JUNIPER NETWORKS

Junos® OS

ICMP Router Discovery Protocol Feature Guide for Routing Devices

Release
14.1

Published: 2014-06-10

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Junos® OS ICMP Router Discovery Protocol Feature Guide for Routing Devices
14.1
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Supported Platforms

For the features described in this document, the following platforms are supported:

- J Series
- SRX Series
- T Series
- MX Series
- M Series

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

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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.

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```
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 xi 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.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

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

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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`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*
Italic text like this	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** *domain-name*
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• 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)	Encloses optional keywords or variables.	**stub <default-metric** *metric***>;**
| (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** **(*string1* | *string2* | *string3*)**
# (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)	Encloses a variable for which you can substitute one or more values.	**community name members [** ***community-ids*** **]**

Indention and braces ({ })	Identifies a level in the configuration hierarchy.	[edit]
		routing-options {
		  static {
		  route default {
		  nexthop *address*;
		  retain;
		  }
		  }
		}

; (semicolon)	Identifies a leaf statement at a configuration hierarchy level.	

GUI Conventions

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

Convention	Description	Examples
Bold text like this	Represents graphical user interface (GUI) items you click or select.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select **Protocols>Ospf**.

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Requesting Technical Support

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/.
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- 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: http://kb.juniper.net/InfoCenter/
- 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.

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PART 1

Overview

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CHAPTER 1

Introduction to ICMP Router Discovery

ICMP Router Discovery Overview

Router discovery uses Internet Control Message Protocol (ICMP) router advertisements and router solicitation messages to allow a host to discover the addresses of operational routers on the subnet. Hosts must discover routers before they can send IP datagrams outside their subnet.

Router discovery allows a host to discover the addresses of operational routers on the subnet. The Junos® operating system (Junos OS) implementation of router discovery supports server mode only.

Each router periodically multicasts a router advertisement from each of its multicast interfaces, announcing the IP address of that interface. Hosts listen for advertisements to discover the addresses of their neighboring routers. When a host starts, it can send a multicast router solicitation to ask for immediate advertisements.

The router discovery messages do not constitute a routing protocol. They enable hosts to discover the existence of neighboring routers, but do not determine which router is best to reach a particular destination.

This section discusses the following topics:

Operation of a Router Discovery Server

The router discovery server distributes information about the addresses of all routers on directly connected networks and about their preferences for becoming the default router. (A host sends a packet to the default router if the host does not have a route to a destination in its routing table.) The server does this by periodically sending router advertisement packets out each interface on which router discovery is enabled. In addition to containing the router addresses, these packets also announce the existence of the server itself.

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The server can either transmit broadcast or multicast router advertisement packets. Multicast packets are sent to 224.0.0.1, which is the all-hosts multicast address. When packets are sent to the all-hosts multicast address, or when an interface is configured for the limited-broadcast address 255.255.255.255, all IP addresses configured on the physical interface are included in the router advertisement. When the packets are being sent to a network or subnet broadcast address, only the address associated with that network or subnet is included in the router advertisement.

When the routing protocol process first starts on the server router, the server sends router advertisement packets every few seconds. Then, the server sends these packets less frequently, commonly every 10 minutes.

The server responds to router solicitation packets it receives from a client. The response is sent unicast unless a router advertisement packet is due to be sent out momentarily.

NOTE: **Junos OS does not support the ICMP router solicitation message with the source address as 0.0.0.0.**

Router Advertisement Messages

Router advertisement messages include a preference level and a lifetime field for each advertised router address.

The preference level specifies the router's preference to become the default router. When a host chooses a default router address, it chooses the address with the highest preference. You can configure the preference level by including the **priority** statement.

The lifetime field indicates the maximum length of time that the advertised addresses are to be considered valid by hosts in the absence of further advertisements. You can configure the advertising rate by including the **max-advertisement-interval** and **min-advertisement-interval** statements, and you can configure the lifetime by including the **lifetime** statement. .

Related Documentation

- Example: Configuring ICMP Router Discovery on page 12

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Recursive DNS Servers Overview

To access any location on the Internet, the domain name system (DNS) server plays a pivotal role in resolving the domain name into its associated IP address. The DNS resolution service can also be provided by the DHCP server. The routing protocol process (rpd) of routers generates router advertisements to facilitate IPv6 hosts in autoconfiguration and in learning network information. For IPv6 stateless autoconfiguration, DNS configuration is provided by router advertisements. The router advertisement-based DNS configuration is useful in networks where an IPv6 host's address is autoconfigured through an IPv6 stateless address and where there is no existing DHCPv6 infrastructure.

Depending on their configuration, DNS servers can be classified into the following types:

- Recursive domain name system
- Nonrecursive domain name system

DNS servers can resolve either recursive or nonrecursive queries. For a recursive query by a DNS client, the DNS server returns either the IP address associated with the domain name or an error. A recursive query does not return a referral. For a nonrecursive query, the DNS server returns the IP address of the domain name or an error or a referral to another DNS server which might have the resolution of the query.

For IPv6 hosts, a maximum of three recursive DNS server addresses can be configured along with their respective lifetimes. The default value of the lifetime of the configured recursive DNS server addresses is 1800 seconds. The configured IPv6 host uses the specified recursive DNS server address for DNS resolution where the IPv6 host's address is autoconfigured through an IPv6 stateless address and where there is no DHCPv6 infrastructure available.

CAUTION: The recursive DNS server configuration is included in the router advertisement packet, which is a part of the Neighbor Discovery Protocol (NDP). In general, in an unsecured deployment scenario, an attacker could send a router advertisement with a fraudulent recursive DNS server address, misleading the IPv6 host into contacting an unintended DNS server for DNS name resolution. These attacks are similar to neighbor discovery attacks and attacks against unauthenticated DHCP. We recommend using the Secure Neighbor Discovery (SEND) protocol as a security mechanism for neighbor discovery to allow all the neighbor discovery options including the recursive DNS server options to be automatically included in the signatures.

For more information about configuring the SEND protocol, see www.juniper.net/techpubs/en_US/junos14.1/topics/topic-map/ipv6-secure-neighbor.html

Related Documentation

- dns-server-address on page 26
- lifetime on page 28

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CHAPTER 2

ICMP Router Discovery Reference

Supported ICMP Router Discovery and IPv6 Neighbor Discovery Standards

Junos OS substantially supports the following RFCs, which define standards for the Internet Control Message Protocol (ICMP for IP version 4 [IPv4]) and neighbor discovery (for IP version 6 [IPv6]).

- RFC 1256, *ICMP Router Discovery Messages*
- RFC 4861, *Neighbor Discovery for IP version 6 (IPv6)*
- RFC 2462, *IPv6 Stateless Address Autoconfiguration*
- RFC 2463, *Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification*
- RFC 4443, *Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification*
- RFC 4861, *IPv6 Stateless Address Autoconfiguration*
- RFC 4862, *Neighbor Discovery for IP version 6 (IPv6)*
- RFC 6106, *IPv6 Router Advertisement Options for DNS Configuration*

Related Documentation

- *Supported IPv4, TCP, and UDP Standards*
- *Supported IPv6 Standards*
- *Accessing Standards Documents on the Internet*

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PART 2

Configuration

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CHAPTER 3

Concept and Example

Example: Configuring ICMP Router Discovery

Understanding the ICMP Router Discovery Protocol

The ICMP Router Discovery Protocol (IRDP) enables hosts to locate routers on the local subnet and use them as a gateway to reach other networks. Junos OS supports running IRDP in server mode, meaning that router discovery packets are generated. Junos OS does not support IRDP in client mode running as a host sending router solicitation messages. IRDP is specified in RFC 1256, *ICMP Router Discovery Messages*.

For a host to participate on an internetwork, it needs connectivity to at least one router on the local network. One way to ensure that this is the case is to manually configure each host with the address of a local router as its default router (also called a *gateway*). This method is time-consuming to set up, difficult to maintain, and inflexible.

When you enable the Dynamic Host Configuration Protocol (DHCP) on a host, you do not need to configure the default router. DHCP uses a method called router discovery to automatically discover local routers, and learn other information about them.

The information provided includes the router's address (or addresses, if it has more than one) and how long the host should retain information about the router. Router advertisement messages are sent periodically. Hosts listen for these messages. When an advertisement is received, the host processes it and adds the information about the router to its routing table. A host that has no manually configured routing information has no connectivity to routers when it first powers on. Instead of waiting for the next Router Advertisement message, the host sends a router solicitation message on its local network. This prompts any router that receives this message to immediately send an extra router advertisement message directly to that host.

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By default, router discovery is disabled on Junos OS routing devices. When router discovery is enabled, the default behavior is to advertise all interfaces. If the router supports multicast, all the IPv4 Layer 3 interfaces are advertised through multicast. Otherwise, all the IPv4 Layer 3 interfaces are advertised through broadcast.

Example: Configuring ICMP Router Discovery

This example shows how to configure Internet Control Message Protocol (ICMP) router advertisements to allow IPv4 hosts to discover the addresses of operational routers on the subnet. Hosts must discover routers before they can send IP datagrams outside their subnet.

Requirements

This example assumes that a server or a client computer on the local network supports RFC 1256, *ICMP Router Discovery Messages*.

Overview

Before a host is able to send a message to a host outside its own subnet, it must be able to identify the address of the immediate router. This is typically done through reading a configuration file upon startup, and on some multicast networks by listening to routing protocol traffic. When a server or a client computer on the local network that supports RFC 1256 needs to locate a default gateway (router), the server or client computer uses ICMP to send a router solicitation. Hosts that support RFC 1256 send an ICMP router discovery message on the multicast address 224.0.0.2. Routers on the local network that support RFC 1256 immediately respond with a router advertisement.

The all-routers IP multicast address, 224.0.0.2, is the local IP broadcast address that IPv4 reserved. IPv4 multicast addresses in the range 224.0.0.0/24 (from 224.0.0.0 to 224.0.0.255) are reserved for the local subnet.

The ICMP Router Discovery Protocol (IRDP) uses router advertisements as well as router solicitation messages to allow hosts to learn the IP addresses of the router that is attached to the immediate network. When a host is started, it sends router solicitation messages to check for the address of the immediate router.

NOTE: Not all hosts perform router discovery using the method specified in RFC 1256. If the host has DHCP enabled, it might not use ICMP router discovery. The performance of router discovery is one of the DHCP options that is defined in RFC 1541, *Dynamic Host Configuration Protocol*. This option specifies whether the client solicits routers using the ICMP router discovery method specified in RFC 1256. A value of 1 indicates that the client performs router discovery. A value of 0 indicates that the client does not.

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To configure the router to be a router discovery server, you must include at least the following statement in the configuration. All other router discovery configuration statements are optional.

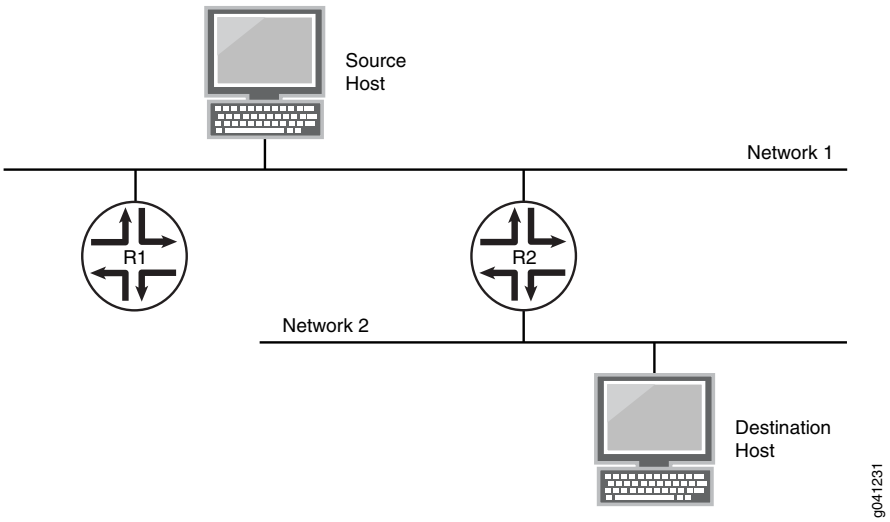
```
[edit]
protocols {
  router-discovery;
}
```

To configure a router as a server for ICMP router discovery, you can include the following statements in the configuration:

```
[edit]
protocols {
  router-discovery {
    disable;
    address address {
      (advertise | ignore);
      (broadcast | multicast);
      (ineligible | priority number);
    }
    interface interface-name {
      lifetime seconds;
      max-advertisement-interval seconds;
      min-advertisement-interval seconds;
    }
    traceoptions {
      file filename <files number> <size size> <world-readable | no-world-readable>;
      flag flag <detail> <disable>;
    }
  }
}
```

Figure 1 on page 13 shows a simplified sample topology.

Figure 1: ICMP Router Discovery Topology



Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set interfaces ge-1/2/0 unit 6 description to-R2
set interfaces ge-1/2/0 unit 6 family inet address 10.0.0.6/24
set protocols router-discovery traceoptions file icmp-log
set protocols router-discovery traceoptions flag all
set protocols router-discovery interface ge-1/2/0.6 max-advertisement-interval 60
set protocols router-discovery interface ge-1/2/0.6 min-advertisement-interval 10
set protocols router-discovery interface ge-1/2/0.6 lifetime 120
set protocols router-discovery address 10.0.0.6 multicast
set protocols router-discovery address 10.0.0.6 priority 900
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure ICMP router discovery:

1. Configure the network interfaces.

   This example shows multiple loopback interface addresses to simulate attached networks.

   ```
   [edit interfaces]
   user@R1# set ge-1/2/0 unit 6 description to-R2
   user@R1# set ge-1/2/0 unit 6 family inet address 10.0.0.6/24
   ```

2. Enable router discovery.

   ```
   [edit protocols]
   user@R1# set router-discovery
   ```

3. (Optional) Enable trace operations for router discovery.

   ```
   [edit protocols router-discovery]
   user@R1# set traceoptions file icmp-log
   user@R1# set traceoptions flag all
   ```

4. (Optional) Set the IRDP maximum interval between advertisements.

   ```
   [edit protocols router-discovery]
   user@R1# set interface ge-1/2/0.6 max-advertisement-interval 60
   ```

5. (Optional) Set the IRDP minimum interval between advertisements.

   ```
   [edit protocols router-discovery]
   user@R1# set interface ge-1/2/0.6 min-advertisement-interval 10
   ```

6. (Optional) Set the IRDP period for which advertisements are valid.

   ```
   [edit protocols router-discovery]
   user@R1# set interface ge-1/2/0.6 lifetime 120
   ```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7. (Optional) Configure the router to include the 10.0.0.6 IP address in IRDP advertisements to the all-hosts multicast address (224.0.0.1).

   If the router supports IP multicast, and if the interface supports IP multicast, **multicast** is the default. Otherwise, the addresses are included in broadcast router advertisement packets.

   ```
   [edit protocols router-discovery]
   user@R1# set address 10.0.0.6 multicast
   ```

8. (Optional) Set the preference of the address to become a default router.

   This preference is set relative to the preferences of other router addresses on the same subnet.

   ```
   [edit protocols router-discovery]
   user@R1# set address 10.0.0.6 priority 900
   ```

Results From configuration mode, confirm your configuration by entering the **show interfaces** and **show protocols** commands. If the output does not display the intended configuration, repeat the configuration instructions in this example to correct it.

```
user@R1# show interfaces
ge-1/2/0 {
   unit 6 {
      description to-R2;
      family inet {
         address 10.0.0.6/24;
      }
   }
}
```

```
user@R1# show protocols
router-discovery {
   traceoptions {
      file icmp-log;
      flag all;
   }
   interface ge-1/2/0.6 {
      max-advertisement-interval 60;
      min-advertisement-interval 10;
      lifetime 120;
   }
   address 10.0.0.6 {
      multicast;
      priority 900;
   }
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

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Checking the Trace Log

Purpose Verify that the expected interfaces are sending messages.

Action From operational mode, enter the **show log icmp-log** command.

```
user@R1> show log icmp-log
Mar 21 14:42:54 trace_on: Tracing to "/var/log/icmp-log" started
Mar 21 14:42:54.409027 rdisc_ifa_change: Preference for address
10.0.0.6(ge-1/2/0.6) set to 900
Mar 21 14:43:33.983695 task_timer_uset: timer RouterDiscoveryServer_Group <Touched
 Processing> set to offset 22 at 14:43:16
Mar 21 14:43:33.984263 rdisc_server_timer: group ge-1/2/0.6 timer set to 22
Mar 21 14:43:55.985225 task_timer_uset: timer RouterDiscoveryServer_Group <Touched
 Processing> set to offset 37 at 14:44:10
Mar 21 14:43:55.985520 rdisc_server_timer: group ge-1/2/0.6 timer set to 37
Mar 21 14:44:32.986407 task_timer_uset: timer RouterDiscoveryServer_Group <Touched
 Processing> set to offset 39 at 14:44:44
Mar 21 14:44:32.986961 rdisc_server_timer: group ge-1/2/0.6 timer set to 39
Mar 21 14:45:11.987331 task_timer_uset: timer RouterDiscoveryServer_Group <Touched
 Processing> set to offset 10 at 14:44:42
Mar 21 14:45:11.987888 rdisc_server_timer: group ge-1/2/0.6 timer set to 10
Mar 21 14:45:21.990974 task_timer_uset: timer RouterDiscoveryServer_Group <Touched
 Processing> set to offset 23 at 14:45:34
Mar 21 14:45:21.991548 rdisc_server_timer: group ge-1/2/0.6 timer set to 23
Mar 21 14:45:44.992150 task_timer_uset: timer RouterDiscoveryServer_Group <Touched
 Processing> set to offset 45 at 14:46:06
Mar 21 14:45:44.992710 rdisc_server_timer: group ge-1/2/0.6 timer set to 45
```

Meaning The log output shows that the preference was set to 900 for IP address 10.0.0.6 and that messages are being sent on the ge-1/2/0.6 interface.

Related Documentation

- *Example: Configuring Secure IPv6 Neighbor Discovery*

Example: Configuring Recursive DNS Server Address

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Recursive DNS Servers Overview

To access any location on the Internet, the domain name system (DNS) server plays a pivotal role in resolving the domain name into its associated IP address. The DNS resolution service can also be provided by the DHCP server. The routing protocol process (rpd) of routers generates router advertisements to facilitate IPv6 hosts in autoconfiguration and in learning network information. For IPv6 stateless autoconfiguration, DNS configuration is provided by router advertisements. The router advertisement-based DNS configuration is useful in networks where an IPv6 host's address is autoconfigured through an IPv6 stateless address and where there is no existing DHCPv6 infrastructure.

Depending on their configuration, DNS servers can be classified into the following types:

- Recursive domain name system
- Nonrecursive domain name system

DNS servers can resolve either recursive or nonrecursive queries. For a recursive query by a DNS client, the DNS server returns either the IP address associated with the domain name or an error. A recursive query does not return a referral. For a nonrecursive query, the DNS server returns the IP address of the domain name or an error or a referral to another DNS server which might have the resolution of the query.

For IPv6 hosts, a maximum of three recursive DNS server addresses can be configured along with their respective lifetimes. The default value of the lifetime of the configured recursive DNS server addresses is 1800 seconds. The configured IPv6 host uses the specified recursive DNS server address for DNS resolution where the IPv6 host's address is autoconfigured through an IPv6 stateless address and where there is no DHCPv6 infrastructure available.

CAUTION: The recursive DNS server configuration is included in the router advertisement packet, which is a part of the Neighbor Discovery Protocol (NDP). In general, in an unsecured deployment scenario, an attacker could send a router advertisement with a fraudulent recursive DNS server address, misleading the IPv6 host into contacting an unintended DNS server for DNS name resolution. These attacks are similar to neighbor discovery attacks and attacks against unauthenticated DHCP. We recommend using the Secure Neighbor Discovery (SEND) protocol as a security mechanism for neighbor discovery to allow all the neighbor discovery options including the recursive DNS server options to be automatically included in the signatures.

For more information about configuring the SEND protocol, see www.juniper.net/techpubs/en_US/junos14.1/topics/topic-map/ipv6-secure-neighbor.html

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Example: Configuring Recursive DNS Server Addresses for IPv6 Hosts

This example shows how to configure the recursive DNS server address of an IPv6 host. The recursive DNS server address is included in the router advertisement that is sent to the neighboring devices.

Requirements

This example uses the following hardware and software components:

- Two MX Series routers with IPv6 enabled on the connected interfaces.
- Junos OS Release 14.1 or later running on all devices.

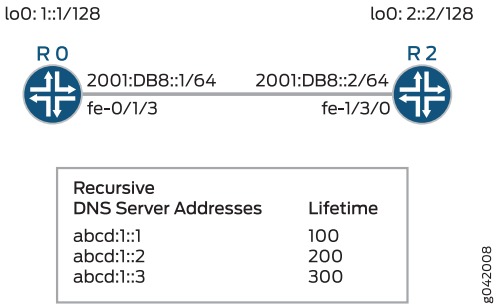
Overview

The example includes two routers that are directly connected. Configure IPv6 on the directly connected interfaces. Enable router advertisement on the interfaces and configure the recursive DNS server addresses and their lifetimes on the interfaces. This example verifies that the router advertisement sent to the neighboring device includes the configured recursive DNS server addresses.

Topology

Figure 2 on page 18 shows the sample topology.

Figure 2: Configuring Recursive DNS Server Address for IPv6 Hosts



Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Router R0

```
set interfaces fe-0/1/3 unit 0 family inet6 address 2001:DB8::1/64
set interfaces lo0 unit 0 family inet6 address 1::1/128
set protocols router-advertisement interface fe-0/1/3 max-advertisement-interval 4
```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```
set protocols router-advertisement interface fe-0/1/3 min-advertisement-interval 3
set protocols router-advertisement interface fe-0/1/3 dns-server-address abcd:1::1 lifetime
  100
set protocols router-advertisement interface fe-0/1/3 dns-server-address abcd:1::2
  lifetime 200
set protocols router-advertisement interface fe-0/1/3 dns-server-address abcd:1::3
  lifetime 300
```

Router R1

```
set interfaces fe-1/3/0 unit 0 family inet6 address 2001:DB8::2/64
set interfaces lo0 unit 0 family inet6 address 1::2/128
set protocols router-advertisement interface fe-1/3/0 max-advertisement-interval 4
set protocols router-advertisement interface fe-1/3/0 min-advertisement-interval 3
set protocols router-advertisement interface fe-1/3/0 dns-server-address abcd:1::4
  lifetime 100
```

Configuring the Recursive DNS Server Address

Step-by-Step Procedure

The following example requires that you navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

NOTE: Repeat this procedure for Router R1, modifying the appropriate interface names, addresses, and any other parameters for the router.

To configure the recursive DNS server address on Router R0:

1. Enable IPv6 on the physical interface.

   ```
   [edit interfaces]
   user@R0# set fe-0/1/3 unit 0 family inet6 address 2001:DB8::1/64
   ```

2. Configure the loopback address.

   ```
   [edit interfaces]
   user@R0# set lo0 unit 0 family inet6 address 1::1/128
   ```

3. Specify the time interval between router advertisements on the interface.

   The router sends advertisements to neighbors after the specified time interval. In this example, Router R0 sends router advertisements to Router R1 after a minimum interval of 3 seconds and a maximum interval of 4 seconds.

   ```
   [edit protocols router-advertisement]
   user@R0# set interface fe-0/1/3 max-advertisement-interval 4
   user@R0# set interface fe-0/1/3 min-advertisement-interval 3
   ```

4. Configure the recursive DNS addresses and their lifetimes on the interface.

   ```
   [edit protocols router-advertisement]
   user@R0# set interface fe-0/1/3 dns-server-address abcd:1::1 lifetime 100
   user@R0# set interface fe-0/1/3 dns-server-address abcd:1::2 lifetime 200
   user@R0# set interface fe-0/1/3 dns-server-address abcd:1::3 lifetime 300
   ```

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Results

From configuration mode, confirm your configuration by entering the **show interfaces** and **show protocols** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@R0# show interfaces
fe-0/1/3 {
    unit 0 {
        family inet6 {
            address 2001:DB8::1/64;
        }
    }
}
lo0 {
    unit 0 {
        family inet6 {
            address ::1/128;
        }
    }
}
user@R0# show protocols
router-advertisement {
    interface fe-0/1/3.0 {
        max-advertisement-interval 4;
        min-advertisement-interval 3;
        dns-server-address abcd:1::1 {
            lifetime 100;
        }
        dns-server-address abcd:1::2 {
            lifetime 200;
        }
        dns-server-address abcd:1::3 {
            lifetime 300;
        }
    }
}
```

If you are done configuring the device, commit the configuration.

```
user@R0# commit
```

Verification

Verifying That the Router Advertisement Includes the Recursive DNS Server Address

Purpose Verify that the router advertisement on Router R1 includes the recursive DNS server address configured on Router R0.

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Action From operational mode on Router R1, enter the **show ipv6 router-advertisement** command.

```
user@R1> show ipv6 router-advertisement

Interface: fe-1/3/0.0
  Advertisements sent: 18, last sent 00:00:02 ago
  Solicits received: 0
  Advertisements received: 18
  Advertisement from fe80::214:f6ff:fe22:5422, heard 00:00:02 ago
    Managed: 0
    Other configuration: 0
    Reachable time: 0 ms
    Default lifetime: 12 sec
    Retransmit timer: 0 ms
    Current hop limit: 64
    RDNSS address: abcd:1::1
      Lifetime: 100 sec
    RDNSS address: abcd:1::2
      Lifetime: 200 sec
    RDNSS address: abcd:1::3
      Lifetime: 300 sec
```

Meaning The recursive DNS server address and the configured lifetime are included in the router advertisements on Router R1.

Related Documentation

- dns-server-address on page 26
- lifetime on page 28
- Configuring a Recursive DNS Server Address for IPv6 Hosts on page 21

Configuring a Recursive DNS Server Address for IPv6 Hosts

For IPv6 hosts, a maximum of three recursive DNS server addresses can be configured along with their respective lifetimes. The configured IPv6 host uses the specified recursive DNS server address for DNS resolution where the IPv6 host's address is autoconfigured through an IPv6 stateless address and where there is no DHCPv6 infrastructure available.

To configure a recursive DNS server address on IPv6 hosts, follow these steps:

1. Configure the recursive DNS server address for the IPv6 host.

   ```
   [edit protocols router-advertisement]
   user@host# set interfaces interface name dns-server-address address
   ```

   For example, to assign IPv6 address abcd:1::1 as the recursive dns server address to interface fe-1/0/1:

   ```
   [edit protocols router-advertisement]
   user@host# set interfaces fe-1/0/1 dns-server-address abcd:1::1
   ```

2. Configure the lifetime to specify the time in seconds for which the recursive DNS server address remains valid.

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```
[edit protocols router-advertisement interfaces interface name dns-server-address
  address]
user@host# set lifetime seconds
```

For example, to specify a lifetime of 60 seconds for the recursive DNS server address:

```
[edit protocols router-advertisement interfaces interface name dns-server-address
  address]
user@host# set lifetime 60
```

The default value of the lifetime of the configured recursive DNS server address is 1800 seconds.

Related Documentation

- dns-server-address on page 26
- lifetime on page 28
- Example: Configuring Recursive DNS Server Address on page 16

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CHAPTER 4

Configuration Statements

[edit protocols router-discovery] Hierarchy Level

The following statement hierarchy can also be included at the **[edit logical-systems *logical-system-name*]** hierarchy level.

```
protocols {
  router-discovery {
    disable;
    address address {
      (advertise | ignore);
      (broadcast | multicast);
      (ineligible | priority number);
    }
    interface interface-name {
      lifetime seconds;
```

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```
        max-advertisement-interval seconds;
        min-advertisement-interval seconds;
      }
      traceoptions {
        file filename <files number> <size size> <world-readable | no-world-readable>;
        flag flag <flag-modifier> <disable>;
      }
    }
  }
```

Related Documentation

- *Notational Conventions Used in Junos OS Configuration Hierarchies*
- *[edit protocols] Hierarchy Level*

address (Protocols Router Discovery)

Syntax

```
address (Protocols Router Discovery) address {
  (advertise | ignore);
  (broadcast | multicast);
  (ineligible | priority number);
}
```

Hierarchy Level

[edit logical-systems *logical-system-name* protocols router-discovery],
[edit protocols router-discovery]

Release Information

Statement introduced before Junos OS Release 7.4.

Description

Specify the IP addresses to include in router advertisement packets.

Options

address—IP address. To specify more than one address, specify multiple addresses or include multiple **address** statements.

The remaining statements are explained separately.

Required Privilege Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring ICMP Router Discovery on page 11

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advertise

Syntax (advertise | ignore);

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-discovery address *address*], [edit protocols router-discovery address *address*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify whether the server should advertise the IP address in its router advertisement packets:

- **advertise**—Advertise the IP address in its router advertisement packets.
- **ignore**—Do not advertise the IP addresses in router advertisement packets.

Default **advertise**

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

Related Documentation
- Example: Configuring ICMP Router Discovery on page 11

broadcast

Syntax (broadcast | multicast);

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-discovery address *address*], [edit protocols router-discovery address *address*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify when the server should include the IP addresses in router advertisement packets. On the same physical interfaces, some addresses might be included only in multicast packets, while others might be included only in broadcast packets.

If you specify **broadcast**, the server includes the addresses in router advertisement packets only if the packets are broadcast.

Default **multicast** if the router supports IP multicast; **broadcast** if the router does not support IP multicast.

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

Related Documentation
- Example: Configuring ICMP Router Discovery on page 11
- multicast on page 32

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disable (Protocols Router Discovery)

Syntax disable;

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-discovery],
[edit protocols router-discovery]

Release Information Statement introduced before Junos OS Release 7.4.

Description Disable router discovery.

Default The configured object is enabled (operational) unless explicitly disabled.

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

Related Documentation
- Example: Configuring ICMP Router Discovery on page 11

dns-server-address

Syntax
```
dns-server-address address {
  lifetime seconds;
}
```

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-advertisement interface *interface-name*],
[edit protocols router-advertisement interface *interface-name*]

Release Information Statement introduced in Junos OS Release 14.1.

Description Specify the recursive DNS server address that the device must use to resolve DNS names. The recursive DNS server address is the 128-bit IPv6 address of the recursive DNS server. You can configure a maximum of three recursive DNS server addresses at the interface level.

The remaining statement is explained separately.

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

Related Documentation
- Example: Configuring Recursive DNS Server Addresses for IPv6 Hosts on page 18
- Recursive DNS Servers Overview on page 5
- lifetime on page 28

ignore

See advertise

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ineligible

Syntax ineligible;

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-discovery address *address*], [edit protocols router-discovery address *address*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify that the address can never become the default router.

Required Privilege Level routing—To view this statement in the configuration.

Related Documentation
- Example: Configuring ICMP Router Discovery on page 11
- priority on page 33

interface (Protocols Router Discovery)

Syntax
```
interface interface-name {
  lifetime seconds;
  max-advertisement-interval seconds;
  min-advertisement-interval seconds;
}
```

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-discovery], [edit protocols router-discovery]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify physical interfaces on which to configure timers for router advertisement messages.

Options *interface-name*—Name of an interface. Specify the full interface name, including the physical and logical address components. To configure all interfaces, specify **all**.

The remaining statements are explained separately.

Required Privilege Level routing—To view this statement in the configuration.

Related Documentation
- Example: Configuring ICMP Router Discovery on page 11

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lifetime

Syntax lifetime *seconds*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-advertisement interface *interface-name* dns-server-address *address*],
[edit protocols router-advertisement interface *interface-name* dns-server-address *address*]

Release Information Statement introduced in Junos OS Release 14.1.

Description Specify the maximum time in seconds for which the recursive DNS server address remains valid. The device can use the specified recursive DNS server address for DNS name resolution until the time specified by this statement.

seconds– Maximum time for which the recursive DNS server address remains valid.

Options

Range: 0 through 4294967295 seconds

Default: 1800 seconds

Values: 0 indicates that the advertised recursive DNS server address is no longer valid and that this recursive DNS server address entry can be deleted. 4294967295 seconds indicates an infinite lifetime and a persistent entry in the device for this recursive DNS server address.

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

Related Documentation

- Recursive DNS Servers Overview on page 5
- Example: Configuring Recursive DNS Server Addresses for IPv6 Hosts on page 18
- dns-server-address on page 26

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lifetime

Syntax lifetime *seconds*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-discovery interface *interface-name*],
[edit protocols router-discovery interface *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify how long the addresses sent by the server in its router advertisement packets are valid. This time must be long enough so that another router advertisement packet is sent before the lifetime has expired. The lifetime value is placed in the advertisement lifetime field of the router advertisement packet. If this amount of time passes and the host has not received a router advertisement from the server, the router marks the advertised addresses as invalid.

Options *seconds*—Lifetime value. A value of 0 indicates that one or more addresses are no longer valid.

Range: Three times the value set by the **max-advertisement-interval** statement through 2 hours, 30 minutes (9000 seconds)

Default: 1800 seconds (30 minutes, which is three times the default value for the **max-advertisement-interval** statement)

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

Related Documentation

- Example: Configuring ICMP Router Discovery on page 11
- max-advertisement-interval on page 30

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max-advertisement-interval (Protocols Router Discovery)

Syntax max-advertisement-interval *seconds*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-discovery interface *interface-name*],
[edit protocols router-discovery interface *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify the maximum time the router waits before sending periodic router advertisement packets out the interface. These packets are broadcast or multicast, depending on how the address corresponding to this physical interface is configured.

Options ***seconds***—Maximum time between router advertisement packets.

Range: 4 through 1800 seconds

Default: 600 seconds (10 minutes)

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

Related Documentation

- Example: Configuring ICMP Router Discovery on page 11
- broadcast on page 25
- lifetime on page 29
- min-advertisement-interval on page 31
- multicast on page 32

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min-advertisement-interval (Protocols Router Discovery)

Syntax min-advertisement-interval *seconds*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-discovery interface *interface-name*],
[edit protocols router-discovery interface *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify the minimum time the router waits before sending router advertisement packets out the interface in response to router solicitation packets it receives from a client. These packets are broadcast or multicast, depending on how the address corresponding to this physical interface is configured.

Options ***seconds***—Minimum time between router advertisement packets.

Range: 3 seconds through 1800 seconds

Default: 400 seconds (0.75 times the default value for the **max-advertisement-interval** statement)

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

Related Documentation

- Example: Configuring ICMP Router Discovery on page 11
- broadcast on page 25
- max-advertisement-interval on page 30
- multicast on page 32

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multicast (Protocols Router Discovery)

Syntax (multicast | broadcast);

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-discovery address *address*], [edit protocols router-discovery address *address*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify when the server should include the IP addresses in router advertisement packets. On the same physical interfaces, some addresses might be included only in multicast packets, while others might be included only in broadcast packets.

If you specify **multicast**, the server includes the addresses in router advertisement packets only if the packets are multicast. If the router supports IP multicast, and if the interface supports IP multicast, **multicast** is the default. Otherwise, the addresses are included in broadcast router advertisement packets. If the router does not support IP multicast, the addresses are not included.

Default **multicast** if the router supports IP multicast; **broadcast** if the router does not support IP multicast.

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

Related Documentation

- Example: Configuring ICMP Router Discovery on page 11
- broadcast on page 25

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priority (Protocols Router Discovery)

Syntax priority *number*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-discovery address *address*], [edit protocols router-discovery address *address*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Specify the preference of the address to become a default router. This preference is set relative to the preferences of other router addresses on the same subnet.

Options *number*—Preference of the addresses for becoming the default router. A higher value indicates that the address has a greater preference for becoming the default router.

Range: 0 through 0x80000000

Default: 0 (This address has the least chance of becoming the default router.)

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

Related Documentation

- Example: Configuring ICMP Router Discovery on page 11

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router-discovery

Syntax

```
router-discovery {
  disable;
  address address {
    (advertise | ignore);
    (broadcast | multicast);
    (ineligible | priority number);
  }
  interface interface-name {
    lifetime seconds;
    max-advertisement-interval seconds;
    min-advertisement-interval seconds;
  }
  traceoptions {
    file filename <files number> <size size> <world-readable | no-world-readable>;
    flag flag <flag-modifier> <disable>;
  }
}
```

Hierarchy Level [edit logical-systems *logical-system-name* protocols],
[edit protocols]

Release Information Statement introduced before Junos OS Release 7.4.

Description Enable ICMP router discovery (server mode) on the router.

The remaining statements are explained separately.

Default Router discovery is disabled on the router. When router discovery is enabled, the default behavior is to advertise all interfaces. If the router supports multicast, all the IPv4 Layer 3 interfaces are advertised through multicast. Otherwise, all the IPv4 Layer 3 interfaces are advertised through broadcast.

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

Related Documentation

- Example: Configuring ICMP Router Discovery on page 11

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traceoptions (Protocols Router Discovery)

Syntax

```
traceoptions {
    file filename <files number> <size size> <world-readable | no-world-readable>;
    flag flag <flag-modifier> <disable>;
}
```

Hierarchy Level [edit logical-systems *logical-system-name* protocols router-discovery],
[edit protocols router-discovery]

Release Information Statement introduced before Junos OS Release 7.4.

Description Configure ICMP protocol-level tracing options.

To specify more than one tracing operation, include multiple **flag** statements.

Default The default ICMP protocol-level tracing options are inherited from the routing protocols **traceoptions** statement included at the **[edit routing-options]** hierarchy level.

Options **disable**—(Optional) Disable the tracing operation. One use of this option is to disable a single operation when you have defined a broad group of tracing operations, such as **all**.

file *filename*—Name of the file to receive the output of the tracing operation. Enclose the name within quotation marks. All files are placed in the directory **/var/log**. We recommend that you place ICMP tracing output in the file **icmp-log**.

files *number*—(Optional) Maximum number of trace files. When a trace file named ***trace-file*** reaches its maximum size, it is renamed ***trace-file*.0**, then ***trace-file*.1**, and so on, until the maximum number of trace files is reached. Then, the oldest trace file is overwritten.

If you specify a maximum number of files, you also must specify a maximum file size with the **size** option.

Range: 2 through 1000 files

Default: 2 files

flag *flag*—Tracing operation to perform. To specify more than one tracing operation, include multiple **flag** statements. These are the ICMP-specific tracing options:

- **error**—Errored ICMP packets
- **info**—ICMP information packets
- **packets**—All packets
- **router-discovery**—All ICMP packets
- **redirect**—ICMP redirect packets

These are the global tracing options:

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- **all**—All tracing operations
- **general**—A combination of the **normal** and **route** trace operations
- **normal**—All normal operations

Default: If you do not specify this option, only unusual or abnormal operations are traced.

- **policy**—Policy operations and actions
- **route**—Routing table changes
- **state**—State transitions
- **task**—Interface transactions and processing
- **timer**—Timer usage

flag-modifier—(Optional) Modifier for the tracing flag. You can specify one or more of these modifiers:

- **detail**—Provide detailed trace information
- **receive**—Packets being received
- **send**—Packets being transmitted

no-world-readable—(Optional) Prevent any user from reading the log file.

size *size*—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named ***trace-file*** reaches this size, it is renamed ***trace-file*.0**. When the ***trace-file*** again reaches its maximum size, ***trace-file*.0** is renamed ***trace-file*.1** and ***trace-file*** is renamed ***trace-file*.0**. This renaming scheme continues until the maximum number of trace files is reached. Then, the oldest trace file is overwritten.

If you specify a maximum file size, you also must specify a maximum number of trace files with the **files** option.

Syntax: ***x*k** to specify KB, ***x*m** to specify MB, or ***x*g** to specify GB

Range: 10 KB through the maximum file size supported on your system

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege Level

routing and trace—To view this statement in the configuration.
routing-control and trace-control—To add this statement to the configuration.

Related Documentation

- Example: Configuring ICMP Router Discovery on page 11

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PART 3

Administration

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CHAPTER 5

Operational Commands

- monitor interface
- monitor start
- monitor stop
- ping
- show log
- traceroute

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monitor interface

Syntax monitor interface
<*interface-name* | traffic <detail>>

Release Information Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 11.1 for the QFX Series.

Description Display real-time statistics about interfaces, updating the statistics every second. Check for and display common interface failures, such as SONET/SDH and T3 alarms, loopbacks detected, and increases in framing errors.

NOTE: This command is not supported on the QFX3000 QFabric system.

Options **none**—Display real-time statistics for all interfaces.

detail—(Optional) With traffic option only, display detailed output.

interface-name—(Optional) Display real-time statistics for the specified interface. In a TX Matrix or TX Matrix Plus router, display real-time statistics for the physical interfaces on the specified line-card chassis (LCC) only.

traffic—(Optional) Display traffic data for all active interfaces. In a TX Matrix or TX Matrix Plus router, display real-time statistics for the physical interfaces on the specified LCC only.

Additional Information The output of this command shows how much each field has changed since you started the command or since you cleared the counters by pressing the c key. For a description of the statistical information provided in the output of this command, see the **show interfaces extensive** command for a particular interface type in the CLI Explorer. To control the output of the **monitor interface** command while it is running, use the keys listed in Table 3 on page 40. The keys are not case-sensitive.

Table 3: Output Control Keys for the monitor interface Command

Key	Action
c	Clears (returns to zero) the delta counters since **monitor interface** was started. This does not clear the accumulative counter. To clear the accumulative counter, use the **clear interfaces interval** command.
f	Freezes the display, halting the display of updated statistics and delta counters.
i	Displays information about a different interface. The command prompts you for the name of a specific interface.

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Table 3: Output Control Keys for the monitor interface Command *(continued)*

Key	Action
n	Displays information about the next interface. The **monitor interface** command displays the physical or logical interfaces in the same order as the **show interfaces terse** command.
q or Esc	Quits the command and returns to the command prompt.
t	Thaws the display, resuming the update of the statistics and delta counters.

To control the output of the **monitor interface traffic** command while it is running, use the keys listed in Table 4 on page 41. The keys are not case-sensitive.

Table 4: Output Control Keys for the monitor interface traffic Command

Key	Action
b	Displays the statistics in units of bits and bits per second (bps).
c	Clears (return to 0) the delta counters in the **Current Delta** column. The statistics counters are not cleared.
d	Displays the **Current Delta** column (instead of the rate column) in Bps or packets per second (pps).
p	Displays the statistics in units of packets and packets per second (pps).
q or Esc	Quits the command and returns to the command prompt.
r	Displays the rate column (instead of the **Current Delta** column) in Bps and pps.

Required Privilege Level trace

List of Sample Output

monitor interface (Physical) on page 43
monitor interface (OTN Interface) on page 44
monitor interface (Logical) on page 45
monitor interface (QFX3500 Switch) on page 45
monitor interface traffic on page 46
monitor interface traffic (QFX3500 Switch) on page 46
monitor interface traffic detail (QFX3500 Switch) on page 47

Output Fields Table 5 on page 42 describes the output fields for the **monitor interface** command. Output fields are listed in the approximate order in which they appear.

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Table 5: monitor interface Output Fields

Field Name	Field Description	Level of Output
router1	Hostname of the router.	All levels
Seconds	How long the monitor interface command has been running or how long since you last cleared the counters.	All levels
Time	Current time (UTC).	All levels
Delay *x/y/z*	Time difference between when the statistics were displayed and the actual clock time. • ***x***—Time taken for the last polling (in milliseconds). • ***y***—Minimum time taken across all pollings (in milliseconds). • ***z***—Maximum time taken across all pollings (in milliseconds).	All levels
Interface	Short description of the interface, including its name, status, and encapsulation.	All levels
Link	State of the link: **Up**, **Down**, or **Test**.	All levels
Current delta	Cumulative number for the counter in question since the time shown in the Seconds field, which is the time since you started the command or last cleared the counters.	All levels
Local Statistics	(Logical interfaces only) Number and rate of bytes and packets destined to the router or switch through the specified interface. When a burst of traffic is received, the value in the output packet rate field might briefly exceed the peak cell rate. It usually takes less than 1 second for this counter to stabilize. • **Input bytes**—Number of bytes received on the interface. • **Output bytes**—Number of bytes transmitted on the interface. • **Input packets**—Number of packets received on the interface. • **Output packets**—Number of packets transmitted on the interface.	All levels
Remote Statistics	(Logical interfaces only) Statistics for traffic transiting the router or switch. When a burst of traffic is received, the value in the output packet rate field might briefly exceed the peak cell rate. It usually takes less than 1 second for this counter to stabilize. • **Input bytes**—Number of bytes received on the interface. • **Output bytes**—Number of bytes transmitted on the interface. • **Input packets**—Number of packets received on the interface. • **Output packets**—Number of packets transmitted on the interface.	All levels

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Table 5: monitor interface Output Fields *(continued)*

Field Name	Field Description	Level of Output
Traffic statistics	Total number of bytes and packets received and transmitted on the interface. These statistics are the sum of the local and remote statistics. When a burst of traffic is received, the value in the output packet rate field might briefly exceed the peak cell rate. It usually takes less than 1 second for this counter to stabilize. • **Input bytes**—Number of bytes received on the interface. • **Output bytes**—Number of bytes transmitted on the interface. • **Input packets**—Number of packets received on the interface. • **Output packets**—Number of packets transmitted on the interface.	All levels
Description	With the **traffic** option, displays the interface description configured at the **[edit interfaces *interface-name*]** hierarchy level.	**detail**

Sample Output

monitor interface (Physical)

```
user@host> monitor interface so-0/0/0
router1                          Seconds: 19                  Time: 15:46:29

Interface: so-0/0/0, Enabled, Link is Up
Encapsulation: PPP, Keepalives, Speed: OC48
Traffic statistics:                                          Current Delta
  Input packets:                     6045 (0 pps)                     [11]
  Input bytes:                    6290065 (0 bps)                  [13882]
  Output packets:                   10376 (0 pps)                    [10]
  Output bytes:                  10365540 (0 bps)                  [9418]
Encapsulation statistics:
  Input keepalives:                  1901                             [2]
  Output keepalives:                 1901                             [2]
  NCP state: Opened
  LCP state: Opened
Error statistics:
  Input errors:                         0                             [0]
  Input drops:                          0                             [0]
  Input framing errors:                 0                             [0]
  Policed discards:                     0                             [0]
  L3 incompletes:                       0                             [0]
  L2 channel errors:                    0                             [0]
  L2 mismatch timeouts:                 0                             [0]
  Carrier transitions:                  1                             [0]
  Output errors:                        0                             [0]
  Output drops:                         0                             [0]
  Aged packets:                         0                             [0]
Active alarms : None
Active defects: None
SONET error counts/seconds:
  LOS count                             1                             [0]
  LOF count                             1                             [0]
  SEF count                             1                             [0]
  ES-S                                  0                             [0]
  SES-S                                 0                             [0]
SONET statistics:
  BIP-B1                           458871                             [0]
```

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```
  BIP-B2                              460072                              [0]
  REI-L                               465610                              [0]
  BIP-B3                              458978                              [0]
  REI-P                               458773                              [0]
Received SONET overhead:
  F1      : 0x00  J0        : 0x00  K1        : 0x00
  K2      : 0x00  S1        : 0x00  C2        : 0x00
  C2(cmp) : 0x00  F2        : 0x00  Z3        : 0x00
  Z4      : 0x00  S1(cmp)   : 0x00
Transmitted SONET overhead:
  F1      : 0x00  J0        : 0x01  K1        : 0x00
  K2      : 0x00  S1        : 0x00  C2        : 0xcf
  F2      : 0x00  Z3        : 0x00  Z4        : 0x00

Next='n', Quit='q' or ESC, Freeze='f', Thaw='t', Clear='c', Interface='i'
```

monitor interface (OTN Interface)

```
user@host> monitor interface ge-7/0/0


Interface: ge-7/0/0, Enabled, Link is Up
Encapsulation: Ethernet, Speed: 10000mbps
Traffic statistics:
  Input bytes:                          0 (0 bps)
  Output bytes:                         0 (0 bps)
  Input packets:                        0 (0 pps)
  Output packets:                       0 (0 pps)
Error statistics:
  Input errors:                         0
  Input drops:                          0
  Input framing errors:                 0
  Policed discards:                     0
  L3 incompletes:                       0
  L2 channel errors:                    0
  L2 mismatch timeouts:                 0
  Carrier transitions:                  5
  Output errors:                        0
  Output drops:                         0
  Aged packets:                         0
Active alarms : None
Active defects: None
Input MAC/Filter statistics:
  Unicast packets                       0
  Broadcast packets                     0
  Multicast packets                     0
  Oversized frames                      0
  Packet reject count                   0
  DA rejects                            0
  SA rejects                            0
Output MAC/Filter Statistics:
  Unicast packets                       0
  Broadcast packets                     0
  Multicast packets                     0
  Packet pad count                      0
  Packet error count                    0
OTN Link 0
  OTN Alarms: OTU_BDI, OTU_TTIM, ODU_BDI
  OTN Defects: OTU_BDI, OTU_TTIM, ODU_BDI, ODU_TTIM
  OTN OC - Seconds
    LOS                                 2
```


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```
    LOF                                9
  OTN OTU - FEC Statistics
    Corr err ratio                   N/A
    Corr bytes                         0
    Uncorr words                       0
  OTN OTU - Counters
    BIP                                0
    BBE                                0
    ES                                 0
    SES                                0
    UAS                              422
  OTN ODU - Counters
    BIP                                0
    BBE                                0
    ES                                 0
    SES                                0
    UAS                              422
  OTN ODU - Received Overhead    APSPCC 0-3:              0
```

monitor interface (Logical)

```
user@host> monitor interface so-1/0/0.0
host name               Seconds: 16                  Time: 15:33:39
                                                              Delay: 0/0/1
Interface: so-1/0/0.0, Enabled, Link is Down
Flags: Hardware-Down Point-To-Point SNMP-Traps
Encapsulation: PPP
Local statistics:                                          Current delta
  Input bytes:                          0                          [0]
  Output bytes:                         0                          [0]
  Input packets:                        0                          [0]
  Output packets:                       0                          [0]
Remote statistics:
  Input bytes:                          0 (0 bps)                  [0]
  Output bytes:                         0 (0 bps)                  [0]
  Input packets:                        0 (0 pps)                  [0]
  Output packets:                       0 (0 pps)                  [0]
Traffic statistics:
  Destination address: 192.168.8.193, Local: 192.168.8.21

Next='n', Quit='q' or ESC, Freeze='f', Thaw='t', Clear='c', Interface='i'
```

monitor interface (QFX3500 Switch)

```
user@switch> monitor interface ge-0/0/0
Interface: ge-0/0/0, Enabled, Link is Down
Encapsulation: Ethernet, Speed: Unspecified
Traffic statistics:                                        Current delta
  Input bytes:                          0 (0 bps)                  [0]
  Output bytes:                         0 (0 bps)                  [0]
  Input packets:                        0 (0 pps)                  [0]
  Output packets:                       0 (0 pps)                  [0]
Error statistics:
  Input errors:                         0                          [0]
  Input drops:                          0                          [0]
  Input framing errors:                 0                          [0]
  Policed discards:                     0                          [0]
  L3 incompletes:                       0                          [0]
  L2 channel errors:                    0                          [0]
  L2 mismatch timeouts:                 0                          [0]
  Carrier transitions:                  0                          [0]
```

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```
  Output errors:                      0                                 [0]
  Output drops:                       0                                 [0]
  Aged packets:                       0                                 [0]
Active alarms : LINK
Active defects: LINK
Input MAC/Filter statistics:
  Unicast packets                     0                                 [0]
  Broadcast packets                   0  Multicast packet               [0]

Interface warnings:
  o Outstanding LINK alarm
```

monitor interface traffic

```
user@host> monitor interface traffic
host name                Seconds: 15                 Time: 12:31:09

Interface    Link  Input packets        (pps)     Output packets        (pps)
 so-1/0/0    Down              0          (0)                  0          (0)
 so-1/1/0    Down              0          (0)                  0          (0)
 so-1/1/1    Down              0          (0)                  0          (0)
 so-1/1/2    Down              0          (0)                  0          (0)
 so-1/1/3    Down              0          (0)                  0          (0)
 t3-1/2/0    Down              0          (0)                  0          (0)
 t3-1/2/1    Down              0          (0)                  0          (0)
 t3-1/2/2    Down              0          (0)                  0          (0)
 t3-1/2/3    Down              0          (0)                  0          (0)
 so-2/0/0      Up         211035          (1)              36778          (0)
 so-2/0/1      Up         192753          (1)              36782          (0)
 so-2/0/2      Up         211020          (1)              36779          (0)
 so-2/0/3      Up         211029          (1)              36776          (0)
 so-2/1/0      Up         189378          (1)              36349          (0)
 so-2/1/1    Down              0          (0)              18747          (0)
 so-2/1/2    Down              0          (0)              16078          (0)
 so-2/1/3      Up              0          (0)              80338          (0)
 at-2/3/0      Up              0          (0)                  0          (0)
 at-2/3/1    Down              0          (0)                  0          (0)

Bytes=b, Clear=c, Delta=d, Packets=p, Quit=q or ESC, Rate=r, Up=^U, Down=^D
```

monitor interface traffic (QFX3500 Switch)

```
user@switch> monitor interface traffic
switch                             Seconds: 7                  Time: 16:04:37

Interface    Link  Input packets        (pps)     Output packets        (pps)
 ge-0/0/0    Down              0          (0)                  0          (0)
 ge-0/0/1      Up         392187          (0)             392170          (0)
 ge-0/0/2    Down              0          (0)                  0          (0)
 ge-0/0/3    Down              0          (0)                  0          (0)
 ge-0/0/4    Down              0          (0)                  0          (0)
 ge-0/0/5    Down              0          (0)                  0          (0)
 ge-0/0/6    Down              0          (0)                  0          (0)
 ge-0/0/7    Down              0          (0)                  0          (0)
 ge-0/0/8    Down              0          (0)                  0          (0)
 ge-0/0/9      Up         392184          (0)             392171          (0)
 ge-0/0/10   Down              0          (0)                  0          (0)
 ge-0/0/11   Down              0          (0)                  0          (0)
 ge-0/0/12   Down              0          (0)                  0          (0)
 ge-0/0/13   Down              0          (0)                  0          (0)
 ge-0/0/14   Down              0          (0)                  0          (0)
```


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```
 ge-0/0/15   Down              0          (0)              0          (0)
 ge-0/0/16   Down              0          (0)              0          (0)
 ge-0/0/17   Down              0          (0)              0          (0)
 ge-0/0/18   Down              0          (0)              0          (0)
 ge-0/0/19   Down              0          (0)              0          (0)
 ge-0/0/20   Down              0          (0)              0          (0)
 ge-0/0/21   Down              0          (0)              0          (0)
 ge-0/0/22     Up         392172          (0)         392187          (0)
 ge-0/0/23     Up         392185          (0)         392173          (0)
 vcp-0       Down              0                           0
 vcp-1       Down              0                           0
 ae0         Down              0          (0)              0          (0)
 bme0          Up              0                     1568706
```

monitor interface traffic detail (QFX3500 Switch)

```
user@switch> monitor interface traffic detail
switch                                                  Seconds: 74
        Time: 16:03:02

Interface    Link  Input packets        (pps)     Output packets        (pps)
Description
 ge-0/0/0    Down              0          (0)              0          (0)
 ge-0/0/1      Up         392183          (0)         392166          (0)
 ge-0/0/2    Down              0          (0)              0          (0)
 ge-0/0/3    Down              0          (0)              0          (0)
 ge-0/0/4    Down              0          (0)              0          (0)
 ge-0/0/5    Down              0          (0)              0          (0)
 ge-0/0/6    Down              0          (0)              0          (0)
 ge-0/0/7    Down              0          (0)              0          (0)
 ge-0/0/8    Down              0          (0)              0          (0)
 ge-0/0/9      Up         392181          (0)         392168          (0)
 ge-0/0/10   Down              0          (0)              0          (0)
 ge-0/0/11   Down              0          (0)              0          (0)
 ge-0/0/12   Down              0          (0)              0          (0)
 ge-0/0/13   Down              0          (0)              0          (0)
 ge-0/0/14   Down              0          (0)              0          (0)
 ge-0/0/15   Down              0          (0)              0          (0)
 ge-0/0/16   Down              0          (0)              0          (0)
 ge-0/0/17   Down              0          (0)              0          (0)
 ge-0/0/18   Down              0          (0)              0          (0)
 ge-0/0/19   Down              0          (0)              0          (0)
 ge-0/0/20   Down              0          (0)              0          (0)
 ge-0/0/21   Down              0          (0)              0          (0)
 ge-0/0/22     Up         392169          (0)         392184          (1)
 ge-0/0/23     Up         392182          (0)         392170          (0)
 vcp-0       Down              0                           0
 vcp-1       Down              0                           0
 ae0         Down              0          (0)              0          (0)
 bme0          Up              0                     1568693
```

monitor start

Syntax monitor start *filename*

Release Information Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.

Description Start displaying the system log or trace file and additional entries being added to those files.

Options ***filename***—Specific log or trace file.

Additional Information Log files are generated by the routing protocol process or by system logging. The log files generated by system logging are configured with the **syslog** statement at the **[edit system]** hierarchy level and the **options** statement at the **[edit routing-options]** hierarchy level. The trace files generated by the routing protocol process are configured with **traceoptions** statements at the **[edit routing-options]**, **[edit interfaces]**, and **[edit protocols *protocol*]** hierarchy levels.

NOTE: To monitor a log file within a logical system, issue the **monitor start** ***logical-system-name/filename*** command.

Required Privilege Level trace

Related Documentation
- *monitor list*
- monitor stop on page 50

List of Sample Output monitor start on page 49

Output Fields Table 6 on page 48 describes the output fields for the **monitor start** command. Output fields are listed in the approximate order in which they appear.

Table 6: monitor start Output Fields

Field Name	Field Description
******filename******	Name of the file from which entries are being displayed. This line is displayed initially and when the command switches between log files.
Date and time	Timestamp for the log entry.

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Sample Output

monitor start

```
user@host> monitor start system-log
*** system-log***
Jul 20 15:07:34 hang sshd[5845]: log: Generating 768 bit RSA key.
Jul 20 15:07:35 hang sshd[5845]: log: RSA key generation complete.
Jul 20 15:07:35 hang sshd[5845]: log: Connection from 204.69.248.180 port 912
Jul 20 15:07:37 hang sshd[5845]: log: RSA authentication for root accepted.
Jul 20 15:07:37 hang sshd[5845]: log: ROOT LOGIN as 'root' from trip.jcmax.com
Jul 20 15:07:37 hang sshd[5845]: log: Closing connection to 204.69.248.180
```

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monitor stop

Syntax monitor stop *filename*

Release Information Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.

Description Stop displaying the system log or trace file.

Options ***filename***—Specific log or trace file.

Additional Information Log files are generated by the routing protocol process or by system logging. The log files generated by system logging are those configured with the **syslog** statement at the **[edit system]** hierarchy level and the **options** statement at the **[edit routing-options]** hierarchy level. The trace files generated by the routing protocol process are those configured with **traceoptions** statements at the **[edit routing-options]**, **[edit interfaces]**, and **[edit protocols *protocol*]** hierarchy levels.

Required Privilege Level trace

Related Documentation
- *monitor list*
- monitor start on page 48

List of Sample Output monitor stop on page 50

Output Fields This command produces no output.

Sample Output

monitor stop

```
user@host> monitor stop
```

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ping

List of Syntax
Syntax on page 51
Syntax (QFX Series) on page 51

Syntax

ping *host*
<bypass-routing>
<count *requests*>
<detail>
<do-not-fragment>
<inet | inet6>
<interface *source-interface*>
<interval *seconds*>
<logical-system *logical-system-name*>
<loose-source *value*>
<mac-address *mac-address*>
<no-resolve>
<pattern *string*>
<rapid>
<record-route>
<routing-instance *routing-instance-name*>
<size *bytes*>
<source *source-address*>
<strict >
<strict-source *value*.>
<tos *type-of-service*>
<ttl *value*>
<verbose>
<vpls *instance-name*>
<wait *seconds*>

Syntax (QFX Series)

ping *host*
<bypass-routing>
<count *requests*>
<detail>
<do-not-fragment>
<inet>
<interface *source-interface*>
<interval *seconds*>
<logical-system *logical-system-name*>
<loose-source *value*>
<mac-address *mac-address*>
<no-resolve>
<pattern *string*>
<rapid>
<record-route>
<routing-instance *routing-instance-name*>
<size *bytes*>
<source *source-address*>
<strict>
< strict-source *value*>
<tos *type-of-service*>
<ttl *value*>
<verbose>

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<wait *seconds*>

Release Information Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 11.1 for the QFX Series.

Description Check host reachability and network connectivity. The **ping** command sends Internet Control Message Protocol (ICMP) ECHO_REQUEST messages to elicit ICMP ECHO_RESPONSE messages from the specified host. Press Ctrl+c to interrupt a ping command.

Options ***host***—IP address or hostname of the remote system to ping.

bypass-routing—(Optional) Bypass the normal routing tables and send ping requests directly to a system on an attached network. If the system is not on a directly attached network, an error is returned. Use this option to ping a local system through an interface that has no route through it.

count *requests*—(Optional) Number of ping requests to send. The range of values is **1** through **2,000,000,000**. The default value is an unlimited number of requests.

detail—(Optional) Include in the output the interface on which the ping reply was received.

do-not-fragment—(Optional) Set the do-not-fragment (DF) flag in the IP header of the ping packets. For IPv6 packets, this option disables fragmentation.

NOTE: In Junos OS Release 11.1 and later, when issuing the **ping** command for an IPv6 route with the **do-not-fragment** option, the maximum ping packet size is calculated by subtracting 48 bytes (40 bytes for the IPV6 header and 8 bytes for the ICMP header) from the MTU. Therefore, if the ping packet size (including the 48-byte header) is greater than the MTU, the ping operation might fail.

inet—(Optional) Ping Packet Forwarding Engine IPv4 routes.

inet6—(Optional) Ping Packet Forwarding Engine IPv6 routes.

interface *source-interface*—(Optional) Interface to use to send the ping requests.

interval *seconds*—(Optional) How often to send ping requests. The range of values, in seconds, is **1** through infinity. The default value is **1**.

logical-system *logical-system-name*—(Optional) Name of logical system from which to send the ping requests.

Alternatively, enter the **set cli logical-system *logical-system-name*** command and then run the **ping** command. To return to the main router or switch, enter the **clear cli logical-system** command.

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loose-source *value*—(Optional) Intermediate loose source route entry (IPv4). Open a set of values.

mac-address *mac-address*—(Optional) Ping the physical or hardware address of the remote system you are trying to reach.

no-resolve—(Optional) Do not attempt to determine the hostname that corresponds to the IP address.

pattern *string*—(Optional) Specify a hexadecimal fill pattern to include in the ping packet.

rapid—(Optional) Send ping requests rapidly. The results are reported in a single message, not in individual messages for each ping request. By default, five ping requests are sent before the results are reported. To change the number of requests, include the **count** option.

record-route—(Optional) Record and report the packet's path (IPv4).

routing-instance *routing-instance-name*—(Optional) Name of the routing instance for the ping attempt.

size *bytes*—(Optional) Size of ping request packets. The range of values, in bytes, is **0** through **65,468**. The default value is **56**, which is effectively 64 bytes because 8 bytes of ICMP header data are added to the packet.

source *source-address*—(Optional) IP address of the outgoing interface. This address is sent in the IP source address field of the ping request. If this option is not specified, the default address is usually the loopback interface (**lo.0**).

strict—(Optional) Use the strict source route option (IPv4).

strict-source *value*—(Optional) Intermediate strict source route entry (IPv4). Open a set of values.

tos *type-of-service*—(Optional) Set the type-of-service (ToS) field in the IP header of the ping packets. The range of values is **0** through **255**.

If the device configuration includes the **dscp-code-point** *value* statement at the **[edit class-of-service host-outbound-traffic]** hierarchy level, the configured DSCP value overrides the value specified in this command option. In this case, the ToS field of ICMP echo request packets sent on behalf of this command carries the DSCP value specified in the **dscp-code-point** configuration statement instead of the value you specify in this command option.

ttl *value*—(Optional) Time-to-live (TTL) value to include in the ping request (IPv6). The range of values is **0** through **255**.

verbose—(Optional) Display detailed output.

vpls *instance-name*—(Optional) Ping the instance to which this VPLS belongs.

wait *seconds*—(Optional) Maximum wait time, in seconds, after the final packet is sent. If this option is not specified, the default delay is **10** seconds. If this option is used without the count option, a default count of **5** packets is used.

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Required Privilege Level network

Related Documentation
- *Configuring the Junos OS ICMPv4 Rate Limit for ICMPv4 Routing Engine Messages*

List of Sample Output
ping hostname on page 54
ping hostname rapid on page 54
ping hostname size count on page 54

Output Fields When you enter this command, you are provided feedback on the status of your request. An exclamation point (**!**) indicates that an echo reply was received. A period (**.**) indicates that an echo reply was not received within the timeout period. An **x** indicates that an echo reply was received with an error code. These packets are not counted in the received packets count. They are accounted for separately.

Sample Output

ping hostname

```
user@host> ping skye
PING skye.net (192.168.169.254): 56 data bytes
64 bytes from 192.168.169.254: icmp_seq=0 ttl=253 time=1.028 ms
64 bytes from 192.168.169.254: icmp_seq=1 ttl=253 time=1.053 ms
64 bytes from 192.168.169.254: icmp_seq=2 ttl=253 time=1.025 ms
64 bytes from 192.168.169.254: icmp_seq=3 ttl=253 time=1.098 ms
64 bytes from 192.168.169.254: icmp_seq=4 ttl=253 time=1.032 ms
64 bytes from 192.168.169.254: icmp_seq=5 ttl=253 time=1.044 ms
^C [abort]
```

ping hostname rapid

```
user@host> ping skye rapid
PING skye.net (192.168.169.254): 56 data bytes
!!!!!
--- skye.net ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.956/0.974/1.025/0.026 ms
```

ping hostname size count

```
user@host> ping skye size 200 count 5
PING skye.net (192.168.169.254): 200 data bytes
208 bytes from 192.168.169.254: icmp_seq=0 ttl=253 time=1.759 ms
208 bytes from 192.168.169.254: icmp_seq=1 ttl=253 time=2.075 ms
208 bytes from 192.168.169.254: icmp_seq=2 ttl=253 time=1.843 ms
208 bytes from 192.168.169.254: icmp_seq=3 ttl=253 time=1.803 ms
208 bytes from 192.168.169.254: icmp_seq=4 ttl=253 time=17.898 ms

--- skye.net ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 1.759/5.075/17.898 ms
```


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show log

List of Syntax

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Syntax (QFabric System) on page 55
Syntax (TX Matrix Routers) on page 55

Syntax

show log
<*filename* | user <*username*>>

Syntax (QFabric System)

show log *filename*
<*device-type (device-id* | *device-alias*)>

Syntax (TX Matrix Routers)

show log
<all-lcc | lcc *number* | scc>
<*filename* | user <*username*>>

Release Information

Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
Command introduced in Junos OS Release 11.1 for the QFX Series.
Option *device-type (device-id* | *device-alias*) is introduced in Junos OS Release 13.1 for the QFX Series.

Description

List log files, display log file contents, or display information about users who have logged in to the router or switch.

Options

none—List all log files.

<all-lcc | lcc *number* | scc>—(TX Matrix routers only)(Optional) Display logging information about all T640 routers (or line-card chassis) or a specific T640 router (replace ***number*** with a value from 0 through 3) connected to a TX Matrix router. Or, display logging information about the TX Matrix router (or switch-card chassis).

device-type—(QFabric system only) (Optional) Display log messages for only one of the following device types:

- **director-device**—Display logs for Director devices.
- **infrastructure-device**—Display logs for the logical components of the QFabric system infrastructure, including the diagnostic Routing Engine, fabric control Routing Engine, fabric manager Routing Engine, and the default network Node group and its backup (NW-NG-0 and NW-NG-0-backup).
- **interconnect-device**—Display logs for Interconnect devices.
- **node-device**—Display logs for Node devices.

NOTE: If you specify the device-type optional parameter, you must also specify either the device-id or device-alias optional parameter.

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(*device-id* | *device-alias*)—If a device type is specified, display logs for a device of that type. Specify either the device ID or the device alias (if configured).

filename—(Optional) Display the log messages in the specified log file. For the routing matrix, the filename must include the chassis information.

NOTE: The *filename* parameter is mandatory for the QFabric system. If you did not configure a syslog filename, specify the default filename of messages.

user <*username*>—(Optional) Display logging information about users who have recently logged in to the router or switch. If you include ***username***, display logging information about the specified user.

Required Privilege Level trace

List of Sample Output

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show log user on page 57

Sample Output

show log

```
user@host> show log
total 57518
-rw-r--r--  1 root  bin      211663 Oct  1 19:44 dcd
-rw-r--r--  1 root  bin      999947 Oct  1 19:41 dcd.0
-rw-r--r--  1 root  bin      999994 Oct  1 17:48 dcd.1
-rw-r--r--  1 root  bin      238815 Oct  1 19:44 rpd
-rw-r--r--  1 root  bin     1049098 Oct  1 18:00 rpd.0
-rw-r--r--  1 root  bin     1061095 Oct  1 12:13 rpd.1
-rw-r--r--  1 root  bin     1052026 Oct  1 06:08 rpd.2
-rw-r--r--  1 root  bin     1056309 Sep 30 18:21 rpd.3
-rw-r--r--  1 root  bin     1056371 Sep 30 14:36 rpd.4
-rw-r--r--  1 root  bin     1056301 Sep 30 10:50 rpd.5
-rw-r--r--  1 root  bin     1056350 Sep 30 07:04 rpd.6
-rw-r--r--  1 root  bin     1048876 Sep 30 03:21 rpd.7
-rw-rw-r--  1 root  bin       19656 Oct  1 19:37 wtmp
```

show log filename

```
user@host> show log rpd
Oct  1 18:00:18 trace_on: Tracing to ?/var/log/rpd? started
Oct  1 18:00:18 EVENT <MTU> ds-5/2/0.0 index 24 <Broadcast PointToPoint Multicast
Oct  1 18:00:18
Oct  1 18:00:19 KRT recv len 56 V9 seq 148 op add Type route/if af 2 addr
13.13.13.21 nhop type local nhop 13.13.13.21
Oct  1 18:00:19 KRT recv len 56 V9 seq 149 op add Type route/if af 2 addr
13.13.13.22 nhop type unicast nhop 13.13.13.22
Oct  1 18:00:19 KRT recv len 48 V9 seq 150 op add Type ifaddr index 24 devindex
43
Oct  1 18:00:19 KRT recv len 144 V9 seq 151 op chnge Type ifdev devindex 44
```


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```
Oct  1 18:00:19 KRT recv len 144 V9 seq 152 op chnge Type ifdev devindex 45
Oct  1 18:00:19 KRT recv len 144 V9 seq 153 op chnge Type ifdev devindex 46
Oct  1 18:00:19 KRT recv len 1272 V9 seq 154 op chnge Type ifdev devindex 47
...
```

show log filename (QFabric System)

```
user@qfabric> show log messages
Mar 28 18:00:06 qfabric chassisd: QFABRIC_INTERNAL_SYSLOG: Mar 28 18:00:06 ED1486
 chassisd: CHASSISD_SNMP_TRAP10: SNMP trap generated: FRU power on
(jnxFruContentsIndex 8, jnxFruL1Index 1, jnxFruL2Index 1, jnxFruL3Index 0,
jnxFruName PIC: 48x 10G-SFP+ @ 0/0/*, jnxFruType 11, jnxFruSlot 0,
jnxFruOfflineReason 2, jnxFruLastPowerOff 0, jnxFruLastPowerOn 2159)
Mar 28 18:00:07 qfabric chassisd: QFABRIC_INTERNAL_SYSLOG: Mar 28 18:00:07 ED1486
 chassisd: CHASSISD_SNMP_TRAP10: SNMP trap generated: FRU power on
(jnxFruContentsIndex 8, jnxFruL1Index 1, jnxFruL2Index 2, jnxFruL3Index 0,
jnxFruName PIC:  @ 0/1/*, jnxFruType 11, jnxFruSlot 0, jnxFruOfflineReason 2,
jnxFruLastPowerOff 0, jnxFruLastPowerOn 2191)
Mar 28 18:00:07 qfabric chassisd: QFABRIC_INTERNAL_SYSLOG: Mar 28 18:00:07 ED1492
 chassisd: CHASSISD_SNMP_TRAP10: SNMP trap generated: FRU power on
(jnxFruContentsIndex 8, jnxFruL1Index 1, jnxFruL2Index 1, jnxFruL3Index 0,
jnxFruName PIC: 48x 10G-SFP+ @ 0/0/*, jnxFruType 11, jnxFruSlot 0,
jnxFruOfflineReason 2, jnxFruLastPowerOff 0, jnxFruLastPowerOn 242726)
Mar 28 18:00:07 qfabric chassisd: QFABRIC_INTERNAL_SYSLOG: Mar 28 18:00:07 ED1492
 chassisd: CHASSISD_SNMP_TRAP10: SNMP trap generated: FRU power on
(jnxFruContentsIndex 8, jnxFruL1Index 1, jnxFruL2Index 2, jnxFruL3Index 0,
jnxFruName PIC:  @ 0/1/*, jnxFruType 11, jnxFruSlot 0, jnxFruOfflineReason 2,
jnxFruLastPowerOff 0, jnxFruLastPowerOn 242757)
Mar 28 18:00:16 qfabric file: QFABRIC_INTERNAL_SYSLOG: Mar 28 18:00:16 ED1486
file: UI_COMMIT: User 'root' requested 'commit' operation (comment: none)
Mar 28 18:00:27 qfabric file: QFABRIC_INTERNAL_SYSLOG: Mar 28 18:00:27 ED1486
file: UI_COMMIT: User 'root' requested 'commit' operation (comment: none)
Mar 28 18:00:50 qfabric file: QFABRIC_INTERNAL_SYSLOG: Mar 28 18:00:50
_DCF_default___NW-INE-0_RE0_ file: UI_COMMIT: User 'root' requested 'commit'
operation (comment: none)
Mar 28 18:00:50 qfabric file: QFABRIC_INTERNAL_SYSLOG: Mar 28 18:00:50
_DCF_default___NW-INE-0_RE0_ file: UI_COMMIT: User 'root' requested 'commit'
operation (comment: none)
Mar 28 18:00:55 qfabric file: QFABRIC_INTERNAL_SYSLOG: Mar 28 18:00:55 ED1492
file: UI_COMMIT: User 'root' requested 'commit' operation (comment: none)
Mar 28 18:01:10 qfabric file: QFABRIC_INTERNAL_SYSLOG: Mar 28 18:01:10 ED1492
file: UI_COMMIT: User 'root' requested 'commit' operation (comment: none)
Mar 28 18:02:37 qfabric chassisd: QFABRIC_INTERNAL_SYSLOG: Mar 28 18:02:37 ED1491
 chassisd: CHASSISD_SNMP_TRAP10: SNMP trap generated: FRU power on
(jnxFruContentsIndex 8, jnxFruL1Index 1, jnxFruL2Index 1, jnxFruL3Index 0,
jnxFruName PIC: 48x 10G-SFP+ @ 0/0/*, jnxFruType 11, jnxFruSlot 0,
jnxFruOfflineReason 2, jnxFruLastPowerOff 0, jnxFruLastPowerOn 33809)
```

show log user

```
user@host> show log user
darius   mg2546                   Thu Oct  1 19:37   still logged in
darius   mg2529                   Thu Oct  1 19:08 - 19:36  (00:28)
darius   mg2518                   Thu Oct  1 18:53 - 18:58  (00:04)
root     mg1575                   Wed Sep 30 18:39 - 18:41  (00:02)
root     ttyp2    jun.site.per    Wed Sep 30 18:39 - 18:41  (00:02)
alex     ttyp1    192.168.1.2      Wed Sep 30 01:03 - 01:22  (00:19)
```

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traceroute

List of Syntax
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Syntax

traceroute *host*
<as-number-lookup>
<bypass-routing>
<clns>
<gateway *address*>
<inet | inet6>
<interface *interface-name*>
<logical system *logical-system-name*>
<monitor *host*>
<mpls (ldp *FEC address* | rsvp *label-switched-path-name*)>
<no-resolve>
<propagate-ttl>
<routing-instance *routing-instance-name*>
<source *source-address*>
<tos *value*>
<ttl *value*>
<wait *seconds*>

Syntax (QFX Series)

traceroute *host*
<as-number-lookup>
<bypass-routing>
<gateway *address*>
<inet>
<interface *interface-name*>
<monitor *host*>
<no-resolve>
<routing-instance *routing-instance-name*>
<source *source-address*>
<tos *value*>
<ttl *value*>
<wait *seconds*>

Release Information

Command introduced before Junos OS Release 7.4.
Command introduced in Junos OS Release 9.0 for EX Series switches.
mpls option introduced in Junos OS Release 9.2.
Command introduced in Junos OS Release 11.1 for the QFX Series.
propagate-ttl option introduced in Junos OS Release 12.1.

Description

Display the route that packets take to a specified network host. Use **traceroute** as a debugging tool to locate points of failure in a network.

Options

host—IP address or name of remote host.

as-number-lookup—(Optional) Display the autonomous system (AS) number of each intermediate hop on the path from the host to the destination.

bypass-routing—(Optional) Bypass the normal routing tables and send requests directly to a system on an attached network. If the system is not on a directly attached

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network, an error is returned. Use this option to display a route to a local system through an interface that has no route through it.

clns—(Optional) Trace the route belonging to the Connectionless Network Service (CLNS).

gateway *address*—(Optional) Address of a router or switch through which the route transits.

inet | inet6—(Optional) Trace the route belonging to IPv4 or IPv6, respectively.

interface *interface-name*—(Optional) Name of the interface over which to send packets.

logical-system *logical-system-name*—(Optional) Perform this operation on all logical systems or on a particular logical system.

monitor *host*—(Optional) Display real-time monitoring information for the specified host.

mpls (ldp *FEC address* | rsvp *label-switched-path name*)—(Optional) See ***traceroute mpls ldp*** and ***traceroute mpls rsvp***.

no-resolve—(Optional) Do not attempt to determine the hostname that corresponds to the IP address.

propagate-ttl—(Optional) On the PE routing device, use this option to view locally generated Routing Engine transit traffic. This is applicable for MPLS L3VPN traffic only.

Use for troubleshooting, when you want to view hop-by-hop information from the local provider router to the remote provider router, when TTL decrementing is disabled on the core network using the **no-proagate-ttl** configuration statement.

NOTE: **Using propagate-ttl with traceroute on the CE router does not show hop-by-hop information.**

routing-instance *routing-instance-name*—(Optional) Name of the routing instance for the traceroute attempt.

source *source-address*—(Optional) Source address of the outgoing traceroute packets.

tos *value*—(Optional) Value to include in the IP type-of-service (ToS) field. The range of values is **0** through **255**.

ttl *value*—(Optional) Maximum time-to-live value to include in the traceroute request. The range of values is **0** through **128**.

wait *seconds*—(Optional) Maximum time to wait for a response to the traceroute request.

Required Privilege Level network

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Related Documentation

- *traceroute monitor*

List of Sample Output

Output Fields

Table 7 on page 60 describes the output fields for the **traceroute** command. Output fields are listed in the approximate order in which they appear.

Table 7: traceroute Output Fields

Field Name	Field Description
traceroute to	IP address of the receiver.
hops max	Maximum number of hops allowed.
byte packets	Size of packets being sent.
number-of-hops	Number of hops from the source to the named router or switch.
router-name	Name of the router or switch for this hop.
address	Address of the router or switch for this hop.
Round trip time	Average round-trip time, in milliseconds (ms).

Sample Output

traceroute

```
user@host> traceroute santacruz
traceroute to green.company.net (10.156.169.254), 30 hops max, 40 byte packets
 1  blue23 (10.168.1.254)    2.370 ms  2.853 ms  0.367 ms
 2  red14  (10.168.255.250)  0.778 ms  2.937 ms  0.446 ms
 3  yellow (10.156.169.254)  7.737 ms  89.905 ms  0.834 ms
```

traceroute as-number-lookup host

```
user@host> traceroute as-number-lookup 10.100.1.1
traceroute to 10.100.1.1 (10.100.1.1), 30 hops max, 40 byte packets
 1  10.39.1.1 (10.39.1.1)  0.779 ms  0.728 ms  0.562 ms
 2  10.39.1.6 (10.39.1.6) [AS  32]  0.657 ms  0.611 ms  0.617 ms
 3  10.100.1.1 (10.100.1.1) [AS  10, 40, 50]  0.880 ms  0.808 ms  0.774 ms
```

traceroute no-resolve

```
user@host> traceroute santacruz no-resolve
```


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```
traceroute to green.company.net (10.156.169.254), 30 hops max, 40 byte packets
 1  10.168.1.254  0.458 ms  0.370 ms  0.365 ms
 2  10.168.255.250  0.474 ms  0.450 ms  0.444 ms
 3  10.156.169.254  0.931 ms  0.876 ms  0.862 ms
```

traceroute propogate-ttl

```
user@host> traceroute propagate-ttl 100.200.2.2 routing-instance VPN-A
traceroute to 100.200.2.2 (100.200.2.2) from 1.1.0.2, 30 hops max, 40 byte packets

 1  1.2.0.2 (1.2.0.2)  2.456 ms  1.753 ms  1.672 ms
     MPLS Label=299776 CoS=0 TTL=1 S=0
     MPLS Label=299792 CoS=0 TTL=1 S=1
 2  1.3.0.2 (1.3.0.2)  1.213 ms  1.225 ms  1.166 ms
     MPLS Label=299792 CoS=0 TTL=1 S=1
 3  100.200.2.2 (100.200.2.2)  1.422 ms  1.521 ms  1.443 ms
```

traceroute (Between CE Routers, Layer 3 VPN)

```
user@host> traceroute vpn09
traceroute to vpn09.skybank.net (10.255.14.179), 30 hops max, 40
      byte packets
       1  10.39.10.21 (10.39.10.21)  0.598 ms  0.500 ms  0.461 ms
       2  10.39.1.13 (10.39.1.13)  0.796 ms  0.775 ms  0.806 ms
           MPLS Label=100006 CoS=0 TTL=1 S=1
       3  vpn09.skybank.net (10.255.14.179)  0.783 ms  0.716 ms  0.686
```

traceroute (Through an MPLS LSP)

```
user@host> traceroute mpls1
traceroute to 10.168.1.224 (10.168.1.224), 30 hops max, 40 byte packets
 1  mpls1-sr0.company.net (10.168.200.101)  0.555 ms  0.393 ms  0.367 ms
     MPLS Label=1024 CoS=0 TTL=1
 2  mpls5-lo0.company.net (10.168.1.224)  0.420 ms  0.394 ms  0.401 ms
```

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PART 4

Troubleshooting

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CHAPTER 6

Routing Protocol Process Memory FAQs

Routing Protocol Process Memory FAQs Overview

Junos OS is based on the FreeBSD Unix operating system. The open source software is modified and hardened to operate in the device's specialized environment. For example, some executables have been deleted, while other utilities were de-emphasized. Additionally, certain software processes were added to enhance the routing functionality. The result of this transformation is the kernel, the heart of the Junos OS software.

The kernel is responsible for operating multiple processes that perform the actual functions of the device. Each process operates in its own protected memory space, while the communication among all the processes is still controlled by the kernel. This separation provides isolation between the processes, and resiliency in the event of a process failure. This is important in a core routing platform because a single process failure does not cause the entire device to cease functioning.

Some of the common software processes include the routing protocol process (rpd) that controls the device's protocols, the device control process (dcd) that controls the device's interfaces, the management process (mgd) that controls user access to the device, the chassis process (chassisd) that controls the device's properties itself, and the Packet Forwarding Engine process (pfed) that controls the communication between the device's Packet Forwarding Engine and the Routing Engine. The kernel also generates specialized processes as needed for additional functionality, such as SNMP, the Virtual Router Redundancy Protocol (VRRP), and Class of Service (CoS).

The routing protocol process is a software process within the Routing Engine software, which controls the routing protocols that run on the device. Its functionality includes all protocol messages, routing table updates, and implementation of routing policies.

The routing protocol process starts all configured routing protocols and handles all routing messages. It maintains one or more routing tables, which consolidate the routing information learned from all routing protocols. From this routing information, the routing protocol process determines the active routes to network destinations and installs these routes into the Routing Engine's forwarding table. Finally, it implements routing policy, which allows you to control the routing information that is transferred between the routing

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protocols and the routing table. Using routing policy, you can filter and limit the transfer of information as well as set properties associated with specific routes.

Related Documentation

- Routing Protocol Process Memory FAQs on page 66

Routing Protocol Process Memory FAQs

The following sections present the most frequently asked questions and answers related to the routing protocol process memory utilization, operation, interpretation of related command outputs, and troubleshooting the software process.

Frequently Asked Questions: Routing Protocol Process Memory

This section presents frequently asked questions and answers related to the memory usage of the routing protocol process.

Why does the routing protocol process use excessive memory?

The routing protocol process uses hundreds of megabytes of RAM in the Routing Engine to store information needed for the operation of routing and related protocols, such as BGP, OSPF, IS-IS, RSVP, LDP and MPLS. Such huge consumption of memory is common for the process, as the information it stores includes routes, next hops, interfaces, routing policies, labels, and label-switched paths (LSPs). Because access to the RAM memory is much faster than access to the hard disk, most of the routing protocol process information is stored in the RAM memory instead of using the hard disk space. This ensures that the performance of the routing protocol process is maximized.

How can I check the amount of memory the routing protocol process is using?

You can check routing protocol process memory usage by entering the **show system processes** and the **show task memory** Junos OS command-line interface (CLI) operational mode commands.

The **show system processes** command displays information about software processes that are running on the device and that have controlling terminals. The **show task memory** command displays memory utilization for routing protocol tasks on the Routing Engine.

You can check the routing protocol process memory usage by using the **show system processes** command with the **extensive** option. The **show task memory** command displays a report generated by the routing protocol process on its own memory usage. However, this report does not display all the memory used by the process. The value reported by the routing protocol process does not account for the memory used for the **TEXT** and **STACK** segments, or the memory used by the process's internal memory manager. Further, the Resident Set Size value includes shared library pages used by the routing protocol process.

For more information about checking the routing protocol process memory usage.

For more information, see the **show system processes** command and the **show task memory** command.

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I just deleted a large number of routes from the routing protocol process. Why is it still using so much memory?

The **show system processes extensive** command displays a **RES** value measured in kilobytes. This value represents the amount of program memory resident in the physical memory. This is also known as RSS or Resident Set Size. The **RES** value includes shared library pages used by the process. Any amount of memory freed by the process might still be considered part of the **RES** value. Generally, the kernel delays the migrating of memory out of the **Inact** queue into the **Cache** or **Free** list unless there is a memory shortage. This can lead to large discrepancies between the values reported by the routing protocol process and the kernel, even after the routing protocol process has freed a large amount of memory.

Frequently Asked Questions: Interpreting Routing Protocol Process-Related Command Outputs

This section presents frequently asked questions and answers about the routing protocol process-related Junos OS command-line interface (CLI) command outputs that are used to display the memory usage of the routing protocol process.

How do I interpret memory numbers displayed in the show system processes extensive command output?

The **show system processes extensive** command displays exhaustive system process information about software processes that are running on the device and have controlling terminals. This command is equivalent to the UNIX **top** command. However, the UNIX **top** command shows real-time memory usage, with the memory values constantly changing, while the **show system processes extensive** command provides a snapshot of memory usage in a given moment.

To check overall CPU and memory usage, enter the **show system processes extensive** command. Refer to Table 8 on page 68 for information about the **show system processes extensive** commands output fields.

```
user@host> show system processes extensive
last pid:   544;  load averages:  0.00,  0.00,  0.00    18:30:33
37 processes:  1 running, 36 sleeping

Mem: 25M Active, 3968K Inact, 19M Wired, 184K Cache, 8346K Buf, 202M Free
Swap: 528M Total, 64K Used, 528M Free
  PID USERNAME PRI NICE SIZE    RES STATE    TIME   WCPU    CPU COMMAND
  544 root      30   0   604K   768K RUN      0:00  0.00%  0.00% top
    3 root      28   0     0K    12K psleep   0:00  0.00%  0.00% vmdaemon
    4 root      28   0     0K    12K update   0:03  0.00%  0.00% update
  528 aviva     18   0   660K   948K pause    0:00  0.00%  0.00% tcsh
  204 root      18   0   300K   544K pause    0:00  0.00%  0.00% csh
  131 root      18   0   332K   532K pause    0:00  0.00%  0.00% cron
  186 root      18   0   196K    68K pause    0:00  0.00%  0.00% watchdog
   27 root      10   0   512M 16288K mfsidl   0:00  0.00%  0.00% mount_mfs
    1 root      10   0   620K   344K wait     0:00  0.00%  0.00% init
  304 root       3   0   884K   900K ttyin    0:00  0.00%  0.00% bash
  200 root       3   0   180K   540K ttyin    0:00  0.00%  0.00% getty
  203 root       3   0   180K   540K ttyin    0:00  0.00%  0.00% getty
  202 root       3   0   180K   540K ttyin    0:00  0.00%  0.00% getty
  201 root       3   0   180K   540K ttyin    0:00  0.00%  0.00% getty
  194 root       2   0  2248K  1640K select   0:11  0.00%  0.00% rpd
  205 root       2   0   964K   800K select   0:12  0.00%  0.00% tnp.chassisd
```

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```
  189 root      2 -12   352K   740K select   0:03  0.00%  0.00% xntpd
  114 root      2   0   296K   612K select   0:00  0.00%  0.00% amd
  188 root      2   0   780K   600K select   0:00  0.00%  0.00% dcd
  527 root      2   0   176K   580K select   0:00  0.00%  0.00% rlogind
  195 root      2   0   212K   552K select   0:00  0.00%  0.00% inetd
  187 root      2   0   192K   532K select   0:00  0.00%  0.00% tnetd
   83 root      2   0   188K   520K select   0:00  0.00%  0.00% syslogd
  538 root      2   0  1324K   516K select   0:00  0.00%  0.00% mgd
   99 daemon    2   0   176K   492K select   0:00  0.00%  0.00% portmap
  163 root      2   0   572K   420K select   0:00  0.00%  0.00% nsrexecd
  192 root      2   0   560K   400K select   0:10  0.00%  0.00% snmpd
  191 root      2   0  1284K   376K select   0:00  0.00%  0.00% mgd
  537 aviva     2   0   636K   364K select   0:00  0.00%  0.00% cli
  193 root      2   0   312K   204K select   0:07  0.00%  0.00% mib2d
    5 root      2   0     0K    12K pfesel   0:00  0.00%  0.00% if_pfe
    2 root    -18   0     0K    12K psleep   0:00  0.00%  0.00% pagedaemon
    0 root    -18   0     0K     0K sched    0:00  0.00%  0.00% swapper
```

Table 8 on page 68 describes the output fields that represent the memory values for the **show system processes extensive** command. Output fields are listed in the approximate order in which they appear.

Table 8: show system processes extensive Output Fields

Field Name	Field Description
Mem	Information about physical and virtual memory allocation.
Active	Memory allocated and actively used by the program.
Inact	Memory allocated but not recently used or memory freed by the programs. Inactive memory remains mapped in the address space of one or more processes and, therefore, counts toward the RSS value of those processes.
Wired	Memory that is not eligible to be swapped, usually used for in-kernel memory structures and/or memory physically locked by a process.
Cache	Memory that is not associated with any program and does not need to be swapped before being reused.
Buf	Size of memory buffer used to hold data recently called from the disk.
Free	Memory that is not associated with any programs. Memory freed by a process can become **Inactive**, **Cache**, or **Free**, depending on the method used by the process to free the memory.
Swap	Information about swap memory. • Total—Total memory available to be swapped to disk. • Used—Memory swapped to disk. • Free—Memory available for further swap.

The rest of the command output displays information about the memory usage of each process. The **SIZE** field indicates the size of the virtual address space, and the **RES** field indicates the amount of the program in physical memory, which is also known as RSS or Resident Set Size. For more information, see the **show system processes** command.

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What is the difference between Active and Inact memory that is displayed by the show system processes extensive command?

When the system is under memory pressure, the pageout process reuses memory from the free, cache, inact and, if necessary, active pages. When the pageout process runs, it scans memory to see which pages are good candidates to be unmapped and freed up. Thus, the distinction between **Active** and **Inact** memory is only used by the pageout process to determine which pool of pages to free first at the time of a memory shortage.

The pageout process first scans the **Inact** list, and checks whether the pages on this list have been accessed since the time they have been listed here. The pages that have been accessed are moved from the **Inact** list to the **Active** list. On the other hand, pages that have not been accessed become prime candidates to be freed by the pageout process. If the pageout process cannot produce enough free pages from the **Inact** list, pages from the **Active** list get freed up.

Because the pageout process runs only when the system is under memory pressure, the pages on the **Inact** list remain untouched – even if they have not been accessed recently – when the amount of **Free** memory is adequate.

How do I interpret memory numbers displayed in the show task memory command output?

The **show task memory** command provides a comprehensive picture of the memory utilization for routing protocol tasks on the Routing Engine. The routing protocol process is the main task that uses Routing Engine memory.

To check routing process memory usage, enter the **show task memory** command. Refer to Table 9 on page 69 for information about the **show task memory** command output fields.

```
user@host> show task memory
Memory                 Size (kB)  %Available  When
  Currently In Use:        29417          3%  now
  Maximum Ever Used:       33882          4%  00/02/11 22:07:03
  Available:              756281        100%  now
```

Table 9 on page 69 describes the output fields for the **show task memory** command. Output fields are listed in the approximate order in which they appear.

Table 9: show task memory Output Fields

Field Name	Field Description
Memory Currently In Use	Memory currently in use. Dynamically allocated memory plus the **DATA** segment memory in kilobytes.
Memory Maximum Ever Used	Maximum memory ever used.
Memory Available	Memory currently available.

The **show task memory** command does not display all the memory used by the routing protocol process. This value does not account for the memory used for the **TEXT** and

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STACK segments, or the memory used by the routing protocol process's internal memory manager.

Why is the Currently In Use value less than the RES value?

The **show task memory** command displays a **Currently In Use** value measured in kilobytes. This value represents the memory currently in use. It is the dynamically allocated memory plus the **DATA** segment memory. The **show system processes extensive** command displays a **RES** value measured in kilobytes. This value represents the amount of program memory resident in the physical memory. This is also known as RSS or Resident Set Size.

The **Currently In Use** value does not account for all of the memory that the routing protocol process uses. This value does not include the memory used for the **TEXT** and the **STACK** segments, and a small percentage of memory used by the routing protocol process's internal memory manager. Further, the **RES** value includes shared library pages used by the routing protocol process.

Any amount of memory freed by the routing protocol process might still be considered part of the **RES** value. Generally, the kernel delays the migrating of memory out of the **Inact** queue into the **Cache** or **Free** list unless there is a memory shortage. This can lead to large discrepancies between the **Currently In Use** value and the **RES** value.

Frequently Asked Questions: Routing Protocol Process Memory Swapping

This section presents frequently asked questions and answers related to the memory swapping of the routing protocol process from the Routing Engine memory to the hard disk memory.

How do I monitor swap activity?

When the system is under memory pressure, the pageout process reuses memory from the free, cache, inact and, if necessary, active pages. You can monitor the swap activity by viewing the syslog message reported by the kernel during periods of high pageout activity.

The syslog message appears as follows:

```
Mar  3 20:08:02 olympic /kernel: High pageout rate!! 277 pages/sec.
```

You can use the **vmstat -s** command to print the statistics for the swapout activity. The displayed statistics appear as follows:

```
0 swap pager pageouts
0 swap pager pages paged out
```

The **swap pager pageouts** is the number of pageout operations to the swap device, and the **swap pager pages paged out** is the number of pages paged out to the swap device.

Why does the system start swapping when I try to dump core using the request system core-dumps command?

The **request system core-dumps** command displays a list of system core files created when the device has failed. This command can be useful for diagnostic purposes. Each list item includes the file permissions, number of links, owner, group, size, modification

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date, path, and filename. You can use the **core-filename** option and the **core-file-info**, **brief**, and **detail** options to display more information about the specified core-dump files.

You can use the **request system core-dumps** command to perform a non-fatal core-dump without aborting the routing protocol process. To do this, the routing protocol process is forked, generating a second copy, and then aborted. This process can double the memory consumed by the two copies of the routing protocol processes, pushing the system into swap.

Why does the show system processes extensive command show that memory is swapped to disk although there is plenty of free memory?

Memory can remain swapped out indefinitely if it is not accessed again. Therefore, the **show system processes extensive** command shows that memory is swapped to disk even though there is plenty of free memory, and such a situation is not unusual.

Frequently Asked Questions: Troubleshooting the Routing Protocol Process

This section presents frequently asked questions and answers related to a shortage of memory and memory leakage by the routing protocol process.

What does the RPD_OS_MEMHIGH message mean?

The **RPD_OS_MEMHIGH** message is written into the system message file if the routing protocol process is running out of memory. This message alerts you that the routing protocol process is using the indicated amount and percentage of Routing Engine memory, which is considered excessive. This message is generated either because the routing protocol process is leaking memory or the use of system resources is excessive, perhaps because routing filters are misconfigured or the configured network topology is very complex.

When the memory utilization for the routing protocol process is using all available Routing Engine DRAM memory (Routing Engines with maximum 2 GB DRAM) or reaches the limit of 2 GB of memory (Routing Engines with 4 GB DRAM), a message of the following form is written every minute in the syslog message file:

```
RPD_OS_MEMHIGH: Using 188830 KB of memory, 100 percent of available
```

This message includes the amount, in kilobytes and/or the percentage, of the available memory in use.

This message should not appear under normal conditions, as any further memory allocations usually require a portion of existing memory to be written to swap. As a recommended solution, increase the amount of RAM in the Routing Engine. For more information, go to http://kb.juniper.net/InfoCenter/index?page=content&id=KB14186 .

What can I do when there is a memory shortage even after a swap?

It is not recommended for the system to operate in this state, notwithstanding the existence of swap. The protocols that run in the routing protocol process usually have a real-time requirement that cannot reliably withstand the latency of being swapped to hard disk. If the memory shortage has not resulted from a memory leak, then either a

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reduction in the memory usage or an upgrade to a higher memory-capacity Routing Engine is required.

How do I determine whether there is a memory leak in the routing protocol process?

Memory leaks are typically the result of a seemingly unbounded growth in the memory usage of a process as reported by the **show system processes extensive** command.

There are two classes of memory leaks that the routing protocol process can experience.

- The first class occurs when the allocated memory that is no longer in use is not freed. This class of leak can usually be fixed by taking several samples of the **show task memory detail** command over a period of time and comparing the deltas.
- The second class occurs when there is a late access to freed memory. If the access is not outside the mapped address space, the kernel backfills the accessed page with real memory. This backfill is done without the knowledge of the routing protocol process's internal memory allocator, which makes this class of leak much more difficult to resolve. If a memory leak of this class is suspected, writing the state of the system to a disk file (creating a core file) is suggested.

A large discrepancy between the **RES** value and the **Currently In Use** value might indicate a memory leak. However, large discrepancies can also occur for legitimate reasons. For example, the memory used for the **TEXT** and **STACK** segments or the memory used by the routing protocol process's internal memory manager might not be displayed. Further, the **RES** value includes shared library pages used by the process.

What is the task_timer?

The source of a routing protocol process memory leak can usually be identified by dumping the timers for each task. You can use the **show task *task-name*** command to display routing protocol tasks on the Routing Engine. Tasks can be baseline tasks performed regardless of the device's configuration, and other tasks that depend on the device configuration.

For more information, see the **show task** command.

Related Documentation

- Routing Protocol Process Memory FAQs Overview on page 65

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PART 5

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