge the contents of the file into your routing platform configuration by issuing the **load merge** configuration mode command:

```
[edit]
user@host# load merge /var/tmp/ex-script.conf
load complete
```

Merging a Snippet

To merge a snippet, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration snippet into a text file, save the file with a name, and copy the file to a directory on your routing platform.

For example, copy the following snippet to a file and name the file **ex-script-snippet.conf**. Copy the **ex-script-snippet.conf** file to the **/var/tmp** directory on your routing platform.

```
commit {
  file ex-script-snippet.xsl; }
```

2. Move to the hierarchy level that is relevant for this snippet by issuing the following configuration mode command:

```
[edit]
user@host# edit system scripts
[edit system scripts]
```


3. Merge the contents of the file into your routing platform configuration by issuing the **load merge relative** configuration mode command:

```
[edit system scripts]
user@host# load merge relative /var/tmp/ex-script-snippet.conf
load complete
```

For more information about the **load** command, see the CLI User Guide.

Documentation Conventions

Table 1 on page ix defines notice icons used in this guide.

Table 1: Notice Icons





Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.

Table 2 on page ix defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the configure command: user@host> configure
Fixed-width text like this	Represents output that appears on the terminal screen.	user@host> show chassis alarms No alarms currently active
<i>Italic text like this</i>	<ul style="list-style-type: none"> Introduces or emphasizes important new terms. Identifies book names. Identifies RFC and Internet draft titles. 	<ul style="list-style-type: none"> A policy <i>term</i> is a named structure that defines match conditions and actions. <i>Junos OS System Basics Configuration Guide</i> RFC 1997, <i>BGP Communities Attribute</i>

Table 2: Text and Syntax Conventions (*continued*)

Convention	Description	Examples
<i>Italic text like this</i>	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# set system domain-name <i>domain-name</i>
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none"> To configure a stub area, include the stub statement at the [edit protocols ospf area area-id] hierarchy level. The console port is labeled CONSOLE.
< > (angle brackets)	Enclose optional keywords or variables.	stub <default-metric <i>metric</i> >;
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	broadcast multicast (<i>string1</i> <i>string2</i> <i>string3</i>)
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	rsvp { # Required for dynamic MPLS only
[] (square brackets)	Enclose a variable for which you can substitute one or more values.	community name members [<i>community-ids</i>]
Indentation and braces ({ })	Identify a level in the configuration hierarchy.	[edit] routing-options { static { route default { nexthop <i>address</i> ; retain; } } }
;(semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
J-Web GUI Conventions		
Bold text like this	Represents J-Web graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none"> In the Logical Interfaces box, select All Interfaces. To cancel the configuration, click Cancel.
> (bold right angle bracket)	Separates levels in a hierarchy of J-Web selections.	In the configuration editor hierarchy, select Protocols>Ospf .

Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can send your comments to techpubs-comments@juniper.net, or fill out the documentation feedback form at

<https://www.juniper.net/cgi-bin/docbugreport/> . If you are using e-mail, be sure to include the following information with your comments:

- Document or topic name
- URL or page number
- Software release version (if applicable)

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Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or JNASC support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at <http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf>.
- Product warranties—For product warranty information, visit <http://www.juniper.net/support/warranty/>.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

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- Search for known bugs: <http://www2.juniper.net/kb/>
- Find product documentation: <http://www.juniper.net/techpubs/>
- Find solutions and answer questions using our Knowledge Base: <http://kb.juniper.net/>
- Download the latest versions of software and review release notes: <http://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications: <https://www.juniper.net/alerts/>
- Join and participate in the Juniper Networks Community Forum: <http://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Management tool: <http://www.juniper.net/cm/>

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: <https://tools.juniper.net/SerialNumberEntitlementSearch/>

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at <http://www.juniper.net/cm/>.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see <http://www.juniper.net/support/requesting-support.html>.

PART 1

Overview

- [RPM Services on page 3](#)

CHAPTER 1

RPM Services

- [Real-Time Performance Monitoring Services Overview on page 3](#)

Real-Time Performance Monitoring Services Overview

Real-Time Performance Monitoring (RPM) enables you to configure active probes to track and monitor traffic. Probes collect packets per destination and per application, including PING Internet Control Message Protocol (ICMP) packets, User Datagram Protocol and Transmission Control Protocol (UDP/TCP) packets with user-configured ports, user-configured Differentiated Services code point (DSCP) type-of-service (ToS) packets, and Hypertext Transfer Protocol (HTTP) packets. RPM provides Management Information Base (MIB) support with extensions for RFC 2925, *Definitions of Managed Objects for Remote Ping, Traceroute, and Lookup Operations*.

You can also configure RPM services to determine automatically whether a path exists between a host router and its configured BGP neighbors. You can view the results of the discovery using an SNMP client. Results are stored in **pingResultsTable**, **jnxPingResultsTable**, **jnxPingProbeHistoryTable**, and **pingProbeHistoryTable**.

Probe configuration and probe results are supported by the command-line interface (CLI) and SNMP.

The following probe types are supported with DSCP marking:

- ICMP echo
- ICMP timestamp
- HTTP get (not available for BGP RPM services)
- UDP echo
- TCP connection
- UDP timestamp

With probes, you can monitor the following:

- Minimum round-trip time
- Maximum round-trip time
- Average round-trip time

- Standard deviation of the round-trip time
- Jitter of the round-trip time—The difference between the minimum and maximum round-trip time

One-way measurements for ICMP timestamp probes include the following:

- Minimum, maximum, standard deviation, and jitter measurements for egress and ingress times
- Number of probes sent
- Number of probe responses received
- Percentage of lost probes

You can configure the following RPM thresholds:

- Round-trip time
- Ingress/egress delay
- Standard deviation
- Jitter
- Successive lost probes
- Total lost probes (per test)

Support is also implemented for user-configured CoS classifiers and for prioritization of RPM packets over regular data packets received on an input interface.

PART 2

Configuration

- [Configuration Tasks on page 7](#)
- [Examples on page 19](#)
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CHAPTER 2

Configuration Tasks

- [Configuring BGP Neighbor Discovery Through RPM on page 7](#)
- [Configuring RPM Probes on page 9](#)
- [Configuring RPM Receiver Servers on page 13](#)
- [Limiting the Number of Concurrent RPM Probes on page 13](#)
- [Configuring RPM Timestamping on page 13](#)
- [Configuring TWAMP on page 16](#)

Configuring BGP Neighbor Discovery Through RPM

BGP neighbors can be configured at the following hierarchy levels:

- **[edit protocols bgp group *group-name*]**—Default logical system and default routing instance.
- **[edit routing-instances *instance-name* protocols bgp group *group-name*]**—Default logical system with a specified routing instance.
- **[edit logical-systems *logical-system-name* protocols bgp group *group-name*]**—Configured logical system and default routing instance.
- **[edit logical-systems *logical-system-name* routing-instances *instance-name* protocols bgp group *group-name*]**—Configured logical system with a specified routing instance.

When you configure BGP neighbor discovery through RPM, if you do not specify a logical system, the RPM probe applies to configured BGP neighbors for all logical systems. If you do not specify a routing instance, the RPM probe applies to configured BGP neighbors in all routing instances. You can explicitly configure RPM probes to apply only to the default logical system, the default routing instance, or to a particular logical system or routing instance.

To configure BGP neighbor discovery through RPM, configure the probe properties at the **[edit services rpm bgp]** hierarchy:

```
data-fill data;  
data-size size;  
destination-port port;  
history-size size;  
logical-system logical-system-name [routing-instances routing-instance-name];
```

moving-average-size *number*;
probe-count *count*;
probe-interval *seconds*;
probe-type *type*;
routing-instances *instance-name*;
test-interval *interval*;

- To specify the contents of the data portion of Internet Control Message Protocol (ICMP) probes, include the **data-fill** statement at the **[edit services rpm bgp]** hierarchy level. The value can be a hexadecimal value.
- To specify the size of the data portion of ICMP probes, include the **data-size** statement at the **[edit services rpm bgp]** hierarchy level. The size can be from 0 through 65507 and the default size is 0.
- To specify the User Datagram Protocol (UDP) port or Transmission Control Protocol (TCP) port to which the probe is sent, include the **destination-port** statement at the **[edit services rpm bgp]** hierarchy level. The **destination-port** statement is used only for the UDP and TCP probe types. The value can be 7 or from 49160 through 65535.
- To specify the number of stored history entries, include the **history-size** statement at the **[edit services rpm bgp]** hierarchy level. Specify a value from 0 to 255. The default is 50.
- To specify the logical system used by ICMP probes, include the **logical-system** *logical-system-name* statement at the **[edit services rpm bgp]** hierarchy level. If you do not specify a logical system, the RPM probe applies to configured BGP neighbors for all logical systems. To apply the probe to only the default logical system, you must set the value of *logical-system-name* to null.
- To specify a number of samples for making statistical calculations, include the **moving-average-size** statement at the **[edit services rpm bgp]** hierarchy level. Specify a value from 0 through 255.
- To specify the number of probes within a test, include the **probe-count** statement at the **[edit services rpm bgp]** hierarchy level. Specify a value from 1 through 15.
- To specify the time to wait between sending packets, include the **probe-interval** statement at the **[edit services rpm bgp]** hierarchy level. Specify a value from 1 through 255 seconds.
- To specify the packet and protocol contents of the probe, include the **probe-type** statement at the **[edit services rpm bgp]** hierarchy level. The following probe types are supported:
 - **icmp-ping**—Sends ICMP echo requests to a target address.
 - **icmp-ping-timestamp**—Sends ICMP timestamp requests to a target address.
 - **tcp-ping**—Sends TCP packets to a target.
 - **udp-ping**—Sends UDP packets to a target.
 - **udp-ping-timestamp**—Sends UDP timestamp requests to a target address.



NOTE: Some probe types require additional parameters to be configured. For example, when you specify the `tcp-ping` or `udp-ping` option, you must configure the destination port using the `destination-port port` statement. The `udp-ping-timestamp` option requires a minimum data size of 12; any smaller data size results in a commit error. The minimum data size for TCP probe packets is 1.

- To specify the routing instance used by ICMP probes, include the **routing-instances** statement at the **[edit services rpm bgp]** hierarchy level. The default routing instance is Internet routing table `inet.0`. If you do not specify a routing instance, the RPM probe applies to configured BGP neighbors in all routing instances. To apply the RPM probe to only the default routing instance, you must explicitly set the value of *instance-name* to **default**.
- To specify the time to wait between tests, include the **test-interval** statement at the **[edit services bgp probe]** hierarchy level. Specify a value from **0** through **86400** seconds.

Configuring RPM Probes

The owner name and test name identifiers of an RPM probe together represent a single RPM configuration instance. When you specify the test name, you also can configure the test parameters.

To configure the probe owner, test name, and test parameters, include the **probe** statement at the **[edit services rpm]** hierarchy level:

```
probe owner {
  test test-name {
    data-fill data;
    data-size size;
    destination-interface interface-name;
    destination-port port;
    dscp-code-point dscp-bits;
    hardware-timestamp;
    history-size size;
    moving-average-size number;
    one-way-hardware-timestamp;
    probe-count count;
    probe-interval seconds;
    probe-type type;
    routing-instance instance-name;
    source-address address;
    target (url url | address address);
    test-interval interval;
    thresholds thresholds;
    traps traps;
  }
}
```

- To specify a probe owner, include the **probe** statement at the **[edit services rpm]** hierarchy level. The probe owner identifier can be up to 32 characters in length.
- To specify a test name, include the **test** statement at the **[edit services rpm probe owner]** hierarchy level. The test name identifier can be up to 32 characters in length. A test represents the range of probes over which the standard deviation, average, and jitter are calculated.
- To specify the contents of the data portion of Internet Control Message Protocol (ICMP) probes, include the **data-fill** statement at the **[edit services rpm probe owner]** hierarchy level. The value can be a hexadecimal value. The **data-fill** statement is not valid with the **http-get** or **http-metadata-get** probe types.
- To specify the size of the data portion of ICMP probes, include the **data-size** statement at the **[edit services rpm probe owner]** hierarchy level. The size can be from 0 through 65507 and the default size is 0. The **data-size** statement is not valid with the **http-get** or **http-metadata-get** probe types.



NOTE: If you configure the hardware timestamp feature (see [“Configuring RPM Timestamping” on page 13](#)), the **data-size** default value is 32 bytes and 32 is the minimum value for explicit configuration. The UDP timestamp probe type is an exception; it requires a minimum data size of 44 bytes.

- On M Series and T Series routers, you configure the **destination-interface** statement to enable hardware timestamping of RPM probe packets. You specify an **sp-** interface to have the AS or Multiservices PIC add the hardware timestamps; for more information, see the topics in Real-Time Performance Monitoring Services. You can also include the **one-way-hardware-timestamp** statement to enable one-way delay and jitter measurements.
- To specify the User Datagram Protocol (UDP) port or Transmission Control Protocol (TCP) port to which the probe is sent, include the **destination-port** statement at the **[edit services rpm probe owner test test-name]** hierarchy level. The **destination-port** statement is used only for the UDP and TCP probe types. The value can be 7 or from 49160 through 65535.
- To specify the value of the Differentiated Services (DiffServ) field within the IP header, include the **dscp-code-point** statement at the **[edit services rpm probe owner test test-name]** hierarchy level. The DiffServ code point (DSCP) bits value can be set to a valid 6-bit pattern; for example, 001111. It also can be set using an alias configured at the **[edit class-of-service code-point-aliases dscp]** hierarchy level. The default is 000000.
- To specify the number of stored history entries, include the **history-size** statement at the **[edit services rpm probe owner test test-name]** hierarchy level. Specify a value from 0 to 255. The default is 50.
- To specify a number of samples for making statistical calculations, include the **moving-average-size** statement at the **[edit services rpm probe owner test test-name]** hierarchy level. Specify a value from 0 through 255.

- To specify the number of probes within a test, include the **probe-count** statement at the **[edit services rpm probe owner test test-name]** hierarchy level. Specify a value from 1 through 15.
- To specify the time to wait between sending packets, include the **probe-interval** statement at the **[edit services rpm probe owner test test-name]** hierarchy level. Specify a value from 1 through 255 seconds.
- To specify the packet and protocol contents of the probe, include the **probe-type** statement at the **[edit services rpm probe owner test test-name]** hierarchy level. The following probe types are supported:
 - **http-get**—Sends a Hypertext Transfer Protocol (HTTP) get request to a target URL.
 - **http-metadata-get**—Sends an HTTP get request for metadata to a target URL.
 - **icmp-ping**—Sends ICMP echo requests to a target address.
 - **icmp-ping-timestamp**—Sends ICMP timestamp requests to a target address.
 - **tcp-ping**—Sends TCP packets to a target.
 - **udp-ping**—Sends UDP packets to a target.
 - **udp-ping-timestamp**—Sends UDP timestamp requests to a target address.

The following probe types support hardware timestamping of probe packets: **icmp-ping**, **icmp-ping-timestamp**, **udp-ping**, **udp-ping-timestamp**.



NOTE: Some probe types require additional parameters to be configured. For example, when you specify the **tcp-ping** or **udp-ping** option, you must configure the destination port using the **destination-port** statement. The **udp-ping-timestamp** option requires a minimum data size of 12; any smaller data size results in a commit error. The minimum data size for TCP probe packets is 1.

- To specify the routing instance used by ICMP probes, include the **routing-instance** statement at the **[edit services rpm probe owner test test-name]** hierarchy level. The default routing instance is Internet routing table **inet.0**.
- To specify the source IP address used for ICMP probes, include the **source-address** statement at the **[edit services rpm probe owner test test-name]** hierarchy level. If the source IP address is not one of the router's assigned addresses, the packet will use the outgoing interface's address as its source.
- To specify the destination address used for the probes, include the **target** statement at the **[edit services rpm probe owner test test-name]** hierarchy level.
 - For HTTP probe types, specify a fully formed URL that includes **http://** in the URL address.
 - For all other probe types, specify an IP version 4 (IPv4) address for the target host.

- To specify the time to wait between tests, include the **test-interval** statement at the **[edit services rpm probe owner test test-name]** hierarchy level. Specify a value from 0 through 86400 seconds.
- To specify thresholds used for the probes, include the **thresholds** statement at the **[edit services rpm probe owner test test-name]** hierarchy level. A system log message is generated when the configured threshold is exceeded. Likewise, an SNMP trap (if configured) is generated when a threshold is exceeded. The following options are supported:
 - **egress-time**—Measures maximum source-to-destination time per probe.
 - **ingress-time**—Measures maximum destination-to-source time per probe.
 - **jitter-egress**—Measures maximum source-to-destination jitter per test.
 - **jitter-ingress**—Measures maximum destination-to-source jitter per test.
 - **jitter-rtt**—Measures maximum jitter per test, from 0 through 60000000 microseconds.
 - **rtt**—Measures maximum round-trip time per probe, in microseconds.
 - **std-dev-egress**—Measures maximum source-to-destination standard deviation per test.
 - **std-dev-ingress**—Measures maximum destination-to-source standard deviation per test.
 - **std-dev-rtt**—Measures maximum standard deviation per test, in microseconds.
 - **successive-loss**—Measures successive probe loss count, indicating probe failure.
 - **total-loss**—Measures total probe loss count indicating test failure, from 0 through 15.
- Traps are sent if the configured threshold is met or exceeded. To set the trap bit to generate traps, include the **traps** statement at the **[edit services rpm probe owner test test-name]** hierarchy level. The following options are supported:
 - **egress-jitter-exceeded**—Generates traps when the jitter in egress time threshold is met or exceeded.
 - **egress-std-dev-exceeded**—Generates traps when the egress time standard deviation threshold is met or exceeded.
 - **egress-time-exceeded**—Generates traps when the maximum egress time threshold is met or exceeded.
 - **ingress-jitter-exceeded**—Generates traps when the jitter in ingress time threshold is met or exceeded.
 - **ingress-std-dev-exceeded**—Generates traps when the ingress time standard deviation threshold is met or exceeded.
 - **ingress-time-exceeded**—Generates traps when the maximum ingress time threshold is met or exceeded.

- **jitter-exceeded**—Generates traps when the jitter in round-trip time threshold is met or exceeded.
- **probe-failure**—Generates traps for successive probe loss thresholds crossed.
- **rtt-exceeded**—Generates traps when the maximum round-trip time threshold is met or exceeded.
- **std-dev-exceeded**—Generates traps when the round-trip time standard deviation threshold is met or exceeded.
- **test-completion**—Generates traps when a test is completed.
- **test-failure**—Generates traps when the total probe loss threshold is met or exceeded.

**Related
Documentation**

- [Examples: Configuring Real-Time Performance Monitoring on page 20](#)

Configuring RPM Receiver Servers

The RPM TCP and UDP probes are proprietary to Juniper Networks and require a receiver to receive the probes. To configure a server to receive the probes, include the **probe-server** statement at the **[edit services rpm]** hierarchy level:

```
[edit services rpm]
probe-server {
  tcp {
    destination-interface interface-name;
    port (RPM) number;
  }
  udp {
    port (RPM) number;
  }
}
```

The port number specified for the UDP and TCP server can be 7 or from 49160 through 65535.

Limiting the Number of Concurrent RPM Probes

To configure the maximum number of concurrent probes allowed, include the **probe-limit** statement at the **[edit services rpm]** hierarchy level:

```
probe-limit limit;
```

Specify a limit from 1 through 500. The default maximum number is 100.

Configuring RPM Timestamping

To account for latency in the communication of probe messages, you can enable timestamping of the probe packets. You can timestamp the following RPM probe types: **icmp-ping**, **icmp-ping-timestamp**, **udp-ping**, and **udp-ping-timestamp**.

On M Series and T Series routers with an Adaptive Services (AS) or Multiservices PIC, and MX Series routers with a Multiservices DPC, you can enable hardware timestamping of RPM probe messages. The timestamp is applied on both the RPM client router (the router that originates the RPM probes) and the RPM probe server and applies only to IPv4 traffic. It is supported on the following:

- Layer 2 services package on all Multiservices PICs and DPCs.
- Layer 3 service package on AS and Multiservices PICs and Multiservices DPCs.
- SDK Services package on M Series, MX Series, and T Series services PICS that support the Services SDK.
- Layer 2, Layer 3, SDK Services, and PFE RPM timestamping interoperate with each other. Here, the RPM client can be on the Layer 3 **sp-** interface and the RPM server can be on an SDK Services package.

Two-way timestamping is available on **sp-** and **ms-** interfaces. To configure two-way timestamping on M Series and T Series routers, include the **destination-interface** statement at the **[edit services rpm probe probe-owner test test-name]** hierarchy level:

```
destination-interface sp-fpc/pic/port.logical-unit
destination-interface ms-fpc/pic/port.logical-unit
```

Specify the RPM client router and the RPM server router on the adaptive services logical interface or the multiservices interface by including the **rpm** statement at the **[edit interfaces interface-name unit logical-unit-number]** hierarchy level:

```
rpm (client | server);
```

The logical interface must be dedicated to the RPM task. It requires configuration of the **family inet** statement and a /32 address, as shown in the example. This configuration is also needed for other services such as NAT and stateful firewall. You cannot configure RPM service on **unit 0** because RPM requires a dedicated logical interface; the same unit cannot support both RPM and other services. Because active flow monitoring requires **unit 0**, but RPM can function on any logical interface, a constraint check prevents you from committing an RPM configuration there.



NOTE: If you configure RPM timestamping on an AS PIC, you cannot configure the **source-address** statement at the **[edit services rpm probe probe-name test test-name]** hierarchy level.

On MX Series routers, you include the **hardware-timestamp** statement at the **[edit services rpm probe probe-name test test-name]** hierarchy level to specify that the probes are to be timestamped in the Packet Forwarding Engine host processor:

```
hardware-timestamp;
```

On the client side, these probes are timestamped in the Packet Forwarding Engine host processor on the egress DPC on the MX Series router originating the RPM probes (RPM client). On the responder side (RPM server), the RPM probes to be timestamped are handled by the Packet Forwarding Engine host processor, which generates the response

instead of the RPM process. The RPM probes are timestamped only on the router that originates them (RPM client). As a result, only round-trip time is measured for these probes.



NOTE: The Packet Forwarding Engine-based RPM feature does not support any stateful firewall configurations. If you need to combine RPM timestamping with a stateful firewall, you should use the interface-based RPM timestamping service described earlier in this section. Multiservices DPCs support stateful firewall processing as well as RPM timestamping.

To configure one-way timestamping, you must also include the `one-way-hardware-timestamp` statement at the `[edit services rpm probe probe-owner test test-name]` hierarchy level:

```
one-way-hardware-timestamp;
```



NOTE: If you configure RPM probes for a services interface (sp-), you need to announce local routes in a specific way for the following routing protocols:

- For OSPF, you can announce the local route by including the services interface in the OSPF area. To configure this setting, include the interface `sp-fpc/pic/port` statement at the `[edit protocols ospf area area-number]` hierarchy level.
- For BGP and IS-IS, you must export interface routes and create a policy that accepts the services interface local route. To export interface routes, include the `point-to-point` and `lan` statements at the `[edit routing-options interface-routes family inet export]` hierarchy level. To configure an export policy that accepts the services interface local route, include the `protocol local`, `rib inet.0`, and `route-filter sp-interface-ip-address/32` exact statements at the `[edit policy-options policy-statement policy-name term term-name from]` hierarchy level and the `accept` action at the `[edit policy-options policy-statement policy-name term term-name then]` hierarchy level. For the export policy to take effect, apply the policy to BGP or IS-IS with the `export policy-name` statement at the `[edit protocols protocol-name]` hierarchy level.

For more information about these configurations, see the Routing Policy Configuration Guide or the Junos OS Routing Protocols Configuration Guide.

Routing the probe packets through the adaptive services or Multiservices PIC also enables you to filter the probe packets to particular queues. The following example shows the RPM configuration and the filter that specifies queuing:

```
services rpm {
  probe p1 {
    test t1 {
      probe-type icmp-ping;
      target address 10.8.4.1;
      probe-count 10;
    }
  }
}
```

```
        probe-interval 10;
        test-interval 10;
        dscp-code-points af11;
        data-size 100;
        destination-interface sp-1/2/0.0;
    }
}
}
firewall {
    filter f1 {
        term t1 {
            from {
                dscp af11;
            }
            then {
                forwarding-class assured-forwarding;
            }
        }
    }
}
interfaces sp-1/2/0 {
    unit 2 {
        rpm client;
        family inet {
            address 10.8.4.2/32;
            filter {
                input f1;
            }
        }
    }
}
interfaces sp-1/2/1 {
    unit 2 {
        rpm server;
        family inet {
            address 10.8.3.2/32;
            filter {
                input f1;
            }
        }
    }
}
```

For more information about firewall filters, see the Routing Policy Configuration Guide; for more information about queuing, see the Junos OS Class of Service Configuration Guide.

Configuring TWAMP

You can configure the Two-Way Active Measurement Protocol (TWAMP) on all M Series and T Series routers that support Multiservices PICs (running in either Layer 2 or Layer 3 mode), and on MX Series routers. Only the responder (server) side of TWAMP is supported.

For more information on TWAMP, see RFC 5357, *A Two-Way Active Measurement Protocol (TWAMP)*.

To configure TWAMP properties, include the **twamp** statement at the **[edit services rpm]** hierarchy level:

```
[edit services rpm]
twamp {
  server {
    client-list list-name {
      [ address address ];
    }
    authentication-mode mode;
    inactivity-timeout seconds;
    maximum-connections count;
    maximum-connections-per-client count;
    maximum-sessions count;
    maximum-sessions-per-connection count;
    port number;
  }
}
```

The TWAMP configuration process includes the following tasks:

- [Configuring TWAMP Interfaces on page 17](#)
- [Configuring TWAMP Servers on page 17](#)

Configuring TWAMP Interfaces

To specify the service PIC logical interface that provides the TWAMP service, include the **twamp-server** statement at the **[edit interfaces sp-fpc/pic/port unit logical-unit-number]** hierarchy level:

```
twamp-server;
```



NOTE: On MX Series routers that do not include a Multiservices DPC, you can configure the **twamp-server** statement on any interface (for example, **ge-1/0/1.10**). It is not necessary to configure this statement on a service interface (**sp-** or **ms-**) but you do need to include it in the configuration to activate the TWAMP reflector functionality.

Configuring TWAMP Servers

You can specify a number of TWAMP server properties, some of which are optional, by including the **server** statement at the **[edit services rpm twamp]** hierarchy level:

```
[edit services rpm twamp]
server {
  client-list list-name {
    [ address address ];
  }
  authentication-mode mode;
  inactivity-timeout seconds;
  maximum-connections count;
  maximum-connections-per-client count;
  maximum-sessions count;
```

```
    maximum-sessions-per-connection count;  
    port number;  
}
```

- To specify the list of allowed control client hosts that can connect to this server, include the **client-list** statement at the **[edit services rpm twamp server]** hierarchy level. Each value you include must be a Classless Interdomain Routing (CIDR) address (IP address plus mask) that represents a network of allowed hosts. You can include multiple client lists, each of which can contain a maximum of 64 entries. You must configure at least one client address to enable TWAMP.
- You must specify the authentication mode by including the **authentication-mode** statement at the **[edit services rpm twamp server]** hierarchy level. There is no default value. You can configure **authenticated** or **encrypted** mode, based on RFC 4656; if there is no authentication or encryptions mode specified, you should set the value to **none**. This statement is required in the TWAMP configuration.
- To specify the inactivity timeout period in seconds, include the **inactivity-timeout** statement at the **[edit services rpm twamp server]** hierarchy level. By default, the value is **1800**; the range is 0 through 3600 seconds.
- To specify the maximum number of concurrent connections the server can have to client hosts, include the **maximum-connections** statement at the **[edit services rpm twamp server]** hierarchy level. The allowed range of values is 1 through 2048 and the default value is 64. You can also limit the number of connections the server can make to a particular client host by including the **maximum-connections-per-client** statement.
- To specify the maximum number of sessions the server can have running at one time, include the **maximum-sessions** statement at the **[edit services rpm twamp server]** hierarchy level. The allowed range of values is 1 through 2048 and the default value is 64. You can also limit the number of sessions the server can have on a single connection by including the **maximum-sessions-per-connection** statement.
- To specify the TWAMP server listening port, include the **port** statement at the **[edit services rpm twamp server]** hierarchy level. The range is 1 through 65,535. This statement is mandatory.

CHAPTER 3

Examples

- [Examples: Configuring BGP Neighbor Discovery Through RPM on page 19](#)
- [Examples: Configuring Real-Time Performance Monitoring on page 20](#)

Examples: Configuring BGP Neighbor Discovery Through RPM

Configure BGP neighbor discovery through RPM for all logical systems and all routing instances:

```
[edit services rpm]
bgp {
  probe-type icmp-ping;
  probe-count 5;
  probe-interval 1;
  test-interval 60;
  history-size 10;
  data-size 255;
  data-fill 0123456789;
}
```

Configure BGP neighbor discovery through RPM for only the following logical systems and routing instances: **LS1/RI1**, **LS1/RI2**, **LS2**, and **RI3**:

```
[edit services rpm]
bgp {
  probe-type icmp-ping;
  probe-count 5;
  probe-interval 1;
  test-interval 60;
  history-size 10;
  data-size 255;
  data-fill 0123456789;
  logical-system {
    LS1 {
      routing-instances {
        RI1;
        RI2;
      }
    }
    LS2;
  }
  routing-instance {
    RI3;
```

```
}  
}
```

Configure BGP neighbor discovery through RPM for only the default logical system and default routing instance:

```
[edit services rpm]  
bgp {  
  probe-type icmp-ping;  
  probe-count 5;  
  probe-interval 1;  
  test-interval 60;  
  history-size 10;  
  data-size 255;  
  data-fill 0123456789;  
  logical-system {  
    null {  
      routing-instances {  
        default;  
      }  
    }  
  }  
}
```

Examples: Configuring Real-Time Performance Monitoring

Configure an RPM instance identified by the probe name **probe1** and the test name **test1**:

```
[edit services rpm]  
probe probe1 {  
  test test1 {  
    dscp-code-points 001111;  
    probe-interval 1;  
    probe-type icmp-ping;  
    target address 172.17.20.182;  
    test-interval 20;  
    thresholds rtt 10;  
    traps rtt-exceeded;  
  }  
}  
probe-server {  
  tcp {  
    destination-interface lt-0/0/0.0  
    port 50000;  
  }  
  udp {  
    destination-interface lt-0/0/0.0  
    port 50001;  
  }  
}  
probe-limit 200;
```


Configure packet classification, using **lt-** interfaces to send the probe packets to a logical tunnel input interface. By sending the packet to the logical tunnel interface, you can configure regular and multifield classifiers, firewall filters, and header rewriting for the probe packets. To use the existing tunnel framework, the **dlci** and **encapsulation** statements must be configured.

```
[edit services rpm]
probe p1 {
  test t1 {
    probe-type icmp-ping;
    target address 10.8.4.1;
    probe-count 10;
    probe-interval 10;
    test-interval 10;
    source-address 10.8.4.2;
    dscp-code-points ef;
    data-size 100;
    destination-interface lt-0/0/0.0;
  }
}
[edit interfaces]
lt-0/0/0 {
  unit 0 {
    encapsulation frame-relay;
    dlci 10;
    peer-unit 1;
    family inet;
  }
  unit 1 {
    encapsulation frame-relay;
    dlci 10;
    peer-unit 0;
    family inet;
  }
}
[edit class-of-service]
interfaces {
  lt-0/0/0 {
    unit 1 {
      classifiers {
        dscp default;
      }
    }
  }
}
```

Configure an input filter on the interface on which the RPM probes are received. This filter enables prioritization of the received RPM packets, separating them from the regular data packets received on the same interface.

```
[edit firewall]
filter recos {
  term recos {
    from {
      source-address {
        10.8.4.1/32;
```

```
    }
    destination-address {
        10.8.4.2/32;
    }
}
then {
    loss-priority high;
    forwarding-class network-control;
}
}
}
[edit interfaces]
fe-5/0/0 {
    unit 0 {
        family inet {
            filter {
                input recos;
            }
            address 10.8.4.2/24;
        }
    }
}
```

Configure an RPM instance and enable RPM for the Services SDK on the adaptive services interface:

```
[edit services rpm]
probe probe1{
    test test1 {
        data-size 1024;
        data-fill 0;
        destination-interface ms-1/2/0.10;
        dscp-code-points 001111;
        probe-count 10;
        probe-interval 1;
        probe-type icmp-ping;
        target address 172.17.20.182;
        test-interval 20;
        thresholds rtt 10;
        traps rtt-exceeded;
    }
}
[edit interfaces]
ms-1/2/0 {
    unit 0 {
        family inet;
    }
    unit 10 {
        rpm client;
        family inet {
            address 1.1.1.1/32;
        }
    }
}
[edit chassis]
fpc 1 {
    pic 2 {
```

```

adaptive-services {
  service-package {
    extension-provider {
      control-cores 1;
      data-cores 1;
      object-cache-size 512;
      policy-db-size 64;
      package jservices-rpm;
      syslog {
        daemon any;
      }
    }
  }
}

```

Configure the minimum statements necessary to enable TWAMP:

```

[edit services]
rpm {
  twamp {
    server {
      authentication-mode none;
      port 10000; # Twamp server's listening port
      client-list LIST-1 { # LIST-1 is the name of the client-list. Multiple lists can be
        configured.
        address {
          20.0.0.2/30; # IP address of the control client.
        }
      }
    }
  }
}
[edit interfaces sp-5/0/0]
unit 0 {
  family inet;
}
unit 10 {
  rpm {
    twamp-server; # You must configure a separate logical interface on the service PIC
    interface for the TWAMP server.
  }
  family inet {
    address 50.50.50.50/32; # This address must be a host address with a 32-bit mask.
  }
}
[edit chassis]
fpc 5 {
  pic 0 {
    adaptive-services {
      service-package layer-2; # Configure the service PIC to run in Layer 2 mode.
    }
  }
}

```

Configure additional TWAMP settings:

```
[edit services]
rpm {
  twamp {
    server {
      maximum-sessions 5;
      maximum-sessions-per-connection 2;
      maximum-connections 3;
      maximum-connections-per-client 1;
      port 10000;
      server-inactivity-timeout ;
      client-list LIST-1 {
        address {
          20.0.0.2/30;
        }
      }
    }
  }
}
```

CHAPTER 4

Configuration Statements

authentication-mode

Syntax	authentication-mode (authenticated control-only-encrypted encrypted none);
Hierarchy Level	[edit services rpm twamp server]
Release Information	Statement introduced in Junos OS Release 9.5.
Description	Specify the authentication or encryption mode support for the TWAMP test protocol. This statement is required in the configuration; if no authentication or encryption is specified, you should set the value to none .
Options	<p>authenticated—Data packets are authenticated.</p> <p>control-only-encrypted—TWAMP control packets are encrypted. TWAMP data packets are in plain text format.</p> <p>encrypted—Data packets are encrypted.</p> <p>none—No authentication or encryption.</p>
Usage Guidelines	See Configuring Real-Time Performance Monitoring.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.


client-list

Syntax	<code>client-list <i>list-name</i> { address <i>address</i>; }</code>
Hierarchy Level	[edit services rpm twamp server]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	List of allowed control client hosts that can connect to this server. Each entry is a Classless Interdomain Routing (CIDR) address (IP address plus mask) that represents a network of allowed hosts. You can configure more than one list, but you must configure at least one client address to enable TWAMP. Each list can contain up to 64 entries.
Options	<i>list-name</i> —Name of client address list. <i>address</i> —Address and mask for an allowed client.
Usage Guidelines	See Configuring Real-Time Performance Monitoring.
Required Privilege Level	system—To view this statement in the configuration. interface-control—To add this statement to the configuration.

data-fill

Syntax	<code>data-fill <i>data</i>;</code>
Hierarchy Level	[edit services rpm bgp], [edit services rpm probe <i>owner</i> test <i>test-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the contents of the data portion of Internet Control Message Protocol (ICMP) probes.
Options	<i>data</i> —A hexadecimal value; for example, 0-9, A-F .
Usage Guidelines	The data-fill statement is not valid with the http-get or http-metadata-get probe types. See “Configuring BGP Neighbor Discovery Through RPM” on page 7 or Configuring Real-Time Performance Monitoring.
Required Privilege Level	system—To view this statement in the configuration. interface-control—To add this statement to the configuration.

data-size

Syntax	<code>data-size size;</code>
Hierarchy Level	[edit services rpm bgp], [edit services rpm probe owner test test-name]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the size of the data portion of ICMP probes.
Options	data —The size can be from 0 through 65507 Default: 0
<div>  <p>NOTE: If you configure the hardware timestamp feature (see Configuring Real-Time Performance Monitoring), the <code>data-size</code> default value is 32 bytes and 32 is the minimum value for explicit configuration. The UDP timestamp probe type is an exception; it requires a minimum data size of 52 bytes.</p> </div>	
Usage Guidelines	The <code>data-size</code> statement is not valid with the <code>http-get</code> or <code>http-metadata-get</code> probe type. See “Configuring BGP Neighbor Discovery Through RPM” on page 7 or Configuring Real-Time Performance Monitoring .
Required Privilege Level	<code>system</code> —To view this statement in the configuration. <code>interface-control</code> —To add this statement to the configuration.

destination-interface

Syntax	<code>destination-interface <i>interface-name</i>;</code>
Hierarchy Level	[edit services rpm probe owner test test-name], [edit services rpm probe-server (tcp udp)]
Release Information	Statement introduced in Junos OS Release 7.5.
Description	<p>On M Series and T Series routers, specify a services (sp-) interface that adds a timestamp to RPM probe messages. This feature is supported only with icmp-ping, icmp-ping-timestamp, udp-ping, and udp-ping-timestamp probe types. You must also configure the rpm statement on the sp- interface and include the unit 0 family inet statement with a /32 address.</p> <p>On M Series, MX Series, and T Series routers, specify a multiservices (ms-) interface that adds a timestamp to RPM probe messages. This feature is supported only with icmp-ping, icmp-ping-timestamp, udp-ping, and udp-ping-timestamp probe types. You must also configure the rpm statement on the ms- interface and include the unit 0 family inet statement with a /32 address.</p> <p>To enable RPM for the Services SDK on the adaptive services interface, configure the object-cache-size, policy-db-size, and package statements at the [edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider] hierarchy level. For the Services SDK, package-name in the package package-name statement is jservices-rpm.</p>
Options	interface-name —Name of the adaptive services interface.
Usage Guidelines	See Configuring Real-Time Performance Monitoring, Configuring Real-Time Performance Monitoring, or Configuring Real-Time Performance Monitoring.
Required Privilege Level	system —To view this statement in the configuration. interface-control —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• hardware-timestamp on page 31• rpm on page 43• Enabling RPM for the Services SDK

destination-port

Syntax	<code>destination-port <i>port</i>;</code>
Hierarchy Level	[edit services rpm bgp], [edit services rpm probe owner test <i>test-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the User Datagram Protocol (UDP) or Transmission Control Protocol (TCP) port to which a probe is sent. This statement is used only for TCP or UDP probe types.
Options	<i>port</i> —The port number can be 7 or from 49,160 to 65,535.
Usage Guidelines	See “ Configuring BGP Neighbor Discovery Through RPM ” on page 7 or Configuring Real-Time Performance Monitoring.
Required Privilege Level	system—To view this statement in the configuration. interface-control—To add this statement to the configuration.

dscp-code-point

Syntax	<code>dscp-code-point <i>dscp-bits</i>;</code>
Hierarchy Level	[edit services rpm probe owner test <i>test-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the value of the Differentiated Services (DiffServ) field within the IP header. The DiffServ code point (DSCP) bits value must be set to a valid 6-bit pattern.
Options	<p><i>dscp-bits</i>—A valid 6-bit pattern; for example, 001111, or one of the following configured DSCP aliases:</p> <ul style="list-style-type: none">• af11—Default: 001010• af12—Default: 001100• af13—Default: 001110• af21—Default: 010010• af22—Default: 010100• af23 —Default: 010110• af31 —Default: 011010• af32 —Default: 011100• af33 —Default: 011110• af41 —Default: 100010• af42 —Default:100100• af43 —Default:100110• be—Default: 000000• cs1—Default: 001000• cs2—Default: 010000• cs3—Default: 011000• cs4—Default: 100000• cs5—Default: 101000• cs6—Default: 110000• cs7—Default: 111000• ef—Default: 101110• nc1—Default: 110000• nc2—Default: 111000

Usage Guidelines	See Configuring Real-Time Performance Monitoring.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

hardware-timestamp

Syntax	hardware-timestamp;
Hierarchy Level	[edit services rpm probe owner test test-name]
Release Information	Statement introduced in Junos OS Release 8.1. Statement applied to MX Series routers in Junos OS Release 10.0. Statement introduced in Junos OS Release 10.3 for EX Series switches.
Description	On MX Series routers and EX Series switches only, enable timestamping of RPM probe messages in the Packet Forwarding Engine host processor. This feature is supported only with icmp-ping , icmp-ping-timestamp , udp-ping , and udp-ping-timestamp probe types.
Usage Guidelines	See Configuring RPM Timestamping.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

history-size

Syntax	history-size <i>size</i> ;
Hierarchy Level	[edit services rpm bgp], [edit services rpm probe owner test test-name]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the number of stored history entries.
Options	<i>size</i> —A value from 0 to 255. Default: 50
Usage Guidelines	See “ Configuring BGP Neighbor Discovery Through RPM ” on page 7 or Configuring RPM Probes.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

inactivity-timeout (Services RPM)

Syntax	<code>inactivity-timeout <i>seconds</i>;</code>
Hierarchy Level	[edit services rpm twamp server]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	Inactivity timeout period, in seconds.
Options	<i>seconds</i> —Length of time the session is inactive before it times out. Default: 1800 seconds
Usage Guidelines	See Configuring TWAMP.
Required Privilege Level	system—To view this statement in the configuration. interface-control—To add this statement to the configuration.

logical-system

Syntax	<code>logical-system <i>logical-system-name</i> { [routing-instances <i>instance-name</i>]; }</code>
Hierarchy Level	[edit services rpm bgp]
Release Information	Statement introduced in Junos OS Release 7.6.
Description	Specify the logical system used by the probes. The remaining statements are explained separately.
Options	<i>logical-system-name</i> —Logical system name.
Usage Guidelines	See “ Configuring BGP Neighbor Discovery Through RPM ” on page 7.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

maximum-connections

Syntax	<code>maximum-connections <i>count</i>;</code>
Hierarchy Level	[edit services rpm twamp server]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	Maximum number of allowed connections between the server and all control client hosts.
Options	<p><i>count</i>—Maximum number of connections.</p> <p>Range: 1 through 2048</p> <p>Default: 64</p>
Usage Guidelines	See Configuring TWAMP.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>

max-connection-duration

Syntax	<code>max-connection-duration <i>hours</i>;</code>
Hierarchy Level	[edit services rpm twamp server]
Release Information	Statement introduced in Junos OS Release 11.1.
Description	Specify the maximum time a connection can exist between a client and the server.
Options	<i>hours</i> —Number of hours a connection can exist between a client and the server.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> Configuring TWAMP

maximum-connections-per-client

Syntax	maximum-connections-per-client <i>count</i> ;
Hierarchy Level	[edit services rpm twamp server]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	Maximum number of allowed connections between the server and a single control client host.
Options	<i>count</i> —Maximum number of connections. Default: 64
Usage Guidelines	See Configuring TWAMP.
Required Privilege Level	system—To view this statement in the configuration. interface-control—To add this statement to the configuration.

maximum-sessions

Syntax	maximum-sessions <i>count</i> ;
Hierarchy Level	[edit services rpm twamp server]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	Maximum number of allowed test sessions the server can have running at one time.
Options	<i>count</i> —Maximum number of sessions. Range: 1 through 2048 Default: 64
Usage Guidelines	See Configuring TWAMP.
Required Privilege Level	system—To view this statement in the configuration. interface-control—To add this statement to the configuration.

maximum-sessions-per-connection

Syntax	<code>maximum-sessions-per-connection <i>count</i>;</code>
Hierarchy Level	[edit services rpm twamp server]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	Maximum number of allowed sessions the server can open on a single client connection.
Options	<i>count</i> —Maximum number of sessions. Default: 64
Usage Guidelines	See Configuring TWAMP.
Required Privilege Level	system—To view this statement in the configuration. interface-control—To add this statement to the configuration.

moving-average-size

Syntax	<code>moving-average-size <i>number</i>;</code>
Hierarchy Level	[edit services rpm bgp], [edit services rpm probe owner test <i>test-name</i>]
Release Information	Statement introduced in Junos OS Release 8.5. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Enable statistical calculation operations to be performed across a configurable number of the most recent samples.
Options	<i>number</i> —Number of samples to be used in calculations. Range: 0 through 255
Usage Guidelines	See Configuring RPM Probes.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

one-way-hardware-timestamp

Syntax	<code>one-way-hardware-timestamp;</code>
Hierarchy Level	[edit services rpm probe owner test test-name]
Release Information	Statement introduced in Junos OS Release 8.5. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Enable timestamping of RPM probe messages for one-way delay and jitter measurements. You must configure this statement along with the destination-interface statement to invoke timestamping. This feature is supported only with icmp-ping , icmp-ping-timestamp , udp-ping , and udp-ping-timestamp probe types.
Usage Guidelines	See Configuring RPM Timestamping.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• destination-interface on page 28, hardware-timestamp on page 31

port (RPM)

Syntax	<code>port number;</code>
Hierarchy Level	[edit services rpm probe-server (tcp udp)]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the port number for the probe server.
Options	number —Port number for the probe server. The value can be 7 or 49,160 through 65,535.
Usage Guidelines	See Configuring RPM Receiver Servers.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

port (TWAMP)

Syntax	<code>port <i>number</i>;</code>
Hierarchy Level	[edit services rpm twamp server]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	TWAMP server listening port. You must configure this statement to enable TWAMP.
Options	<i>number</i> —Port number. Range: 1 through 65,535
Usage Guidelines	See Configuring TWAMP.
Required Privilege Level	system—To view this statement in the configuration. interface-control—To add this statement to the configuration.

probe

Syntax

```
probe owner {  
  test test-name {  
    data-fill data;  
    data-size size;  
    destination-interface interface-name;  
    destination-port port;  
    dscp-code-point dscp-bits;  
    hardware-timestamp;  
    history-size size;  
    moving-average-size number;  
    one-way-hardware-timestamp;  
    probe-count count;  
    probe-interval seconds;  
    probe-type type;  
    routing-instance instance-name;  
    source-address address;  
    target (url | address);  
    test-interval interval;  
    thresholds thresholds;  
    traps traps;  
  }  
}
```

Hierarchy Level [edit [services](#) rpm]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.3 for EX Series switches.

Description Specify an owner name. The owner name combined with the test name represent a single RPM configuration instance.

Options *owner*—Specify an owner name up to 32 characters in length.

The remaining statements are explained separately.

Usage Guidelines See Configuring RPM Probes.

Required Privilege Level system—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

probe-count

Syntax	<code>probe-count <i>count</i>;</code>
Hierarchy Level	[edit services rpm bgp], [edit services rpm probe owner test <i>test-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the number of probes within a test.
Options	<i>count</i> —A value from 1 through 15.
Usage Guidelines	See “ Configuring BGP Neighbor Discovery Through RPM ” on page 7 or Configuring RPM Probes.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

probe-interval

Syntax	<code>probe-interval <i>interval</i>;</code>
Hierarchy Level	[edit services rpm bgp], [edit services rpm probe owner test <i>test-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the time to wait between sending packets, in seconds.
Options	<i>interval</i> —Number of seconds, from 1 through 255.
Usage Guidelines	See “ Configuring BGP Neighbor Discovery Through RPM ” on page 7 or Configuring RPM Probes.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

probe-limit

Syntax	<code>probe-limit <i>limit</i>;</code>
Hierarchy Level	[edit services rpm]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the maximum number of concurrent probes allowed.
Options	<i>limit</i> —A value from 1 through 500. Default: 100.
Usage Guidelines	See Limiting the Number of Concurrent RPM Probes.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

probe-server

Syntax	<pre>probe-server { tcp { destination-interface <i>interface-name</i>; port <i>number</i>; } udp { destination-interface <i>interface-name</i>; port <i>number</i>; } }</pre>
Hierarchy Level	[edit services rpm]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the server to act as a receiver for the probes. The remaining statements are explained separately.
Usage Guidelines	See Configuring RPM Receiver Servers.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

probe-type

Syntax	<code>probe-type type;</code>
Hierarchy Level	[edit services rpm bgp], [edit <code>services rpm probe owner test test-name</code>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the packet and protocol contents of a probe.
Options	<p>type—Specify one of the following probe type values:</p> <ul style="list-style-type: none"> • http-get—(Not available at the [edit services rpm bgp] hierarchy level.) Sends a Hypertext Transfer Protocol (HTTP) get request to a target URL. • http-metadata-get—(Not available at the [edit services rpm bgp] hierarchy level.) Sends an HTTP get request for metadata to a target URL. • icmp-ping—Sends ICMP echo requests to a target address. • icmp-ping-timestamp—Sends ICMP timestamp requests to a target address. • tcp-ping—Sends TCP packets to a target. • udp-ping—Sends UDP packets to a target. • udp-ping-timestamp—Sends UDP timestamp requests to a target address.
Usage Guidelines	See “ Configuring BGP Neighbor Discovery Through RPM ” on page 7 or Configuring RPM Probes .
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>

routing-instance

Syntax	<code>routing-instance <i>instance-name</i>;</code>
Hierarchy Level	<code>[edit services rpm probe owner test test-name]</code>
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the routing instance used by the probes.
Options	<i>instance-name</i> —A routing instance configured at the <code>[edit routing-instance]</code> hierarchy level. Default: Internet routing table <code>inet.0</code> .
Usage Guidelines	See Configuring RPM Probes.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

routing-instances

Syntax	<code>routing-instances <i>instance-name</i>;</code>
Hierarchy Level	<code>[edit services rpm bgp],</code> <code>[edit services rpm bgp logical-system <i>logical-system-name</i>]</code>
Release Information	Statement introduced in Junos OS Release 7.6. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the routing instance used by the probes.
Options	<i>instance-name</i> —A routing instance configured at the <code>[edit routing-instances]</code> hierarchy level. Default: Internet routing table <code>inet.0</code> .
Usage Guidelines	See “Configuring BGP Neighbor Discovery Through RPM” on page 7 .
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

rpm

Syntax	<code>rpm (client server);</code>
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i>]
Release Information	Statement introduced in Junos OS Release 8.1. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Associate an RPM client (router or switch that originates RPM probes) or RPM server with a specified interface.
Options	<i>client</i> —Identifier for RPM client router or switch. <i>server</i> —Identifier for RPM server.
Usage Guidelines	See Configuring RPM Timestamping.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

server

Syntax	<pre>server { client-list <i>list-name</i> { [address <i>address</i>]; } inactivity-timeout <i>seconds</i>; maximum-connections <i>count</i>; maximum-connections-per-client <i>count</i>; maximum-sessions <i>count</i>; maximum-sessions-per-connection <i>count</i>; port <i>number</i>; }</pre>
Hierarchy Level	[edit services rpm twamp]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	TWAMP server configuration settings.
Options	The remaining statements are described separately.
Usage Guidelines	See Configuring TWAMP.
Required Privilege Level	system—To view this statement in the configuration. interface-control—To add this statement to the configuration.

server-inactivity-timeout

Syntax	<code>server-inactivity-timeout <i>minutes</i>;</code>
Hierarchy Level	[edit services rpm twamp server]
Release Information	Statement introduced in Junos OS Release 11.1.
Description	The maximum time the Two-Way Active Measurement Protocol (TWAMP) server has to finish the TWAMP control protocol negotiation.
Options	<i>minutes</i> —Number of minutes the TWAMP server has to finish the TWAMP control protocol negotiation. Default: 15 minutes Range: 1-30 minutes
Usage Guidelines	See Configuring Real-Time Performance Monitoring.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

services (RPM)

Syntax	<code>services rpm { ... }</code>
Hierarchy Level	[edit]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Define the service rules to be applied to traffic.
Options	<i>rpm</i> —Identifies the RPM set of rules statements.
Usage Guidelines	See Real-Time Performance Monitoring Services.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

source-address

Syntax	<code>source-address <i>address</i>;</code>
Hierarchy Level	[edit <code>services rpm probe owner test test-name</code>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the source IP address used for probes. If the source IP address is not one of the router's or switch's assigned addresses, the packet will use the outgoing interface's address as its source.
Options	<i>address</i> —Valid IP address.
Usage Guidelines	See Configuring RPM Probes.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

target (Services RPM)

Syntax	<code>target (url <i>url</i> address <i>address</i>);</code>
Hierarchy Level	[edit <code>services rpm probe owner test test-name</code>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the destination address or URL used for the probes.
Options	<i>url url</i> —For HTTP probe types, specify a fully formed URL that includes <code>http://</code> in the URL address. <i>address address</i> —For all other probe types, specify an IPv4 address for the target host.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> Configuring RPM Probes Configuring Basic Real-Time Performance Monitoring (RPM) Probes in a VDCF

tcp

Syntax	<pre>tcp { destination-interface <i>interface-name</i>; port <i>port</i>; }</pre>
Hierarchy Level	[edit services rpm probe-server]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the port information for the TCP server. The remaining statements are explained separately.
Usage Guidelines	See Configuring RPM Receiver Servers.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

test

Syntax

```
test test-name {
  data-fill data;
  data-size size;
  destination-interface interface-name;
  destination-port port;
  dscp-code-point dscp-bits;
  hardware-timestamp;
  history-size size;
  moving-average-size number;
  one-way-hardware-timestamp;
  probe-count count;
  probe-interval seconds;
  probe-type type;
  routing-instance instance-name;
  source-address address;
  target (url url | address address);
  test-interval interval;
  thresholds thresholds;
  traps traps;
}
```

Hierarchy Level [edit [services](#) rpm [probe](#) owner]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.3 for EX Series switches.

Description Specify the range of probes over which the standard deviation, average, and jitter are calculated. The test name combined with the owner name represent a single RPM configuration instance.

Options *test-name*—Specify a test name. The name can be up to 32 characters in length.
The remaining statements are explained separately.

Usage Guidelines See Configuring RPM Probes.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

test-interval

Syntax	<code>test-interval <i>frequency</i>;</code>
Hierarchy Level	[edit services rpm bgp], [edit services rpm probe owner test <i>test-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the time to wait between tests, in seconds.
Options	<i>frequency</i> —Number of seconds, from 0 through 86400.
Usage Guidelines	See “ Configuring BGP Neighbor Discovery Through RPM ” on page 7 or Configuring RPM Probes.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

thresholds

Syntax	<code>thresholds thresholds;</code>
Hierarchy Level	[edit <code>services rpm probe owner test test-name</code>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify thresholds used for the probes. A system log message is generated when the configured threshold is exceeded. Likewise, an SNMP trap (if configured) is generated when a threshold is exceeded.
Options	<p>thresholds—Specify one or more threshold measurements. The following options are supported:</p> <ul style="list-style-type: none"> • egress-time—Measures maximum source-to-destination time per probe. • ingress-time—Measures maximum destination-to-source time per probe. • jitter-egress—Measures maximum source-to-destination jitter per test. • jitter-ingress—Measures maximum destination-to- source jitter per test. • jitter-rtt—Measures maximum jitter per test, from 0 through 60,000,000 microseconds. • rtt—Measures maximum round-trip time per probe, in microseconds. • std-dev-egress—Measures maximum source-to-destination standard deviation per test. • std-dev-ingress—Measures maximum destination-to-source standard deviation per test. • std-dev-rtt—Measures maximum standard deviation per test, in microseconds. • successive-loss—Measures successive probe loss count, indicating probe failure. • total-loss—Measures total probe loss count indicating test failure, from 0 through 15.
Usage Guidelines	See Configuring RPM Probes.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>

traps

Syntax	<code>traps traps;</code>
Hierarchy Level	[edit <code>services rpm probe owner test test-name</code>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Set the trap bit to generate traps for probes. Traps are sent if the configured threshold is met or exceeded.
Options	<p>traps—Specify one or more traps. The following options are supported:</p> <ul style="list-style-type: none">• egress-jitter-exceeded—Generates traps when the jitter in egress time threshold is met or exceeded.• egress-std-dev-exceeded—Generates traps when the egress time standard deviation threshold is met or exceeded.• egress-time-exceeded—Generates traps when the maximum egress time threshold is met or exceeded.• ingress-jitter-exceeded—Generates traps when the jitter in ingress time threshold is met or exceeded.• ingress-std-dev-exceeded—Generates traps when the ingress time standard deviation threshold is met or exceeded.• ingress-time-exceeded—Generates traps when the maximum ingress time threshold is met or exceeded.• jitter-exceeded—Generates traps when the jitter in round-trip time threshold is met or exceeded.• probe-failure—Generates traps for successive probe loss thresholds crossed.• rtt-exceeded—Generates traps when the maximum round-trip time threshold is met or exceeded.• std-dev-exceeded—Generates traps when the round-trip time standard deviation threshold is met or exceeded.• test-completion—Generates traps when a test is completed.• test-failure—Generates traps when the total probe loss threshold is met or exceeded.



.....

NOTE: For RPM traps to be generated, you must configure the remote-operations SNMP trap category by including the `categories` statement at the [edit `snmp trap-group trap-group-name`] hierarchy level.

.....

Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> Configuring RPM Probes categories

twamp

Syntax	<pre>twamp { server { authentication-mode <i>mode</i>; client-list <i>list-name</i> { [address <i>address</i>]; } inactivity-timeout <i>seconds</i>; max-connection-duration <i>hours</i>; maximum-connections <i>count</i>; maximum-connections-per-client <i>count</i>; maximum-sessions <i>count</i>; maximum-sessions-per-connection <i>count</i>; port <i>number</i>; server-inactivity-timeout <i>minutes</i>; } }</pre>
Hierarchy Level	[edit services rpm]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	<p>Two-Way Active Measurement Protocol (TWAMP) configuration settings.</p> <p>The remaining statements are described separately.</p>
Usage Guidelines	See Configuring TWAMP.
Required Privilege Level	system—To view this statement in the configuration. interface-control—To add this statement to the configuration.

twamp-server

Syntax	twamp-server;
Hierarchy Level	[edit interfaces <i>sp-fpc/pic/port</i> unit <i>logical-unit-number</i>]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	Specify the service PIC logical interface to provide the TWAMP service.
Usage Guidelines	See Configuring TWAMP.
Required Privilege Level	system—To view this statement in the configuration. interface-control—To add this statement to the configuration.

udp

Syntax	udp { destination-interface <i>interface-name</i> ; port <i>port</i> ; }
Hierarchy Level	[edit <i>services</i> rpm <i>probe-server</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.3 for EX Series switches.
Description	Specify the port information for the UDP server. The remaining statements are explained separately.
Usage Guidelines	See Configuring RPM Receiver Servers.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

PART 3

Administration

- [RPM Operational Mode Commands on page 55](#)

CHAPTER 5

RPM Operational Mode Commands

clear services rpm twamp server connection

Syntax	clear services rpm twamp server connection <i><connection-id></i>
Release Information	Command introduced in Junos OS Release 9.3.
Description	Clear connections established between the real-time performance monitoring (RPM) Two-Way Active Measurement Protocol (TWAMP) server and control clients. By default all established connections are cleared (along with the sessions on those connections). To clear only a specific connection, specify the connection ID when you issue the command.
Options	<i>connection-id</i> —(Optional) Clear only the specified connection.
Required Privilege Level	clear

show services rpm active-servers

Syntax	show services rpm active-servers
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches.
Description	Display the protocols and corresponding ports for which a router or switch is configured as a real-time performance monitoring (RPM) server.
Options	This command has no options.
Required Privilege Level	view
List of Sample Output	show services rpm active-servers on page 57
Output Fields	Table 3 on page 57 lists the output fields for the show services rpm active-servers command. Output fields are listed in the approximate order in which they appear.

Table 3: show services rpm active-servers Output Fields

Field Name	Field Description
Protocol	Protocol configured on the receiving probe server. The protocol can be the User Datagram Protocol (UDP) or the Transmission Control Protocol (TCP).
Port	Port configured on the receiving probe server.
Destination interface name	Output interface name for the probes.

Sample Output

show services rpm active-servers

```
user@host> show services rpm active-servers
Protocol: TCP, Port: 50000, Destination interface name: lt-0/0/0.0
Protocol: UDP, Port: 50001, Destination interface name: lt-0/0/0.0
```

show services rpm history-results

Syntax	<pre>show services rpm history-results <brief detail> <owner <i>owner</i>> <since <i>time</i>> <test <i>name</i>></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p>
Description	Display standard information about the results of the last 50 probes for each real-time performance monitoring (RPM) instance.
Options	<p>none—Display the results of the last 50 probes for all RPM instances.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>owner <i>owner</i>—(Optional) Display information for the specified probe owner.</p> <p>since <i>time</i>—(Optional) Display information from the specified time. Specify time as <i>yyyy-mm-dd.hh:mm:ss</i>.</p> <p>test <i>name</i>—(Optional) Display information for the specified test.</p>
Required Privilege Level	view
List of Sample Output	<p>show services rpm history-results on page 60</p> <p>show services rpm history-results detail on page 60</p>
Output Fields	Table 4 on page 58 lists the output fields for the show services rpm history-results command. Output fields are listed in the approximate order in which they appear.

Table 4: show services rpm history-results Output Fields

Field Name	Field Description	Level of Output
Owner	Probe owner.	All levels
Test	Name of a test for a probe instance.	All levels
Probe received	Timestamp when the probe result was determined.	All levels
Round trip time	Average ping round-trip time (RTT), in microseconds.	All levels
Probe results	<p>Result of a particular probe performed by a remote host. The following information is contained in the results:</p> <ul style="list-style-type: none"> Response received—Timestamp when the probe result was determined. Rtt—Average ping round-trip time (RTT), in microseconds. 	detail

Table 4: show services rpm history-results Output Fields (*continued*)

Field Name	Field Description	Level of Output
Results over current test	Displays the results for the current test by probe at the time each probe was completed, as well as the status of the current test at the time the probe was completed.	detail
Probes sent	Number of probes sent with the current test.	detail
Probes received	Number of probe responses received within the current test.	detail
Loss percentage	Percentage of lost probes for the current test.	detail
Measurement	<p>Increment of measurement. Possible values are round-trip time delay and, for the probe type icmp-pin-timestamp, the egress and ingress delay:</p> <ul style="list-style-type: none"> • Minimum—Minimum RTT, ingress delay, or egress delay measured over the course of the current test. • Maximum—Maximum RTT, ingress delay, or egress delay measured over the course of the current test. • Average—Average RTT, ingress delay, or egress delay measured over the course of the current test. • Jitter—Difference, in microseconds, between the maximum and minimum RTT measured over the course of the current test. • Stddev—Standard deviation of the round-trip time, in microseconds, measured over the course of the current test. 	detail

Sample Output

**show services rpm
history-results**

```
user@host> show services rpm history-results
  Owner, Test                Probe received                Round trip time
p1, t1                      Wed Aug 12 01:02:35 2009        315 usec
p1, t1                      Wed Aug 12 01:02:36 2009        266 usec
p1, t1                      Wed Aug 12 01:02:37 2009        314 usec
p1, t1                      Wed Aug 12 01:02:38 2009        388 usec
p1, t1                      Wed Aug 12 01:02:39 2009        316 usec
p1, t1                      Wed Aug 12 01:02:40 2009        271 usec
p1, t1                      Wed Aug 12 01:02:41 2009        314 usec
p1, t1                      Wed Aug 12 01:02:42 2009       1180 usec
```

**show services rpm
history-results detail**

```
user@host> show services rpm history-results detail
Owner: p1, Test: t1, Probe type: icmp-ping-timestamp
Probe results:
  Response received, Wed Aug 12 01:02:35 2009,
  Client and server hardware timestamps
  Rtt: 315 usec
Results over current test:
  Probes sent: 1, Probes received: 1, Loss percentage: 0
  Measurement: Round trip time
    Samples: 1, Minimum: 315 usec, Maximum: 315 usec, Average: 315 usec,
    Peak to peak: 0 usec, Stddev: 0 usec, Sum: 315 usec

Owner: p1, Test: t1, Probe type: icmp-ping-timestamp
Probe results:
  Response received, Wed Aug 12 01:02:36 2009,
  Client and server hardware timestamps
  Rtt: 266 usec, Round trip jitter: -50 usec,
  Round trip interarrival jitter: 3 usec
Results over current test:
  Probes sent: 2, Probes received: 2, Loss percentage: 0
  Measurement: Round trip time
    Samples: 2, Minimum: 266 usec, Maximum: 315 usec, Average: 291 usec,
    Peak to peak: 49 usec, Stddev: 24 usec, Sum: 581 usec
  Measurement: Negative round trip jitter
    Samples: 1, Minimum: 50 usec, Maximum: 50 usec, Average: 50 usec,
    Peak to peak: 0 usec, Stddev: 0 usec, Sum: 50 usec

Owner: p1, Test: t1, Probe type: icmp-ping-timestamp
Probe results:
  Response received, Wed Aug 12 01:02:37 2009,
  Client and server hardware timestamps
  Rtt: 314 usec, Round trip jitter: 49 usec,
  Round trip interarrival jitter: 6 usec
Results over current test:
  Probes sent: 3, Probes received: 3, Loss percentage: 0
  Measurement: Round trip time
    Samples: 3, Minimum: 266 usec, Maximum: 315 usec, Average: 298 usec,
    Peak to peak: 49 usec, Stddev: 23 usec, Sum: 895 usec
  Measurement: Positive round trip jitter
    Samples: 1, Minimum: 49 usec, Maximum: 49 usec, Average: 49 usec,
    Peak to peak: 0 usec, Stddev: 0 usec, Sum: 49 usec
  Measurement: Negative round trip jitter
    Samples: 1, Minimum: 50 usec, Maximum: 50 usec, Average: 50 usec,
    Peak to peak: 0 usec, Stddev: 0 usec, Sum: 50 usec
```



```
Owner: p1, Test: t1, Probe type: icmp-ping-timestamp
Probe results:
  Response received, Wed Aug 12 01:02:38 2009,
  Client and server hardware timestamps
  Rtt: 388 usec, Round trip jitter: 74 usec,
  Round trip interarrival jitter: 10 usec
Results over current test:
  Probes sent: 4, Probes received: 4, Loss percentage: 0
  Measurement: Round trip time
    Samples: 4, Minimum: 266 usec, Maximum: 388 usec, Average: 321 usec,
    Peak to peak: 122 usec, Stddev: 44 usec, Sum: 1283 usec
  Measurement: Positive round trip jitter
    Samples: 2, Minimum: 49 usec, Maximum: 74 usec, Average: 62 usec,
    Peak to peak: 25 usec, Stddev: 12 usec, Sum: 123 usec
  Measurement: Negative round trip jitter
    Samples: 1, Minimum: 50 usec, Maximum: 50 usec, Average: 50 usec,
    Peak to peak: 0 usec, Stddev: 0 usec, Sum: 50 usec
```

show services rpm probe-results

Syntax	<code>show services rpm probe-results</code> <code><owner owner></code> <code><test name></code>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches.
Description	Display the results of the most recent real-time performance monitoring (RPM) probes.
Options	none —Display all results of the most recent RPM probes. owner owner —(Optional) Display information for the specified probe owner. test name —(Optional) Display information for the specified test.
Required Privilege Level	view
List of Sample Output	show services rpm probe-results on page 65 show services rpm probe-results (BGP Neighbor Discovery) on page 66
Output Fields	Table 5 on page 62 lists the output fields for the show services rpm probe-results command. Output fields are listed in the approximate order in which they appear.

Table 5: show services rpm probe-results Output Fields

Field Name	Field Description
Owner	Owner name. When you configure the probe owner statement at the [edit services rpm] hierarchy level, this field displays the configured owner name. When you configure BGP neighbor discovery through RPM, the output for this field is Rpm-Bgp-Owner .
Test	Name of a test representing a collection of probes. When you configure the test test-name statement at the [edit services rpm probe owner] hierarchy level, the field displays the configured test name. When you configure BGP neighbor discovery through RPM, the output for this field is Rpm-BGP-Test-n , where <i>n</i> is a cumulative number.
Target address	Destination address used for the probes.
Source address	Source address used for the probes.
Probe type	Protocol configured on the receiving probe server: http-get , http-metadata-get , icmp-ping , icmp-ping-timestamp , tcp-ping , udp-ping , or udp-ping-timestamp .
Test size	Number of probes within a test.

Table 5: show services rpm probe-results Output Fields (*continued*)

Field Name	Field Description
Routing Instance Name	<p>(BGP neighbor discovery) Name of the configured (if any) routing instance, logical system name, or both, in which the probe is configured:</p> <ul style="list-style-type: none"> When a routing instance is defined within a logical system, the logical system name is followed by the routing instance name. A slash (/) is used to separate the two entities. For example, if the routing instance called R1 is configured within the logical system called LS, the name in the output field is LS/R1. When a routing instance is configured but the default logical system is used, the name in the output field is the name of the routing instance. When a logical system is configured but the default routing instance is used, the name in the output field is the name of the logical system followed by default. A slash (/) is used to separate the two entities. For example, LS/default.
Probe results	<p>Raw measurement of a particular probe sample done by a remote host. This data is provided separately from the calculated results. The following information is contained in the raw measurement:</p> <ul style="list-style-type: none"> Response received—Timestamp when the probe result was determined. Client and server hardware timestamps—If timestamps are configured, an entry appears at this point. Rtt—Average ping round-trip time (RTT), in microseconds. Egress jitter—Egress jitter, in microseconds. Ingress jitter—Ingress jitter, in microseconds. Round trip jitter—Round-trip jitter, in microseconds. Egress interarrival jitter—Egress interarrival jitter, in microseconds. Ingress interarrival jitter—Ingress interarrival jitter, in microseconds. Round trip interarrival jitter—Round-trip interarrival jitter, in microseconds.
Results over current test	<p>Probes are grouped into tests, and the statistics are calculated for each test. If a test contains 10 probes, the average, minimum, and maximum results are calculated from the results of those 10 probes. If the command is issued while the test is in progress, the statistics use information from the completed probes.</p> <ul style="list-style-type: none"> Probes sent—Number of probes sent within the current test. Probes received—Number of probe responses received within the current test. Loss percentage—Percentage of lost probes for the current test. Measurement—Measurement type. Possible values are round-trip time, positive round-trip jitter, negative round-trip jitter, egress time, positive egress jitter, negative egress jitter, ingress time, positive ingress jitter, negative ingress jitter, and, for the probe type icmp-ping-timestamp, the egress delay and ingress delay. <p>For each measurement type, the following individual calculated results are provided:</p> <ul style="list-style-type: none"> Samples—Number of probes. Minimum—Minimum RTT, ingress delay, or egress delay measured over the course of the current test. Maximum—Maximum RTT, ingress delay, or egress delay measured over the course of the current test. Average—Average RTT, ingress delay, or egress delay measured over the course of the current test. Peak to peak—Peak-to-peak difference, in microseconds. Stddev—Standard deviation, in microseconds. Sum—Statistical sum.

Table 5: show services rpm probe-results Output Fields (*continued*)

Field Name	Field Description
Results over last test	<p>Results for the most recently completed test. If the command is issued while the first test is in progress, this information is not displayed</p> <ul style="list-style-type: none"> • Probes sent—Number of probes sent for the most recently completed test. • Probes received—Number of probe responses received for the most recently completed test. • Loss percentage—Percentage of lost probes for the most recently completed test. • Test completed—Time the most recent test was completed. • Measurement—Measurement type. Possible values are round-trip time, positive round-trip jitter, negative round-trip jitter, egress time, positive egress jitter, negative egress jitter, ingress time, positive ingress jitter, negative ingress jitter, and, for the probe type icmp-ping-timestamp, the egress delay and ingress delay. <p>For each measurement type, the following individual calculated results are provided:</p> <ul style="list-style-type: none"> • Samples—Number of probes. • Minimum—Minimum RTT, ingress delay, or egress delay measured for the most recently completed test. • Maximum—Maximum RTT, ingress delay, or egress delay measured for the most recently completed test. • Average—Average RTT, ingress delay, or egress delay measured for the most recently completed test. • Peak to peak—Peak-to-peak difference, in microseconds. • Stddev—Standard deviation, in microseconds. • Sum—Statistical sum.
Results over all tests	<p>Displays statistics made for all the probes, independently of the grouping into tests, as well as statistics for the current test.</p> <ul style="list-style-type: none"> • Probes sent—Number of probes sent in all tests. • Probes received—Number of probe responses received in all tests. • Loss percentage—Percentage of lost probes in all tests. • Measurement—Measurement type. Possible values are round-trip time, positive round-trip jitter, negative round-trip jitter, egress time, positive egress jitter, negative egress jitter, ingress time, positive ingress jitter, negative ingress jitter, and, for the probe types icmp-ping-timestamp and udp-ping-timestamp, the egress delay and ingress delay. <p>For each measurement type, the following individual calculated results are provided:</p> <ul style="list-style-type: none"> • Samples—Number of probes. • Minimum—Minimum RTT, ingress delay, or egress delay measured over the course of the current test. • Maximum—Maximum RTT, ingress delay, or egress delay measured over the course of the current test. • Average—Average RTT, ingress delay, or egress delay measured over the course of the current test. • Peak to peak—Peak-to-peak difference, in microseconds. • Stddev—Standard deviation, in microseconds. • Sum—Statistical sum.

Sample Output

show services rpm
probe-results

```
user@host> show services rpm probe-results
Owner: ADSN-J4300.ADSN-J2300.D2, Test: 75300002
Target address: 172.16.54.172, Source address: 10.206.0.1,
Probe type: udp-ping-timestamp, Test size: 10 probes
Probe results:
  Response received, Tue Feb  6 14:53:15 2007,
  Client and server hardware timestamps
  Rtt: 575 usec, Egress jitter: 5 usec, Ingress jitter: 8 usec,
  Round trip jitter: 12 usec, Egress interarrival jitter: 8 usec,
  Ingress interarrival jitter: 7 usec, Round trip interarrival jitter: 7 usec,

  Round trip interarrival jitter: 669 usec
Results over current test:
  Probes sent: 10, Probes received: 10, Loss percentage: 0
  Measurement: Round trip time
    Samples: 10, Minimum: 805 usec, Maximum: 2859 usec, Average: 1644 usec,
    Peak to peak: 2054 usec, Stddev: 738 usec, Sum: xxxx usec
  Measurement: Positive round trip jitter
    Samples: 5, Minimum: 5 usec, Maximum: 2054 usec, Average: 876 usec,
    Peak to peak: 2049 usec, Stddev: 679 usec, Sum: xxxx usec
  Measurement: Negative round trip jitter
    Samples: 5, Minimum: 5 usec, Maximum: 1812 usec, Average: 926 usec,
    Peak to peak: 1807 usec, Stddev: 665 usec, Sum: xxxx usec
  Measurement: Egress time
    Samples: 10, Minimum: 805 usec, Maximum: 2859 usec, Average: 1644 usec,
    Peak to peak: 2054 usec, Stddev: 738 usec, Sum: xxxx usec
  Measurement: Positive Egress jitter
    Samples: 5, Minimum: 5 usec, Maximum: 2054 usec, Average: 876 usec,
    Peak to peak: 2049 usec, Stddev: 679 usec, Sum: xxxx usec
  Measurement: Negative Egress jitter
    Samples: 5, Minimum: 5 usec, Maximum: 1812 usec, Average: 926 usec,
    Peak to peak: 1807 usec, Stddev: 665 usec, Sum: xxxx usec
  Measurement: Ingress time
    Samples: 10, Minimum: 805 usec, Maximum: 2859 usec, Average: 1644 usec,
    Peak to peak: 2054 usec, Stddev: 738 usec, Sum: xxxx usec
  Measurement: Positive Ingress jitter
    Samples: 5, Minimum: 5 usec, Maximum: 2054 usec, Average: 876 usec,
    Peak to peak: 2049 usec, Stddev: 679 usec, Sum: xxxx usec
  Measurement: Negative Ingress jitter
    Samples: 5, Minimum: 5 usec, Maximum: 1812 usec, Average: 926 usec,
    Peak to peak: 1807 usec, Stddev: 665 usec, Sum: xxxx usec
Results over last test:
  Probes sent: 10, Probes received: 10, Loss percentage: 0
  Test completed on Tue Feb  6 14:53:16 2007
  Measurement: Round trip time
    Samples: 10, Minimum: 805 usec, Maximum: 2859 usec, Average: 1644 usec,
    Peak to peak: 2054 usec, Stddev: 738 usec, Sum: xxxx usec
  Measurement: Positive round trip jitter
    Samples: 5, Minimum: 5 usec, Maximum: 2054 usec, Average: 876 usec,
    Peak to peak: 2049 usec, Stddev: 679 usec, Sum: xxxx usec
  Measurement: Negative round trip jitter
    Samples: 5, Minimum: 5 usec, Maximum: 1812 usec, Average: 926 usec,
    Peak to peak: 1807 usec, Stddev: 665 usec, Sum: xxxx usec
  Measurement: Egress time
    Samples: 10, Minimum: 805 usec, Maximum: 2859 usec, Average: 1644 usec,
    Peak to peak: 2054 usec, Stddev: 738 usec, Sum: xxxx usec
  Measurement: Positive Egress jitter
    Samples: 5, Minimum: 5 usec, Maximum: 2054 usec, Average: 876 usec,
```

```

    Peak to peak: 2049 usec, Stddev: 679 usec, Sum: xxxx usec
Measurement: Negative Egress jitter
    Samples: 5, Minimum: 5 usec, Maximum: 1812 usec, Average: 926 usec,
    Peak to peak: 1807 usec, Stddev: 665 usec, Sum: xxxx usec
Measurement: Ingress time
    Samples: 10, Minimum: 805 usec, Maximum: 2859 usec, Average: 1644 usec,
    Peak to peak: 2054 usec, Stddev: 738 usec, Sum: xxxx usec
Measurement: Positive Ingress jitter
    Samples: 5, Minimum: 5 usec, Maximum: 2054 usec, Average: 876 usec,
    Peak to peak: 2049 usec, Stddev: 679 usec, Sum: xxxx usec
Measurement: Negative Ingress jitter
    Samples: 5, Minimum: 5 usec, Maximum: 1812 usec, Average: 926 usec,
    Peak to peak: 1807 usec, Stddev: 665 usec, Sum: xxxx usec
Results over all tests:
Probes sent: 560, Probes received: 560, Loss percentage: 0
Measurement: Round trip time
    Samples: 560, Minimum: 805 usec, Maximum: 3114 usec, Average: 1756 usec,

    Peak to peak: 2309 usec, Stddev: 519 usec, Sum: xxxx usec
Measurement: Positive round trip jitter
    Samples: 257, Minimum: 0 usec, Maximum: 2054 usec, Average: 597 usec,
    Peak to peak: 2054 usec, Stddev: 427 usec, Sum: xxxx usec
Measurement: Negative round trip jitter
    Samples: 302, Minimum: 1 usec, Maximum: 1812 usec, Average: 511 usec,
    Peak to peak: 1811 usec, Stddev: 408 usec, Sum: xxxx usec
Measurement: Egress time
    Samples: 10, Minimum: 805 usec, Maximum: 2859 usec, Average: 1644 usec,
    Peak to peak: 2054 usec, Stddev: 738 usec, Sum: xxxx usec
Measurement: Positive Egress jitter
    Samples: 5, Minimum: 5 usec, Maximum: 2054 usec, Average: 876 usec,
    Peak to peak: 2049 usec, Stddev: 679 usec, Sum: xxxx usec
Measurement: Negative Egress jitter
    Samples: 5, Minimum: 5 usec, Maximum: 1812 usec, Average: 926 usec,
    Peak to peak: 1807 usec, Stddev: 665 usec, Sum: xxxx usec
Measurement: Ingress time
    Samples: 10, Minimum: 805 usec, Maximum: 2859 usec, Average: 1644 usec,
    Peak to peak: 2054 usec, Stddev: 738 usec, Sum: xxxx usec
Measurement: Positive Ingress jitter
    Samples: 5, Minimum: 5 usec, Maximum: 2054 usec, Average: 876 usec,
    Peak to peak: 2049 usec, Stddev: 679 usec, Sum: xxxx usec
Measurement: Negative Ingress jitter
    Samples: 5, Minimum: 5 usec, Maximum: 1812 usec, Average: 926 usec,
    Peak to peak: 1807 usec, Stddev: 665 usec, Sum: xxxx usec

```

show services rpm
probe-results (BGP
Neighbor Discovery)

```

user@host> show services rpm probe-results
Owner: Rpm-Bgp-Owner, Test: Rpm-Bgp-Test-1
Target address: 10.209.152.37, Probe type: icmp-ping, Test size: 5 probes
Routing Instance Name: LS1/RI1
Probe results:
    Response received, Fri Oct 28 05:20:23 2005
    Rtt: 662 usec
Results over current test:
    Probes sent: 5, Probes received: 5, Loss percentage: 0
    Measurement: Round trip time
        Minimum: 529 usec, Maximum: 662 usec, Average: 585 usec,
        Jitter: 133 usec, Stddev: 53 usec
Results over all tests:
    Probes sent: 5, Probes received: 5, Loss percentage: 0
    Measurement: Round trip time
        Minimum: 529 usec, Maximum: 662 usec, Average: 585 usec,
        Jitter: 133 usec, Stddev: 53 usec

```


show services rpm twamp server connection

Syntax	show services rpm twamp server connection <i><connection-id></i>
Release Information	Command introduced in Junos OS Release 9.3.
Description	Display information about the connections established between the real-time performance monitoring (RPM) Two-Way Active Measurement Protocol (TWAMP) server and control-clients. By default, all established sessions are displayed, unless you specify a session ID when you issue the command.
Options	<i>connection-id</i> —(Optional) Display only information about the specified connection ID.
Required Privilege Level	view
List of Sample Output	show services rpm twamp server connection on page 69
Output Fields	Table 6 on page 68 lists the output fields for the show services rpm twamp server connection command. Output fields are listed in the approximate order in which they appear.

Table 6: show services rpm twamp server connection Output Fields

Field Name	Field Description
Connection ID	Connection ID that uniquely identifies the connection between the TWAMP server and a particular client.
Client address	Client IP address.
Client port	Client port number.
Server address	Server IP address.
Server port	Server port number.
Session count	Session count.
Auth mode	Authentication mode.

Sample Output

`show services rpm
twamp server
connection`

`user@host> show services rpm twamp server connection`

Connection	Client	Client	Server	Server	Session	Auth
ID	address	port	address	port	count	mode
4	1.1.1.1	12345	192.168.219.203	890	16	none
78	3.22.1.55	345	22.2.2.2	89022	5	none
234	192.168.219.203	2345	2.2.22.2	3333	16	none
5	221.4.1.1	82345	2.2.2.2	45909	16	
1	192.168.1.1	645	32.2.2.23	2394	16	

authenticated
encrypted

show services rpm twamp server session

Syntax `show services rpm twamp server session`
`<session-id>`

Release Information Command introduced in Junos OS Release 9.3.

Description Display information about the sessions established between the real-time performance monitoring (RPM) Two-Way Active Measurement Protocol (TWAMP) server and control clients. By default, all established sessions are displayed, unless you specify a session ID when you issue the command.

Options *session-id*—(Optional) Display only information about the specified session ID.

Required Privilege Level view

List of Sample Output [show services rpm twamp server session on page 70](#)

Output Fields [Table 7 on page 70](#) lists the output fields for the `show services rpm twamp server session` command. Output fields are listed in the approximate order in which they appear.

Table 7: show services rpm twamp server session Output Fields

Field Name	Field Description
Session ID	Session ID that uniquely identifies the session between the TWAMP server and a particular client.
Connection ID	Connection ID that uniquely identifies the connection between the TWAMP server and a particular client.
Sender address	Sender IP address.
Sender port	Sender port number.
Reflector address	Reflector IP address.
Reflector port	Reflector port number.

Sample Output

`show services rpm`
`twamp server session`

```
user@host> show services rpm twamp server session
  Session  Connection  Sender  Sender  Reflector  Reflector
   ID      ID         address  port    address    port
   4        44      1.1.1.1  12345   192.168.219.203    890
   78        44      3.22.1.55   345    22.2.2.2      89022
  234       423    192.168.219.203  2345   2.2.22.2      3333
   5        423    221.4.1.1    82345   2.2.2.2      45909
   1        423    192.168.1.1    645    32.2.2.23     2394
```

PART 4

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