



**JUNOS® Internet Software**

## **Baseline Operations Guide**

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## Part 1

## Juniper Networks Hardware and Software

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# About This Guide

This preface provides the following guidelines for using the *JUNOS™ Internet Software Baseline Network Operations Guide*:

- Objectives on page xxv
- Audience on page xxvi
- Supported Routing Platforms on page xxvi
- Using the Index on page xxvi
- Using the Examples in This Manual on page xxvi
- Documentation Conventions on page xxviii
- List of Technical Publications on page xxviii
- Documentation Feedback on page xxxv
- Requesting Technical Support on page xxxvi

## Objectives

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This guide provides operational information helpful for the most basic tasks associated with running a network configured with Juniper Networks products. This guide is not directly related to any particular release of the JUNOS Internet software.

For information about configuration statements and guidelines related to the commands described in this reference, see the following configuration guides:

- *JUNOS System Basics Configuration Guide*—Describes Juniper Networks routing platforms, and provides information about how to configure basic system parameters, supported protocols and software processes, authentication, and a variety of utilities for managing your router on the network.
- *JUNOS CLI User Guide*—Describes how to use the JUNOS command-line interface (CLI) to configure, monitor, and manage Juniper Networks routing platforms.

For information about related tasks performed by Network Operations Center (NOC) personnel, see the following network operations guides:

- *JUNOS Interfaces Network Operations Guide*
- *JUNOS Hardware Network Operations Guide*



---

**NOTE:** To obtain the most current version of this manual, see the product documentation page on the Juniper Networks Web site, located at <http://www.juniper.net/>.

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## Audience

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This guide is designed for Network Operations Center (NOC) personnel who monitor a Juniper Networks M Series or T Series routing platform.

To use this guide, you need a broad understanding of networks in general, the Internet in particular, networking principles, and network configuration. You must also be familiar with one or more of the following Internet routing protocols:

- Border Gateway Protocol (BGP)
- Routing Information Protocol (RIP)
- Intermediate System-to-Intermediate System (IS-IS)
- Open Shortest Path First (OSPF)
- Internet Control Message Protocol (ICMP) router discovery
- Internet Group Management Protocol (IGMP)
- Distance Vector Multicast Routing Protocol (DVMRP)
- Protocol-Independent Multicast (PIM)
- Multiprotocol Label Switching (MPLS)
- Resource Reservation Protocol (RSVP)
- Simple Network Management Protocol (SNMP)

## Supported Routing Platforms

---

For the features described in this manual, JUNOS Software currently supports the following routing platforms:

- M Series
- T Series

## Using the Index

---

This guide contains a complete index. For a list and description of glossary terms, see the *JUNOS Comprehensive Index and Glossary*.

## Using the Examples in This Manual

---

If you want to use the examples in this manual, you can use the `load merge` or the `load merge relative` command. These commands cause the software to merge the

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

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

## Merging a Full Example

To merge a full example, follow these steps:

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

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

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

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

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

## Merging a Snippet

To merge a snippet, follow these steps:

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

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

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

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

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

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





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

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

## Documentation Conventions

Table 1 on page xxviii 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.

## List of Technical Publications

Table 2 on page xxix lists the software and hardware guides and release notes for Juniper Networks M-series, MX-series, and T-series routing platforms and describes the contents of each document. Table 3 on page xxxiii lists the books included in the *Network Operations Guide* series. Table 4 on page xxxiii lists the manuals and release

notes supporting JUNOS software for J-series and SRX-series platforms. All documents are available at <http://www.juniper.net/techpubs/>.

Table 5 on page xxxv lists additional books on Juniper Networks solutions that you can order through your bookstore. A complete list of such books is available at <http://www.juniper.net/books>.

**Table 2: Technical Documentation for Supported Routing Platforms**

Book	Description
<b>JUNOS Software for Supported Routing Platforms</b>	
<i>Access Privilege</i>	Explains how to configure access privileges in user classes by using permission flags and regular expressions. Lists the permission flags along with their associated command-line interface (CLI) operational mode commands and configuration statements.
<i>Broadband Subscriber Management Solutions</i>	Describes residential subscriber management and how you can deploy solutions that include multisubscriber IP address assignment, service provisioning, authentication, authorization, accounting, and dynamic request services in your network.
<i>Class of Service</i>	Provides an overview of the class-of-service (CoS) functions of the JUNOS software and describes how to configure CoS features, including configuring multiple forwarding classes for transmitting packets, defining which packets are placed into each output queue, scheduling the transmission service level for each queue, and managing congestion through the random early detection (RED) algorithm.
<i>CLI User Guide</i>	Describes how to use the JUNOS command-line interface (CLI) to configure, monitor, and manage Juniper Networks routing platforms. This material was formerly covered in the <i>JUNOS System Basics Configuration Guide</i> .
<i>Feature Guide</i>	Provides a detailed explanation and configuration examples for several of the most complex features in the JUNOS software.
<i>High Availability</i>	Provides an overview of hardware and software resources that ensure a high level of continuous routing platform operation and describes how to configure high availability (HA) features such as nonstop active routing (NSR) and graceful Routing Engine switchover (GRES).
<i>MPLS Applications</i>	Provides an overview of traffic engineering concepts and describes how to configure traffic engineering protocols.
<i>Multicast Protocols</i>	Provides an overview of multicast concepts and describes how to configure multicast routing protocols.
<i>Multiplay Solutions</i>	Describes how you can deploy IPTV and voice over IP (VoIP) services in your network.

**Table 2: Technical Documentation for Supported Routing Platforms** *(continued)*

Book	Description
<i>MX-series Layer 2 Configuration Guide</i>	Provides an overview of the Layer 2 functions of the MX-series routers, including configuring bridging domains, MAC address and VLAN learning and forwarding, and spanning-tree protocols. It also details the routing instance types used by Layer 2 applications. All of this material was formerly covered in the <i>JUNOS Routing Protocols Configuration Guide</i> .
<i>MX-series Layer 2 Solutions Guide</i>	Describes common configuration scenarios for the Layer 2 features supported on the MX-series routers, including basic bridged VLANs with normalized VLAN tags, aggregated Ethernet links, bridge domains, Multiple Spanning Tree Protocol (MSTP), and integrated routing and bridging (IRB).
<i>Network Interfaces</i>	Provides an overview of the network interface functions of the JUNOS software and describes how to configure the network interfaces on the routing platform.
<i>Network Management</i>	Provides an overview of network management concepts and describes how to configure various network management features, such as SNMP and accounting options.
<i>Policy Framework</i>	Provides an overview of policy concepts and describes how to configure routing policy, firewall filters, and forwarding options.
<i>Protected System Domain</i>	Provides an overview of the JCS 1200 platform and the concept of Protected System Domains (PSDs). The JCS 1200 platform, which contains up to six redundant pairs of Routing Engines running JUNOS software, is connected to a T320 router or to a T640 or T1600 routing node. To configure a PSD, you assign any number of Flexible PIC concentrators (FPCs) in the T-series routing platform to a pair of Routing Engines on the JCS 1200 platform. Each PSD has the same capabilities and functionality as a physical router, with its own control plane, forwarding plane, and administration.
<i>Routing Protocols</i>	Provides an overview of routing concepts and describes how to configure routing instances, and unicast routing protocols.
<i>Secure Configuration Guide for Common Criteria and JUNOS-FIPS</i>	Provides an overview of secure Common Criteria and JUNOS-FIPS protocols for the JUNOS software and describes how to install and configure secure Common Criteria and JUNOS-FIPS on a routing platform.
<i>Services Interfaces</i>	Provides an overview of the services interfaces functions of the JUNOS software and describes how to configure the services interfaces on the router.
<i>Software Installation and Upgrade Guide</i>	Describes the JUNOS software components and packaging and explains how to initially configure, reinstall, and upgrade the JUNOS system software. This material was formerly covered in the <i>JUNOS System Basics Configuration Guide</i> .
<i>Subscriber Access</i>	Provides an overview of the subscriber access features of the JUNOS software and describes how to configure subscriber access support on the router, including dynamic profiles, class of service, AAA, and access methods.

**Table 2: Technical Documentation for Supported Routing Platforms (continued)**

Book	Description
<i>System Basics</i>	Describes Juniper Networks routing platforms and explains how to configure basic system parameters, supported protocols and software processes, authentication, and a variety of utilities for managing your router on the network.
<i>VPNs</i>	Provides an overview and describes how to configure Layer 2 and Layer 3 virtual private networks (VPNs), virtual private LAN service (VPLS), and Layer 2 circuits. Provides configuration examples.
<b>JUNOS References</b>	
<i>Hierarchy and RFC Reference</i>	Describes the JUNOS configuration mode commands. Provides a hierarchy reference that displays each level of a configuration hierarchy, and includes all possible configuration statements that can be used at that level. This material was formerly covered in the <i>JUNOS System Basics Configuration Guide</i> .
<i>Interfaces Command Reference</i>	Describes the JUNOS software operational mode commands you use to monitor and troubleshoot interfaces.
<i>Routing Protocols and Policies Command Reference</i>	Describes the JUNOS software operational mode commands you use to monitor and troubleshoot routing policies and protocols, including firewall filters.
<i>System Basics and Services Command Reference</i>	Describes the JUNOS software operational mode commands you use to monitor and troubleshoot system basics, including commands for real-time monitoring and route (or path) tracing, system software management, and chassis management. Also describes commands for monitoring and troubleshooting services such as class of service (CoS), IP Security (IPsec), stateful firewalls, flow collection, and flow monitoring.
<i>System Log Messages Reference</i>	Describes how to access and interpret system log messages generated by JUNOS software modules and provides a reference page for each message.
<b>J-Web User Guide</b>	
<i>J-Web Interface User Guide</i>	Describes how to use the J-Web graphical user interface (GUI) to configure, monitor, and manage Juniper Networks routing platforms.
<b>JUNOS API and Scripting Documentation</b>	
<i>JUNOScript API Guide</i>	Describes how to use the JUNOScript application programming interface (API) to monitor and configure Juniper Networks routing platforms.
<i>JUNOS XML API Configuration Reference</i>	Provides reference pages for the configuration tag elements in the JUNOS XML API.
<i>JUNOS XML API Operational Reference</i>	Provides reference pages for the operational tag elements in the JUNOS XML API.
<i>NETCONF API Guide</i>	Describes how to use the NETCONF API to monitor and configure Juniper Networks routing platforms.

**Table 2: Technical Documentation for Supported Routing Platforms** (*continued*)

Book	Description
<i>JUNOS Configuration and Diagnostic Automation Guide</i>	Describes how to use the commit script and self-diagnosis features of the JUNOS software. This guide explains how to enforce custom configuration rules defined in scripts, how to use commit script macros to provide simplified aliases for frequently used configuration statements, and how to configure diagnostic event policies.
<b>Hardware Documentation</b>	
<i>Hardware Guide</i>	Describes how to install, maintain, and troubleshoot routing platforms and components. Each platform has its own hardware guide.
<i>PIC Guide</i>	Describes the routing platform's Physical Interface Cards (PICs). Each platform has its own PIC guide.
<i>DPC Guide</i>	Describes the Dense Port Concentrators (DPCs) for all MX-series routers.
<b>JUNOScope Documentation</b>	
<i>JUNOScope Software User Guide</i>	Describes the JUNOScope software graphical user interface (GUI), how to install and administer the software, and how to use the software to manage routing platform configuration files and monitor routing platform operations.
<b>Advanced Insight Solutions (AIS) Documentation</b>	
<i>Advanced Insight Solutions Guide</i>	Describes the Advanced Insight Manager (AIM) application, which provides a gateway between JUNOS devices and Juniper Support Systems (JSS) for case management and intelligence updates. Explains how to run AI-Scripts on Juniper Networks devices.
<b>Release Notes</b>	
<i>JUNOS Release Notes</i>	Summarize new features and known problems for a particular software release, provide corrections and updates to published JUNOS, JUNOScript, and NETCONF manuals, provide information that might have been omitted from the manuals, and describe upgrade and downgrade procedures.
<i>Hardware Release Notes</i>	Describe the available documentation for the routing platform and summarize known problems with the hardware and accompanying software. Each platform has its own release notes.
<i>JUNOScope Release Notes</i>	Contain corrections and updates to the published JUNOScope manual, provide information that might have been omitted from the manual, and describe upgrade and downgrade procedures.
<i>AIS Release Notes</i>	Summarize AIS new features and guidelines, identify known and resolved problems, provide information that might have been omitted from the manuals, and provide initial setup, upgrade, and downgrade procedures.
<i>AIS AI-Scripts Release Notes</i>	Summarize AI-Scripts new features, identify known and resolved problems, provide information that might have been omitted from the manuals, and provide instructions for automatic and manual installation, including deleting and rolling back.



**Table 3: JUNOS Software Network Operations Guides**

Book	Description
<i>Baseline</i>	Describes the most basic tasks for running a network using Juniper Networks products. Tasks include upgrading and reinstalling JUNOS software, gathering basic system management information, verifying your network topology, and searching log messages.
<i>Interfaces</i>	Describes tasks for monitoring interfaces. Tasks include using loopback testing and locating alarms.
<i>MPLS</i>	Describes tasks for configuring, monitoring, and troubleshooting an example MPLS network. Tasks include verifying the correct configuration of the MPLS and RSVP protocols, displaying the status and statistics of MPLS running on all routing platforms in the network, and using the layered MPLS troubleshooting model to investigate problems with an MPLS network.
<i>MPLS Log Reference</i>	Describes MPLS status and error messages that appear in the output of the <code>show mpls lsp extensive</code> command. The guide also describes how and when to configure Constrained Shortest Path First (CSPF) and RSVP trace options, and how to examine a CSPF or RSVP failure in a sample network.
<i>MPLS Fast Reroute</i>	Describes operational information helpful in monitoring and troubleshooting an MPLS network configured with fast reroute (FRR) and load balancing.
<i>Hardware</i>	Describes tasks for monitoring M-series and T-series routing platforms.

To configure and operate a J-series Services Router or an SRX-series Services Gateway running JUNOS software, you must also use the configuration statements and operational mode commands documented in JUNOS configuration guides and command references. To configure and operate a WX Integrated Services Module, you must also use WX documentation.

**Table 4: JUNOS Software for J-series Services Routers and SRX-series Services Gateways Documentation**

Book	Description
<b>J-series and SRX-series Platforms</b>	
<i>JUNOS Software Interfaces and Routing Configuration Guide</i>	Explains how to configure SRX-series and J-series interfaces for basic IP routing with standard routing protocols, ISDN service, firewall filters (access control lists), and class-of-service (CoS) traffic classification.
<i>JUNOS Software Security Configuration Guide</i>	Explains how to configure and manage SRX-series and J-series security services such as stateful firewall policies, IPsec VPNs, firewall screens, Network Address Translation (NAT), Public Key Cryptography, chassis clusters, Application Layer Gateways (ALGs), and Intrusion Detection and Prevention (IDP).

**Table 4: JUNOS Software for J-series Services Routers and SRX-series Services Gateways Documentation** *(continued)*

Book	Description
<i>JUNOS Software Administration Guide</i>	Shows how to monitor SRX-series and J-series devices and routing operations, firewall and security services, system alarms and events, and network performance. This guide also shows how to administer user authentication and access, upgrade software, and diagnose common problems.
<i>JUNOS Software CLI Reference</i>	Provides the complete configuration hierarchy available on SRX-series and J-series devices. This guide also describes the configuration statements and operational mode commands unique to these devices.
<i>Network and Security Manager: Configuring J Series Services Routers and SRX Series Services Gateways Guide</i>	Explains how to configure, manage, and monitor J-series Services Routers and SRX-series services gateways through NSM.
<i>JUNOS Release Notes</i>	Summarize new features and known problems for a particular release of JUNOS software, including JUNOS software for J-series and SRX-series devices. The release notes also contain corrections and updates to the manuals and software upgrade and downgrade instructions for JUNOS software.
<b>J-series Only</b>	
<i>JUNOS Software Design and Implementation Guide</i>	Provides guidelines and examples for designing and implementing IPsec VPNs, firewalls, and routing on J-series Services Routers running JUNOS software.
<i>J Series Services Routers Quick Start</i>	Explains how to quickly set up a J-series Services Router. This document contains router declarations of conformity.
<i>JUNOS Software with Enhanced Services J-series Services Router Hardware Guide</i>	Provides an overview, basic instructions, and specifications for J-series Services Routers. This guide explains how to prepare a site, unpack and install the router, replace router hardware, and establish basic router connectivity. This guide contains hardware descriptions and specifications.
<i>JUNOS Software Migration Guide</i>	Provides instructions for migrating an SSG device running ScreenOS software to JUNOS software or upgrading a J-series device to a later version of the JUNOS software.
<i>WXC Integrated Services Module Installation and Configuration Guide</i>	Explains how to install and initially configure a WXC Integrated Services Module in a J-series Services Router for application acceleration.

**Table 5: Additional Books Available Through <http://www.juniper.net/books>**

Book	Description
<i>Interdomain Multicast Routing</i>	Provides background and in-depth analysis of multicast routing using Protocol Independent Multicast sparse mode (PIM SM) and Multicast Source Discovery Protocol (MSDP); details any-source and source-specific multicast delivery models; explores multiprotocol BGP (MBGP) and multicast IS-IS; explains Internet Gateway Management Protocol (IGMP) versions 1, 2, and 3; lists packet formats for IGMP, PIM, and MSDP; and provides a complete glossary of multicast terms.
<i>JUNOS Cookbook</i>	Provides detailed examples of common JUNOS software configuration tasks, such as basic router configuration and file management, security and access control, logging, routing policy, firewalls, routing protocols, MPLS, and VPNs.
<i>MPLS-Enabled Applications</i>	Provides an overview of Multiprotocol Label Switching (MPLS) applications (such as Layer 3 virtual private networks [VPNs], Layer 2 VPNs, virtual private LAN service [VPLS], and pseudowires), explains how to apply MPLS, examines the scaling requirements of equipment at different points in the network, and covers the following topics: point-to-multipoint label switched paths (LSPs), DiffServ-aware traffic engineering, class of service, interdomain traffic engineering, path computation, route target filtering, multicast support for Layer 3 VPNs, and management and troubleshooting of MPLS networks.
<i>OSPF and IS-IS: Choosing an IGP for Large-Scale Networks</i>	Explores the full range of characteristics and capabilities for the two major link-state routing protocols: Open Shortest Path First (OSPF) and IS-IS. Explains architecture, packet types, and addressing; demonstrates how to improve scalability; shows how to design large-scale networks for maximum security and reliability; details protocol extensions for MPLS-based traffic engineering, IPv6, and multitopology routing; and covers troubleshooting for OSPF and IS-IS networks.
<i>Routing Policy and Protocols for Multivendor IP Networks</i>	Provides a brief history of the Internet, explains IP addressing and routing (Routing Information Protocol [RIP], OSPF, IS-IS, and Border Gateway Protocol [BGP]), explores ISP peering and routing policies, and displays configurations for both Juniper Networks and other vendors' routers.
<i>The Complete IS-IS Protocol</i>	Provides the insight and practical solutions necessary to understand the IS-IS protocol and how it works by using a multivendor, real-world approach.

## Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can send your comments to [techpubs-comments@juniper.net](mailto:techpubs-comments@juniper.net), or fill out the documentation feedback form at <https://www.juniper.net/cgi-bin/docbugreport/>. If you are using e-mail, be sure to include the following information with your comments:

- Document name
- Document part number
- Page number
- Software release version (not required for Network Operations Guides [NOGs])

## Requesting Technical Support

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

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the JTAC User Guide located at <http://www.juniper.net/customers/support/downloads/710059.pdf>.
- Product warranties—For product warranty information, visit <http://www.juniper.net/support/warranty/>.
- JTAC Hours of Operation —The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

## Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

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

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

## Opening a Case with JTAC

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

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

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



## **Part 1**

# **Juniper Networks Hardware and Software**

- Juniper Networks Router Overview on page 3
- Cheat Sheet for the CLI Commands on page 13
- Work with Problems on Your Network on page 25





## Chapter 1

# Juniper Networks Router Overview

This chapter provides a general overview of Juniper Networks M-series and T-series routers and routing platforms:

- Juniper Networks Router Introduction on page 3
- Router Architecture for M-series Routers and T-series Platforms on page 4
- Data Flow Through the Packet Forwarding Engine on page 5
- Data Flow Through an M-series Router on page 6
- Data Flow Through a T-series Routing Platform on page 7
- Hardware Components on page 8
- Monitor Hardware Components on page 11
- Operational Mode CLI Commands for Router Monitoring on page 11

## Juniper Networks Router Introduction

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Each Juniper Networks M-series and T-series routing platform is a complete routing system that supports a variety of high-speed interfaces (including SONET/SDH, Ethernet, and ATM) for large networks and network applications. Juniper Networks routers share common JUNOS software, features, and technology for compatibility across platforms.

Application-specific integrated circuits (ASICs) form a definitive part of the router design and enable the router to achieve data forwarding rates that match current fiber-optic capacity. All M-series routers use the Internet Processor II ASIC, which performs the route lookup function and several types of packet processing, such as filtering, policing, rate limiting, and sampling. The T-series platforms use the new T-series Internet Processor for route lookups and notification forwarding.

This topic provides a general overview of Juniper Networks M-series and T-series routers and routing platforms:

- Router Architecture for M-series Routers and T-series Platforms on page 4
- Data Flow Through the Packet Forwarding Engine on page 5
- Data Flow Through an M-series Router on page 6
- Data Flow Through a T-series Routing Platform on page 7

## Router Architecture for M-series Routers and T-series Platforms

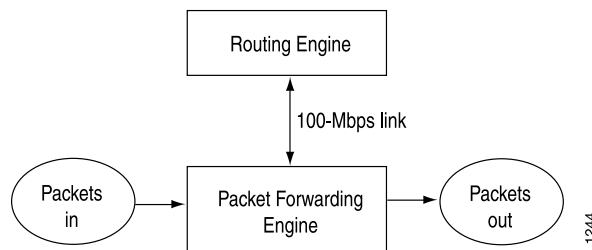
The router architecture of each Juniper Networks M-series router and T-series platform cleanly separates routing and control functions from packet forwarding operations, thereby eliminating bottlenecks and permitting the router to maintain a high level of performance. Each router consists of two major architectural components:

- The Routing Engine, which provides Layer 3 routing services and network management.
- The Packet Forwarding Engine, which provides all operations necessary for transit packet forwarding.

The Routing Engine and Packet Forwarding Engine perform their primary tasks independently, while constantly communicating through a high-speed internal link. This arrangement provides streamlined forwarding and routing control and the capability to run Internet-scale networks at high speeds.

Figure 1 on page 4 illustrates the relationship between the Routing Engine and the Packet Forwarding Engine.

**Figure 1: Router Architecture**

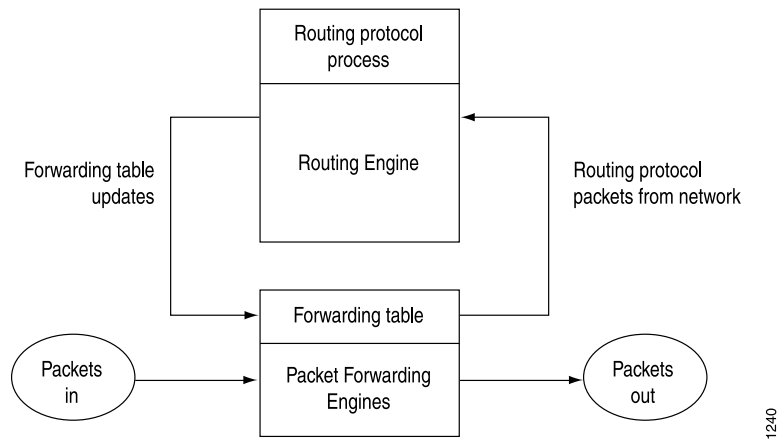


The Routing Engine consists of an Intel-based PCI platform running JUNOS software. For more information about JUNOS software, see “Cheat Sheet for the CLI Commands” on page 13.

*A link to the topic “Command Line Interface Overview” should be included here once the topic is created.*

The Routing Engine constructs and maintains one or more routing tables. From the routing tables, the Routing Engine derives a table of active routes, called the forwarding table, which is then copied into the Packet Forwarding Engine.

The design of the Internet Processor II and T-series Internet Processor ASICs allows the forwarding table in the Packet Forwarding Engine to be updated without interrupting forwarding performance (see Figure 2 on page 5).

**Figure 2: Routing and Forwarding Table Updates**

The Packet Forwarding Engine uses ASICs to perform Layer 2 and Layer 3 packet switching, route lookups, and packet forwarding. On M-series routers, the Packet Forwarding Engine includes the router midplane (on an M40 router, the backplane), Flexible PIC Concentrators (FPCs), Physical Interface Cards (PICs), and other components, unique to each router, that handle forwarding decisions.

The T-series platforms feature multiple Packet Forwarding Engines, up to a maximum of 16 for the T640 Internet routing node and 8 for the T320 Internet router. Each FPC has one or two Packet Forwarding Engines, each with its own memory buffer. Each Packet Forwarding Engine maintains a high-speed link to the Routing Engine. For information about T-series platforms, see the *T640 Internet Routing Node Hardware Guide* and the *T320 Internet Router Hardware Guide*.

## Data Flow Through the Packet Forwarding Engine

You can understand the function of the Packet Forwarding Engine by following the flow of a packet through the router: first into a PIC, then through the switching fabric, and finally out another PIC for transmission on a network link. Generally, the data flows through the Packet Forwarding Engine as follows:

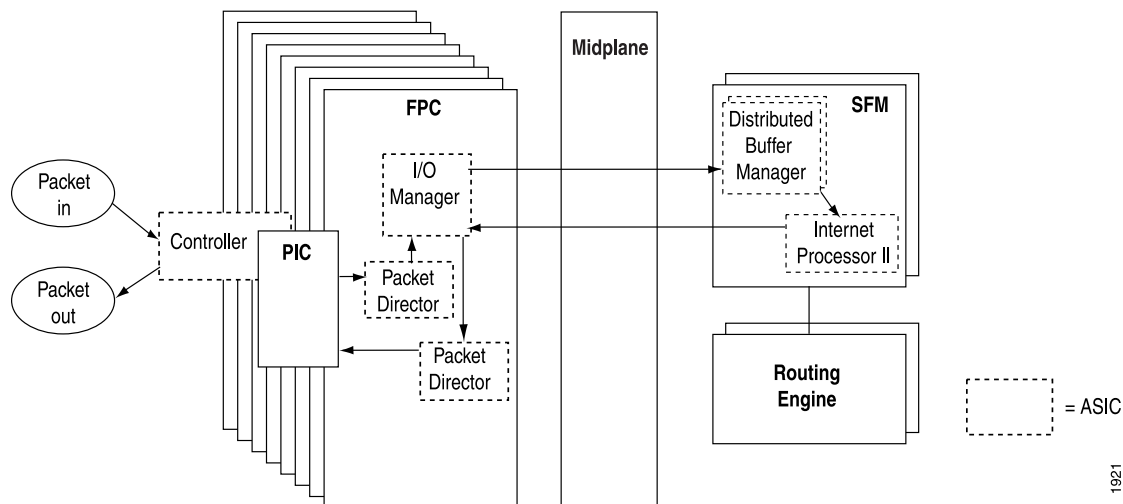
1. Packets enter the router through incoming PIC interfaces, which contain controllers that perform media-specific processing.
2. The PICs pass the packets to the FPCs, where they are divided into cells and are distributed to the router's buffer memory.
3. The Packet Forwarding Engine performs route lookups, forwards the notification to the destination port, reassembles the cells into packets, and sends them to the destination port on the outgoing PIC.
4. The PIC performs encapsulation and other media-specific processing, and sends the packets out into the network.

## Data Flow Through an M-series Router

Figure 3 on page 6 illustrates the flow of data packets through an M-series router, using the M40e router architecture as an example. In this example, data flows in the following sequence:

1. A packet enters through the incoming PIC, which parses and de-encapsulates the packet, then passes it to the FPC.
2. On the FPC, the Packet Director ASIC distributes packets to the active I/O Manager ASICs, where each is divided into cells and sent across the midplane to the Switching and Forwarding Modules (SFM). (On the M40e router, only one SFM is online at a time.) In addition, the behavior aggregate (BA) classifier determines the forwarding treatment for each packet.

**Figure 3: Data Flow Through an M40e Router**



3. When cells arrive at an SFM, the Distributed Buffer Manager ASIC writes them into packet buffer memory, which is distributed evenly across the router's FPCs. The Distributed Buffer Manager ASIC also extracts information needed for route lookups and passes the information to the Internet Processor II ASIC.
4. The Internet Processor II ASIC performs the lookup in the full forwarding table, and finds the outgoing interface and specific next hop for each packet. In addition, the Internet Processor II ASIC performs filtering, policing, sampling and multifield classification, if configured.
5. The forwarding table forwards all unicast packets that do not have options and any multicast packets that have been previously cached. Packets with options are sent to the Routing Engine for resolution.
6. After the Internet Processor II has determined the next hop, it notifies a second Distributed Buffer Manager ASIC, which forwards the notification to the outgoing FPC. Queueing policy and rewrites occur at this time on the egress router. A pointer to the packet is queued at the outgoing port.

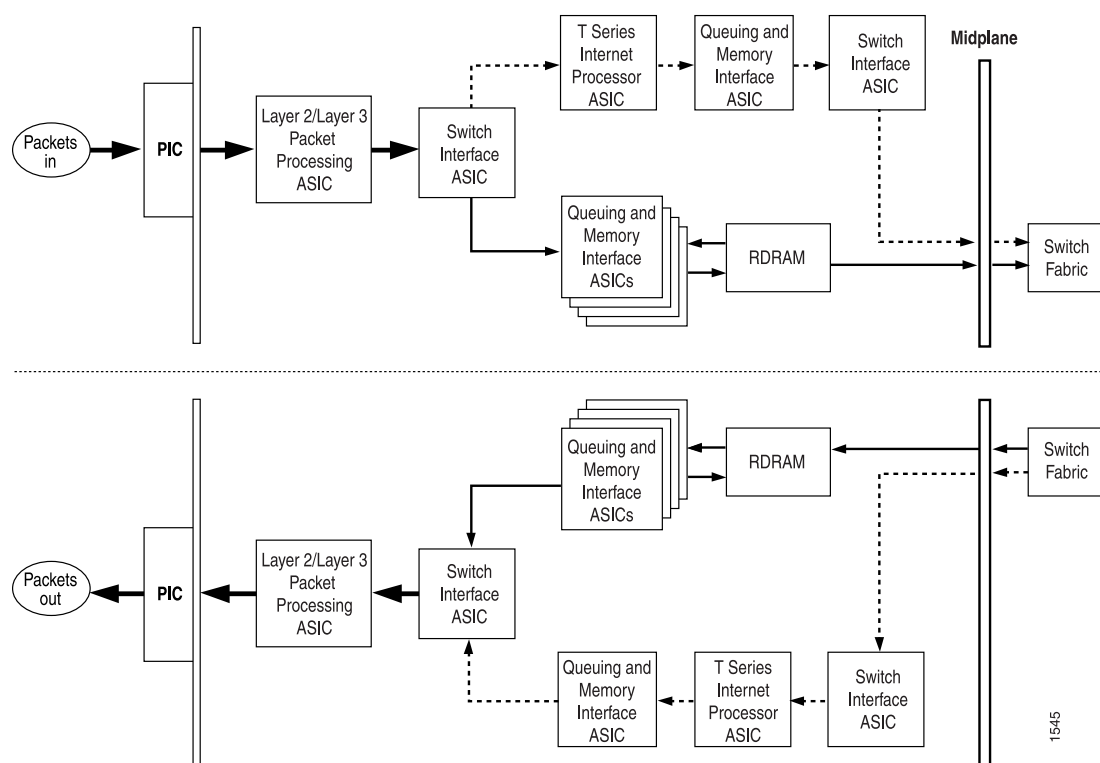
7. When the packet pointer reaches the front of the queue and is ready for transmission, the cells are read from packet buffer memory and are reassembled into the packet, which is passed to the outgoing PIC interface.
8. The PIC performs media-specific processing and sends the packet into the network.

## Data Flow Through a T-series Routing Platform

Figure 4 on page 7 illustrates the data flow through a T640 routing node. In this example, data flows in the following sequence:

1. Packets enter through an incoming PIC and are passed to the Packet Forwarding Engine on the originating FPC.
2. The Layer2/Layer 3 Packet Processing ASIC parses the packets and divides them into cells. In addition, the behavior aggregate (BA) classifier determines the forwarding treatment for each packet.

**Figure 4: Data Flow Through a T640 Routing Node**



3. The network-facing Switch Fabric ASIC places the lookup key in a notification and passes it to the T-series Internet Processor.
4. The Switch Fabric ASIC also passes the data cells to the Queuing and Memory Interface ASICs for buffering on the FPC.

5. The T-series Internet Processor performs the route lookup and forwards the notification to the Queuing and Memory Interface ASIC. In addition, if configured filtering, policing, sampling and multifield classification, are performed at this time.
6. The Queuing and Memory Interface ASIC sends the notification to the switch-fabric-facing Switch Interface ASIC, which sends bandwidth requests through the switch fabric to the destination port, and issues read requests to the Queuing and Memory Interface ASIC to begin reading data cells out of memory.
7. The Switch Interface ASIC on the destination FPC sends bandwidth grants through the switch fabric to the originating Switch Interface ASIC.
8. Upon receipt of each grant, the originating Switch Interface ASIC sends a cell through the switch fabric to the destination Packet Forwarding Engine.
9. On the destination Packet Forwarding Engine, the switch-fabric-facing Switch Interface ASIC receives the data cells, places the lookup key in a notification, and forwards the notification to the T-series Internet Processor.
10. The T-series Internet Processor performs the route lookup and forwards the notification to the Queuing and Memory Interface ASIC, which forwards it to the network-facing Switch Interface ASIC.
11. The Switch Interface ASIC sends requests to the Queuing and Memory Interface ASIC to read the data cells out of memory, and passes the cells to the Layer2/Layer 3 Packet Processing ASIC, which reassembles the cells into packets, performs the necessary Layer 2 encapsulation, and sends the packets to the outgoing PIC. Queueing policy and rewrites occur at this time on the egress router.
12. The PIC passes the packets into the network.

For more information about the M-series routers and T-series platforms, see the router platform-specific hardware guide, and the *JUNOS Hardware Network Operations Guide*.

## Hardware Components

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Each Juniper Networks router consists of a chassis and a set of components, including FPCs, PICs, Routing Engines, power supplies, cooling system, and cable management system. Many of the components are field-replaceable units. The following major components are discussed in this topic:

- Chassis on page 9
- Flexible PIC Concentrators on page 9
- Physical Interface Cards on page 10
- Routing Engine on page 10
- Power Supplies on page 10
- Cooling System on page 10

Chassis

Chassis dimensions are listed in the physical specifications table for each router. For more information about chassis dimensions, see the router platform-specific hardware guide.

Each Juniper Networks router features a rigid sheet metal chassis that houses all of the router components. The chassis are designed to install into a variety of racks, including standard 19-inch equipment racks, telco center-mount racks, and four-post racks and cabinets. See Table 6 on page 9 for the maximum number of each router type that can be installed into a rack. Each chassis includes mounting ears or support posts to facilitate rack mounting, and one or more points for connecting an electrostatic discharge (ESD) wrist strap for use when servicing the router.

Table 6: Maximum Number of Routers per Rack

Router or Routing Node	Maximum in Standard Rack
T640	2
T320	3
M160	2
M40e	2
M40	2
M20	5
M5 and M10	14

Each chassis includes a midplane (called the backplane on an M40 router). The midplane transfers data packets to and from the FPCs, distributes power to router components, and provides signal connectivity to the router components for system monitoring and control.

Flexible PIC Concentrators

The FPCs house the PICs used in the router and connect them to other router components. FPCs install into the front of the router in either a vertical or horizontal orientation, depending on the router. A compatible FPC can be installed into any available FPC slot, regardless of the PICs it contains. If a slot is not occupied by an FPC, a blank FPC panel must be installed to shield the empty slot and allow cooling air to circulate properly through the FPC card cage. For information about FPCs, see the specific hardware guide.

## **Physical Interface Cards**

Juniper Networks M-series routers and T-series platforms use PICs to connect to a wide variety of network media. PICs receive incoming packets from the network and transmit outgoing packets to the network, performing framing and line-speed signaling for their specific media type. Before transmitting outgoing data packets, the PICs encapsulate the packets received from the FPCs. Each PIC is equipped with an ASIC that performs control functions specific to the PIC's media type. For information about PICs, see the specific PIC guide.

## **Routing Engine**

The Routing Engine consists of an Intel-based PCI platform running the JUNOS software. The Routing Engine maintains the routing tables used by the router in which it is installed and controls the routing protocols on the router. The T640 routing node, and the T320, M160, M40e, and M20 routers support up to two Routing Engines, while the M40, M10, and M5 routers support a single Routing Engine.

Each Routing Engine consists of a CPU; SDRAM for storage of the routing and forwarding tables and other processes; a compact flash disk for primary storage of software images, configuration files, and microcode; a hard disk for secondary storage; a PC card slot (on some M40 routers, a floppy disk) for storage of software upgrades; and interfaces for out-of-band management access.

## **Power Supplies**

Each Juniper Networks M-series router, T-series platform, or MX-series router has one to four load-sharing power supplies depending on the platform. If a power supply in a redundant configuration is removed or fails, the other power supplies assume the electrical load. For more information about the power supplies in each router, see the router platform-specific hardware guide.

The power supplies are connected to the router midplane, which distributes the different output voltages throughout the router and its components. Some routers can operate using either AC or DC power; other routers operate with DC power only. For information about the type of power used by each router, see the platform-specific hardware guide.

## **Cooling System**

Each Juniper Networks M-series router and T-series platform features a cooling system designed to keep all router components within recommended operating temperature limits. If one component of the cooling system fails or is removed, the system automatically adjusts the speed of the remaining components to keep the temperature within the acceptable range. The cooling system for each router is unique and can consist of fans, impellers, and air filters. For information about the cooling system components of each router, see the "Major Hardware Components" table in the router platform-specific hardware guide.



Monitor Hardware Components



**NOTE:** If the System Control Board (SCB), System and Switch Board (SSB), or Forwarding Engine Board (FEB) is not running, information about chassis components is not available through the command-line interface (CLI).

- Action** To use the CLI to monitor Juniper Networks routers, follow these steps:
1. Log in to the router. The CLI operational mode prompt (>) appears.
- If the operational mode prompt does not appear when you log in to the router, type **cli** to start the JUNOS software and enter operational mode. The prompt changes to >, indicating that you are in operational mode.
2. Use one of the operational mode CLI commands listed in “Operational Mode CLI Commands for Router Monitoring” on page 11 to monitor router hardware.

Operational Mode CLI Commands for Router Monitoring

**Purpose** Use the operational mode CLI commands listed in Table 7 on page 11 to monitor router hardware.

Table 7: Operational Mode CLI Commands for Router Monitoring

Command	Description
show version	Displays the router hostname, model number, and version of JUNOS software running on the router.
show chassis firmware	Displays the version of firmware running on the SCB, SFM, SSB, FEB, and FPCs.
show chassis hardware	Displays an inventory of the hardware components installed in the router, including the component name, version, part number, serial number, and a brief description.
show chassis environment	Displays environmental information about the router chassis, including the temperature and status.
show chassis environment <i>component-name</i>	Displays more detailed environmental information for the following router components: FPCs, Front Panel Module (FPM), Miscellaneous Subsystem (MCS), PFE Clock Generator (PCG), Power Entry Module (PEM) or power supply, control board, SONET clock generator (SCG), Switch Interface Board (SIB), Routing Engine, and SFM. This command works only on the M40e, M160, and T320 routers, and the T640 routing node.
show chassis craft-interface	Displays operational status information about the router, including the alarm status and LED status of major components.
show chassis alarms	Displays the current router component alarms that have been generated, including the date, time, severity level, and description.

**Table 7: Operational Mode CLI Commands for Router Monitoring** (continued)

Command	Description
<code>show chassis <i>component-name</i></code>	Displays more detailed operational status information about the FPCs, Routing Engine, FEB, SCB, SFMs, and SSB router components, including the temperature of air passing by the Switch Plane Processor (SPP) card and the Switch Plane Router (SPR) card (the two SFM serial components), in degrees Centigrade. The command displays the total CPU DRAM and SRAM being used by the SFM processor. The command output displays the time that the SFM became active and how long the SFM has been up and running. A small uptime can indicate a problem.
<code>show log messages</code>	<p>Displays the contents of the messages system log file that records messages generated by component operational events, including error messages generated by component failures.</p> <p>To monitor the messages file in real time, use the <code>monitor start messages</code> CLI command. This command displays the new entries in the file until you stop monitoring by using the <code>monitor stop messages</code> CLI command.</p>
<code>show log chassisd</code>	<p>Displays the contents of the chassis daemon (<code>chassisd</code>) log file that keeps track of the state of each chassis component</p> <p>To monitor the <code>chassisd</code> file in real time, use the <code>monitor start chassisd</code> CLI command. This command displays the new entries in the file until you stop monitoring by using the <code>monitor stop chassisd</code> CLI command.</p>
<code>request support information</code>	<p>Use this command when you contact the Juniper Networks Technical Assistance Center (JTAC) about your component problem. This command is the equivalent of using the following CLI commands (see “Contact JTAC” on page 89):</p> <ul style="list-style-type: none"> <li>■ <code>show version</code></li> <li>■ <code>show chassis firmware</code></li> <li>■ <code>show chassis hardware</code></li> <li>■ <code>show chassis environment</code></li> <li>■ <code>show interfaces extensive</code> (for each configured interface)</li> <li>■ <code>show configuration</code> (excluding any SECRET-DATA)</li> <li>■ <code>show system virtual-memory</code></li> </ul>

**Contact JTAC** If you cannot determine the cause of a problem or need additional assistance, contact JTAC at <http://www.juniper.net/cm/> or at 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States). For details on the information you need to provide for JTAC, See “Contact JTAC” on page 89. For steps to return a failed component, see “Return the Failed Component” on page 90.

## Chapter 2

# Cheat Sheet for the CLI Commands

This chapter provides quick reference information for the JUNOS software command-line interface (CLI). For more detailed information about using the CLI, see [\[Unresolved xref\]](#).

- CLI Operational Mode Top-Level Commands on page 13
- CLI Configuration Mode Top-Level Commands on page 15
- Load a Configuration Using Copy and Paste Commands on page 18
- CLI Keyboard Shortcuts on page 21
- Manage Output at the ---(more)--- Prompt on page 22

## CLI Operational Mode Top-Level Commands

In operational mode, you enter commands to monitor and diagnose the software, network connectivity, and the router. When you log in to the router and the CLI starts, you are at the top level of the CLI operational mode. At this level, there are several broad groups of CLI commands. Table 8 on page 13 lists the top-level CLI operational mode commands and describes the options available for each command. The commands are listed in alphabetical order.

**Table 8: CLI Operational Mode Top-Level Commands**

Command	Description
clear	Clear statistics and protocol database information.  Syntax: clear (arp   bgp   firewall   helper   igmp   ike   ilmi   interfaces   ipsec   ipv6   isis   ldp   ldp   msdp   multicast   ospf   pim   rip   ripng   route   rsvp   snmp   system   vrrp)
configure	Enter CLI configuration mode.  Alternative commands: configure <exclusive> <private>
file	Perform file manipulation operations, such as copy, delete, list, rename, and show.  Syntax: file (compare   copy   delete   list   rename   show)
help	Provide help information.  Syntax: help (reference   syslog   topic)

**Table 8: CLI Operational Mode Top-Level Commands** (*continued*)

Command	Description
monitor	Monitor a log file or interface traffic in real time.  Syntax: monitor (interface   list   start   stop   traffic)
mtrace	Display trace information about a multicast path from a source to a receiver.  Syntax: mtrace (from-source   monitor   to-gateway)
ping	Verify IP connectivity to another IP host or Asynchronous Transfer Mode (ATM) connectivity (ping) using Operation Administration and Maintenance (OAM) cells to an ATM endstation.  Syntax: ping host <interface source-interface> <bypass-routing> <count requests> <do-not-fragment> <seconds> <pattern string> <record-route> <routing-instance routing-instance-name> <size bytes> <tos type-of-service> <tll value> <via route> <rapid   detail>  Syntax: ping atm interface interface <count count> <end-to-end   segment> <interval interval> <sequence-number> <vci vci> <brief>  Syntax: ping vpn-interface vpn-interface host <local echo-address>
pipe	Filter the output of an operational mode or configuration mode command.  Syntax:   (compare   count   display <detail>   inheritance   xml)   except pattern   find pattern   last match pattern   no-more   resolve <file-names>   save filename   trim columns)
quit	Log out from the CLI process.  Syntax: quit
request	Make system-level requests, such as halt or reboot the router, load software packages, and back up the router's file systems.  Syntax: request system (halt   reboot   snapshot   software)
restart	Restart the router hardware or software processes.  Syntax: restart (fpc   class-of-service   gracefully   immediately   interface-control   mib-process   network-access-service   remote-operations   routing   sampling   sfm   snmp   soft)
set	Set CLI properties, the router's date and time, and the craft interface display text.  Syntax: set (chassis   cli   date)
show	Show information about all aspects of the software, including interfaces and routing protocols.  Syntax: show (accounting   aps   arp   as-path   bgp   chassis   cli   configuration   connections   dvmr   helper   host   igmp   ike   ilmi   interfaces   ipsec   ipv6   isis   l2circuit   l2vpn   ldp   link-management   mpls   msdp   multicast   ntp   ospf   pfe   pim   policer   policy   rip   ripng   route   rsvp   sap   snmp   task   ted   version   vrrp)
ssh	Open a secure shell to another host.  Syntax: ssh host <bypass-routing> <routing-instance routing-instance-name> <source address> <vpn vpn-interface> <v1   v2>

Table 8: CLI Operational Mode Top-Level Commands (continued)

Command	Description
start	Start a software process.  Syntax: start shell
telnet	Start a telnet session to another host.  Syntax: telnet host <8bit> <bypass-routing> <inet   inet6> <noreresolve> <port port > <interface interface> <routing-instance routing-instance-name > <source address > <vpn-interface vpn-interface >
test	Run various diagnostic debugging commands.  Syntax: test (configuration   interface   msdp   policy)
traceroute	Trace the route to a remote host.  Syntax: traceroute host <as-number-lookup> <bypass-routing> <gateway address > <inet   inet6> <routing-instance routing-instance-name > < source address > <tos value > <ttl value > <vpn-interface vpn-interface > <wait seconds >

CLI Configuration Mode Top-Level Commands

In configuration mode, you configure the JUNOS software by creating a hierarchy of configuration statements. You can do this using the CLI or by creating a text (ASCII) file that contains the statement hierarchy. (The statement hierarchy is identical in both the CLI and the text configuration file.) You can configure all properties of the JUNOS software, including interfaces, general routing information, routing protocols, and user access, as well as several system hardware properties. When you have finished entering the configuration statements, you commit them, which activates the configuration on the router.

Table 9 on page 15 lists each CLI configuration mode command and describes the options available for each command. The commands are organized alphabetically.

Table 9: CLI Configuration Mode Commands

Command	Description
activate	Remove the inactive: tag from a statement, effectively reading the statement or identifier to the configuration. Statements or identifiers that have been activated take effect when you next issue the commit command.  Syntax: activate (statement-path   identifier)
annotate	Add comments to a configuration.  Syntax: annotate < statement-path> "comment-string"
commit	Commit the set of changes to the database and cause the changes to take operational effect.  Syntax: commit <and-quit> <check> <confirmed < minutes >> <synchronize>

**Table 9: CLI Configuration Mode Commands** (continued)

Command	Description
copy	<p>Make a copy of an existing statement in the configuration.</p> <p>Syntax: <code>copy &lt; statement-path&gt; identifier 1 to identifier 2</code></p>
deactivate	<p>Add the <code>inactive:</code> tag to a statement, effectively commenting out the statement or identifier from the configuration. Statements or identifiers marked as inactive do not take effect when you issue the <code>commit</code> command.</p> <p>Syntax: <code>deactivate ( statement-path   identifier ?)</code></p>
delete	<p>Delete a statement or identifier. All subordinate statements and identifiers contained within the specified statement path are deleted with it.</p> <p>Syntax: <code>delete ( statement-path   identifier)</code></p>
edit	<p>Move inside the specified statement hierarchy. If the statement does not exist, it is created.</p> <p>Syntax: <code>edit &lt; statement-path &gt;</code></p>
exit	<p>Exit the current level of the statement hierarchy, returning to the level prior to the last <code>edit</code> command, or exit from configuration mode. The <code>quit</code> and <code>exit</code> commands are synonyms.</p> <p>Syntax: <code>exit &lt;configuration-mode&gt;</code></p>
help	<p>Display help about available configuration statements.</p> <p>Syntax: <code>help (apropos   reference   syslog   topic ) &lt; string ??&gt;</code></p>
insert	<p>Insert an identifier into an existing hierarchy.</p> <p>Syntax: <code>insert &lt; statement-path&gt; identifier1 (before   after) identifier2</code></p>
load	<p>Load a configuration from an ASCII configuration file or from terminal input. Your current location in the configuration hierarchy is ignored when the load operation occurs.</p> <p>Syntax: <code>load (merge   override   replace ) ( filename   terminal)</code></p>
quit	<p>Exit the current level of the statement hierarchy, returning to the level prior to the last <code>edit</code> command, or exit from configuration mode. The <code>quit</code> and <code>exit</code> commands are synonyms.</p> <p>Syntax: <code>quit &lt;configuration-mode&gt;</code></p>
rename	<p>Rename an existing configuration statement or identifier.</p> <p>Syntax: <code>rename &lt; statement-path&gt; identifier1 to identifier2</code></p>

**Table 9: CLI Configuration Mode Commands** (continued)

Command	Description
rollback	<p>Return to a previously committed configuration. The software saves the last 10 committed configurations, including the rollback number, date, time, and name of the user who issued the commit configuration command. <b>rollback 0</b> erases any configuration changes made to the current candidate configuration.</p> <p>The currently operational JUNOS software configuration is stored in the file <code>juniper.conf</code>, and the last three committed configurations are stored in the files <code>juniper.conf.1.gz</code>, <code>juniper.conf.2.gz</code>, and <code>juniper.conf.3.gz</code>. These four files are located in the directory <code>/config/</code>, which is on the router's flash drive. The remaining six previous committed configurations, the files <code>juniper.conf.4.gz</code> through <code>juniper.conf.9.gz</code>, are stored in the directory <code>/var/db/config/</code>, which is on the router's hard disk.</p> <p>Syntax: <code>rollback &lt; number &gt;</code></p>
run	<p>Run an operational mode CLI command without exiting from configuration mode.</p> <p>Syntax: <code>run &lt; operation-command &gt;</code></p>
save	<p>Save the configuration to an ASCII file in the user's home directory (by default) or to the user's terminal session. The statement hierarchy and the contents of the current level of the statement hierarchy (and below) are saved. This allows a section of the configuration to be saved, while fully specifying the statement hierarchy.</p> <p>Syntax: <code>save filename   terminal</code></p>
set	<p>Create a statement hierarchy and set identifier values. This is similar to the <b>edit</b> command except that your current level in the hierarchy does not change, and you can set identifier values, while the <b>edit</b> command only allows access to a statement path.</p> <p>Syntax: <code>set ( statement-path   identifier )</code></p>
show	<p>Display the current configuration.</p> <p>Syntax: <code>show ( statement-path   identifier )</code></p>
status	<p>Display the users currently editing the configuration.</p> <p>Syntax: <code>status</code></p>
top	<p>Return to the top level of configuration command mode, indicated by the <b>[edit]</b> banner, or execute a command from the top level of the configuration.</p> <p>Syntax: <code>top &lt; configuration-command &gt;</code></p>
up	<p>Move up one level in the statement hierarchy.</p> <p>Syntax: <code>up &lt; number &gt;</code></p>
update	<p>Update a private database. For more information on the <b>update</b> command, see the <i>JUNOS System Basics and Services Command Reference</i>.</p> <p>Syntax: <code>update</code></p>

## Load a Configuration Using Copy and Paste Commands

You can load configurations using the copy and paste commands in the following ways:

1. Load a Configuration from a File to a Router on page 18
2. Load a Configuration Using the display set Command on page 20

### Load a Configuration from a File to a Router

**Purpose** You can create a file, copy the file to the local router, and then load the file into the CLI. After you have loaded the file, you can commit it to activate the configuration on the router, or you can edit the configuration interactively using the CLI and commit it at a later time.

**Action** To load a configuration from a file, follow these steps:

1. Create the configuration in a file using a text editor such as Notepad, making sure that the syntax of the configuration file is correct. See the *JUNOS System Basics and Services Command Reference*, for information about testing the syntax of a configuration file.
2. In the text file, use an option to perform the required action. The following table lists and describes some options. For an example of a text file, see “What It Means”.

**Table 10: Options for the load Command**

merge	Combines the current configuration and the configuration in <i>filename</i> or the one that you type at the terminal. A <b>merge</b> operation is useful when you are adding a new section to an existing configuration. If the existing configuration and the incoming configuration contain conflicting statements, the statements in the incoming configuration override those in the existing configuration.
override	Discards the current candidate configuration and loads the configuration in <i>filename</i> or the one that you type at the terminal. When you use the <b>override</b> option and commit the configuration, all system processes reparsing the configuration. You can use the <b>override</b> option at any level of the hierarchy.
replace	Searches for the <b>replace</b> tags, deletes the existing statements of the same name, if any, and replaces them with the incoming configuration. If there is no existing statement of the same name, the <b>replace</b> operation adds the statements marked with the <b>replace</b> tag to the configuration.
Note: For this operation to work, you must include <b>replace</b> tags in the text file or configuration you type at the terminal.	

3. Enter **Ctrl+a** to select all the text, and **Ctrl+c** to copy the contents of the text file to the clipboard.
4. On the router, enter configuration mode:



```
user@host> cli
[edit]
user@host#
```

5. Load the configuration file:

```
user@host> load merge terminal
```

6. At the prompt, paste the contents of the clipboard using the mouse and the paste icon.

```
[edit]
user@host# load merge terminal
[Type ^D at a new line to end input]
> Paste the contents of the clipboard here<
```

7. Press Enter.
8. Enter Ctrl+d.
9. Commit the configuration to activate it on the router, or you can edit the configuration interactively using the CLI and commit it at a later time.

**Sample Output** The following is an example of a text file with the **replace** option:

```
interfaces {
replace:
  so-0/0/0 {
    unit 0 {
      family inet {
        address 10.1.34.1/30;
      }
    }
  }

protocols {
replace:
  isis {
    interface so-0/0/1.0 {
      level 1 metric 10;
      level 2 disable;
    }
    interface fxp0.0 {
      disable;
    }
    interface lo0.0;
  }
}
```

The following output is for Step 4 through Step 8:

```
[edit]
user@R1# load merge terminal
[Type ^D at a new line to end input]
interfaces {
replace:
  so-0/0/0 {
    unit 0 {
      family inet {
```

```

        address 10.1.34.1/30;
    }
}
}
protocols {
replace:
  isis {
    interface so-0/0/1.0 {
      level 1 metric 10;
      level 2 disable;
    }
    interface fxp0.0 {
      disable;
    }
    interface lo0.0;
  }
}
load complete

```

**Meaning** The sample output shows a configuration loaded from a text file with the **replace** option. For more information about loading a configuration, see the *JUNOS System Basics Configuration Guide*.

## Load a Configuration Using the **display set** Command

**Purpose** In configuration mode only, you can display the configuration as a series of configuration mode commands required to recreate the configuration. This is useful for users who are not familiar with how to use configuration mode commands or for users who wish to cut, paste, and edit the displayed configuration. In addition, you can duplicate the configuration of one router to another.

**Action** To load a configuration from the local router to a target router, follow these steps:

1. On the local router, enter configuration mode:

```

user@R1> cli
[edit]
user@host#

```

2. Go to the hierarchy level you want to copy. For example:

```

[edit]
user@R1# edit interfaces

```

3. Display the series of configuration commands required to recreate the configuration. For example:

```

[edit interfaces]
user@R1# show | display set
set interfaces so-0/0/0 unit 0 family inet accounting destination-class-usage
set interfaces so-0/0/0 unit 0 family inet address 10.1.12.1/30
set interfaces fxp0 unit 0 family inet address 10.168.70.143/21
set interfaces lo0 unit 0 family inet address 10.0.0.1/32
set interfaces lo0 unit 0 family iso address 49.0002.1000.0000.0003.00

```

4. Copy each line of the configuration individually from the local router to the target router. In the target router, you must be at the top level of the configuration and in configuration mode. For example:

```
mwazna@R2> edit
Entering configuration mode
[edit]
mwazna@R2# set interfaces so-0/0/0 unit 0 family inet accounting
destination-class-usage
```

5. Continue cutting and pasting each line of the configuration.
6. Commit the configuration to activate it on the router, or you can edit the configuration interactively using the CLI and commit it at a later time.

## CLI Keyboard Shortcuts

In the CLI, you can use keyboard sequences to move around and edit a command line. You can also use keyboard sequences to scroll through a list of recently executed commands.

Table 15 on page 23 lists some of the CLI keyboard sequences.

**Table 11: CLI Keyboard Shortcuts**

Keyboard sequence	Action
Ctrl+b	Move the cursor back one character.
Esc+b or Alt+b	Move the cursor back one word.
Ctrl+f	Move the cursor forward one character.
Esc+f or Alt+f	Move the cursor forward one word.
Ctrl+a	Move the cursor to the beginning of the command line.
Ctrl+e	Move the cursor to the end of the command line.
Ctrl+h, Delete, or Backspace	Delete the character before the cursor.
Ctrl+d	Delete the character at the cursor.
Ctrl+k	Delete the all characters from the cursor to the end of the command line.
Ctrl+u or Ctrl+x	Delete the all characters from the command line.
Ctrl+w, Esc + Backspace, or Alt + Backspace	Delete the word before the cursor.
Esc+d or Alt+d	Delete the word after the cursor.
Ctrl+y	Insert the most recently deleted text at the cursor.
Ctrl+l	Redraw the current line.

**Table 11: CLI Keyboard Shortcuts** *(continued)*

Keyboard sequence	Action
Ctrl+p	Scroll backward through the list of recently executed commands.
Ctrl+n	Scroll forward through the list of recently executed commands.
Ctrl+r	Search the CLI history incrementally in reverse order for lines matching the search string.
Esc+/ or Alt+/	Search the CLI history for words for which the current word is a prefix.
Esc-1 through Esc-9 or Alt-1 through Alt-9	Specify the number of times to execute a keyboard sequence.

## Manage Output at the **—(more)—** Prompt

If the output is longer than the screen length, it appears one screen at a time with the UNIX **—(more)—** prompt at the end of the screen. The **—(more)—** prompt indicates that more output is available. The following table lists the keyboard sequences you can use at the **—(more)—** prompt.

**Table 12: Keyboard Shortcuts at the **—(more)—** Prompt**

Keyboard Shortcut	Action
Enter, Return, k, Ctrl+m, Ctrl+n, or down arrow	Scroll down one line.
Tab, d, Ctrl+d, or Ctrl+x	Scroll down one-half screen.
Space or Ctrl+f	Scroll down one whole screen.
Ctrl+e or g	Scroll down to the bottom of the output.
n (or no-more)	Display the output all at once instead of one screen at a time.
j, Ctrl-h, Ctrl-p, or up arrow	Scroll up one line.
u or Ctrl-u	Scroll up one-half screen.
b or Ctrl-b	Scroll up one whole screen.
Ctrl-a or g	Scroll up to the bottom of the output.
/string	Search forward for a string.
?string	Search backward for a string.
n	Repeat previous search for a string.
m or M (or   match string)	Find a text string. You are prompted for the string to match
e or E (or   except string)	Find, ignoring a text string. You are prompted for the string to ignore.

**Table 12: Keyboard Shortcuts at the —(more)— Prompt** *(continued)*

Keyboard Shortcut	Action
Ctrl-C, q, Q, or Ctrl-k	Interrupt the display of output.
H (Same as specifying   hold)	Hold the CLI at the —more- prompt after displaying all output.
c or C	Clear any match conditions and display the complete output.
Ctrl-l	Redraw the output on the screen.
s or S (or   save <i>filename</i> )	Save the command output to a file. You are prompted for a filename.



## Chapter 3

# Work with Problems on Your Network

This chapter describes how to work with problems on your network. It discusses troubleshooting basics, using an example network, and includes the commands you might use to diagnose problems with the router and network.

- Working with Problems on Your Network on page 25
- Isolate a Broken Network Connection on page 25

## Working with Problems on Your Network

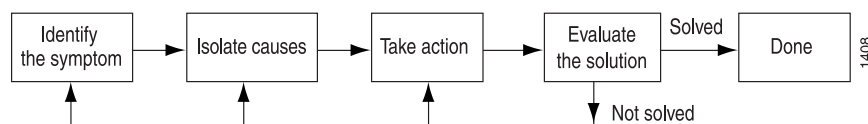
**Problem** This checklist provides links to troubleshooting basics, an example network, and includes a summary of the commands you might use to diagnose problems with the router and network.

**Table 13: Checklist for Working with Problems on Your Network**

Tasks	Command or Action
<b>“Isolate a Broken Network Connection” on page 25</b>	
1. Identify the Symptoms on page 27	ping ( <i>ip-address</i>   <i>hostname</i> ) show route ( <i>ip-address</i>   <i>hostname</i> ) tracert ( <i>ip-address</i>   <i>hostname</i> )
2. Isolate the Causes on page 28	show < configuration   interfaces   protocols   route >
3. Take Appropriate Action on page 28	[edit] delete routing options static route <i>destination-prefix</i> commit and-quit show route <i>destination-prefix</i>
4. Evaluate the Solution on page 29	show route ( <i>ip-address</i>   <i>hostname</i> ) ping ( <i>ip-address</i>   <i>hostname</i> ) count 3 tracert ( <i>ip-address</i>   <i>hostname</i> )

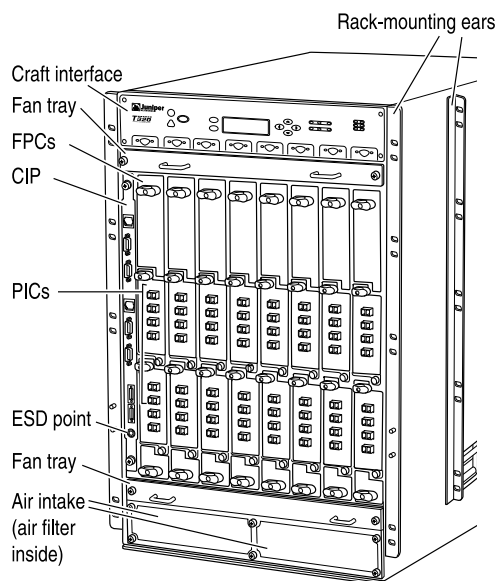
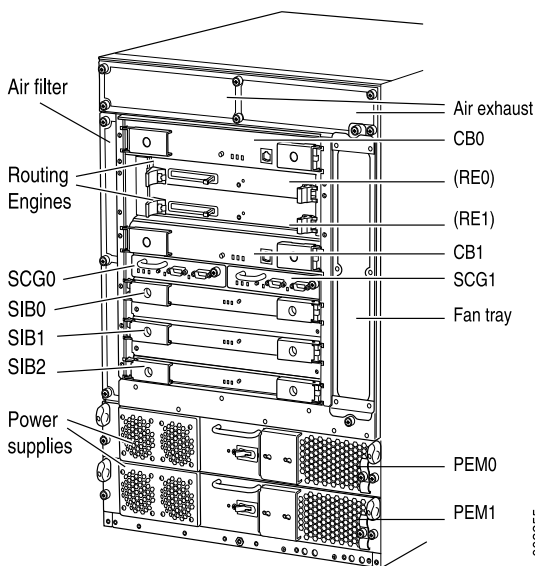
## Isolate a Broken Network Connection

**Purpose** By applying the standard four-step process illustrated in Figure 5 on page 26, you can isolate a failed node in the network.

**Figure 5: Process for Diagnosing Problems in Your Network**

Before you embark on the four-step process, however, it is important that you are prepared for the inevitable problems that occur on all networks. While you might find a solution to a problem by simply trying a variety of actions, you can reach an appropriate solution more quickly if you are systematic in your approach to the maintenance and monitoring of your network. To prepare for problems on your network, understand how the network functions under normal conditions, have records of baseline network activity, and carefully observe the behavior of your network during a problem situation.

Figure 6 on page 26 shows the network topology used in this topic to illustrate the process of diagnosing problems in a network.

**Figure 6: Network with a Problem****T320 front****T320 rear**

The network in Figure 6 on page 26 consists of two autonomous systems (ASs). AS 65001 includes two routers, and AS 65002 includes three routers. The border router (R1) in AS 65001 announces aggregated prefixes 100.100/24 to the AS 65002 network. The problem in this network is that R6 does not have access to R5 because of a loop between R2 and R6.

To isolate a failed connection in your network, follow these steps:

1. Identify the Symptoms on page 27
2. Isolate the Causes on page 28



3. Take Appropriate Action on page 28
4. Evaluate the Solution on page 29

## Identify the Symptoms

**Problem** The symptoms of a problem in your network are usually quite obvious, such as the failure to reach a remote host.

**Solution** To identify the symptoms of a problem on your network, start at one end of your network and follow the routes to the other end, entering all or one of the following JUNOS command-line interfaces (CLI) operational mode commands:

```
user@host> ping (ip-address | host-name)
user@host> show route (ip-address | host-name)
user@host> traceroute (ip-address | host-name)
```

**Sample Output**

```
user@R6> ping 10.0.0.5
PING 10.0.0.5 (10.0.0.5): 56 data bytes
36 bytes from 10.1.26.1: Time to live exceeded
Vr HL TOS Len ID Flg off TTL Pro cks Src Dst
 4 5 00 0054 e2db 0 0000 01 01 a8c6 10.1.26.2 10.0.0.5

36 bytes from 10.1.26.1: Time to live exceeded
Vr HL TOS Len ID Flg off TTL Pro cks Src Dst
 4 5 00 0054 e2de 0 0000 01 01 a8c3 10.1.26.2 10.0.0.5

36 bytes from 10.1.26.1: Time to live exceeded
Vr HL TOS Len ID Flg off TTL Pro cks Src Dst
 4 5 00 0054 e2e2 0 0000 01 01 a8bf 10.1.26.2 10.0.0.5

^C
--- 10.0.0.5 ping statistics ---
3 packets transmitted, 0 packets received, 100% packet loss

user@R6> show route 10.0.0.5

inet.0: 20 destinations, 20 routes (20 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.0.5/32          *[IS-IS/165] 00:02:39, metric 10
                    > to 10.1.26.1 via so-0/0/2.0

user@R6> traceroute 10.0.0.5
traceroute to 10.0.0.5 (10.0.0.5), 30 hops max, 40 byte packets
 1 10.1.26.1 (10.1.26.1) 0.649 ms 0.521 ms 0.490 ms
 2 10.1.26.2 (10.1.26.2) 0.521 ms 0.537 ms 0.507 ms
 3 10.1.26.1 (10.1.26.1) 0.523 ms 0.536 ms 0.514 ms
 4 10.1.26.2 (10.1.26.2) 0.528 ms 0.551 ms 0.523 ms
 5 10.1.26.1 (10.1.26.1) 0.531 ms 0.550 ms 0.524 ms
```

**Meaning** The sample output shows an unsuccessful **ping** command in which the packets are being rejected because the time to live is exceeded. The output for the **show route** command shows the interface (10.1.26.1) that you can examine further for possible problems. The **traceroute** command shows the loop between 10.1.26.1 (R2) and 10.1.26.2 (R6), as indicated by the continuous repetition of the two interface addresses.

## Isolate the Causes

**Problem** A particular symptom can be the result of one or more causes. Narrow down the focus of your search to find each individual cause of the unwanted behavior.

**Solution** To isolate the cause of a particular problem, enter one or all of the following JUNOS CLI operational mode command:

To isolate the cause of a particular problem, enter one or all of the following JUNOS CLI operational mode command:

```
user@host> show < configuration | bgp | interfaces | isis | ospf | route >
```

Your particular problem may require the use of more than just the commands listed above. See the appropriate command reference for a more exhaustive list of commonly used operational mode commands.

**Sample Output**

```
user@R6> show interfaces terse
Interface           Admin Link Proto Local Remote
so-0/0/0            up   up
so-0/0/0.0          up   up   inet 10.1.56.2/30
                    up   up   iso
so-0/0/2            up   up
so-0/0/2.0          up   up   inet 10.1.26.2/30
                    up   up   iso
so-0/0/3            up   up
so-0/0/3.0          up   up   inet 10.1.36.2/30
                    up   up   iso
[...Output truncated...]
```

The following sample output is from R2:

```
user@R2> show route 10.0.0.5

inet.0: 22 destinations, 25 routes (22 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.0.5/32          *[Static/5] 00:16:21
                    > to 10.1.26.2 via so-0/0/2.0
                    [BGP/170] 3d 20:23:35, MED 5, localpref 100
                    AS path: 65001 I
                    > to 10.1.12.1 via so-0/0/0.0
```

**Meaning** The sample output shows that all interfaces on R6 are up. The output from R2 shows that a static route [Static/5] configured on R2 points to R6 (10.1.26.2) and is the preferred route to R5 because of its low preference value. However, the route is looping from R2 to R6, as indicated by the missing reference to R5 (10.1.15.2).

## Take Appropriate Action

**Problem** The appropriate action depends on the type of problem you have isolated. In this example, a static route configured on R2 is deleted from the [routing-options] hierarchy level. Other appropriate actions might include the following:

- Solution**
- Check the local router's configuration and edit it if appropriate.
  - Troubleshoot the intermediate router.
  - Check the remote host configuration and edit it if appropriate.
  - Troubleshoot routing protocols.
  - Identify additional possible causes.

To resolve the problem in this example, enter the following JUNOS CLI commands:

```
[edit]
user@R2# delete routing-options static route destination-prefix
user@R2# commit and-quit
user@R2# show route destination-prefix
```

**Sample Output**

```
[edit]
user@R2# delete routing-options static route 10.0.0.5/32

[edit]
user@R2# commit and-quit
commit complete
Exiting configuration mode

user@R2> show route 10.0.0.5

inet.0: 22 destinations, 24 routes (22 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.0.0.5/32          *[BGP/170] 3d 20:26:17, MED 5, localpref 100
                    AS path: 65001 I
                    > to 10.1.12.1 via so-0/0/0.0
```

**Meaning** The sample output shows the static route deleted from the [routing-options] hierarchy and the new configuration committed. The output for the **show route** command now shows the BGP route as the preferred route, as indicated by the asterisk (\*).

## Evaluate the Solution

**Problem** If the problem is solved, you are finished. If the problem remains or a new problem is identified, start the process over again.

You can address possible causes in any order. In relation to the network in Figure 6 on page 26, we chose to work from the local router toward the remote router, but you might start at a different point, particularly if you have reason to believe that the problem is related to a known issue, such as a recent change in configuration.

**Solution** To evaluate the solution, enter the following JUNOS CLI commands:

```
user@host> show route (ip-address | host-name)
user@host> ping (ip-address | host-name)
user@host> traceroute (ip-address | host-name)
```

**Sample Output**

```
user@R6> show route 10.0.0.5

inet.0: 20 destinations, 20 routes (20 active, 0 holddown, 0 hidden)
```

+ = Active Route, - = Last Active, \* = Both

```
10.0.0.5/32          *[BGP/170] 00:01:35, MED 5, localpref 100, from 10.0.0.2
                    AS path: 65001 I
                    > to 10.1.26.1 via so-0/0/2.0
```

```
user@R6> ping 10.0.0.5
PING 10.0.0.5 (10.0.0.5): 56 data bytes
64 bytes from 10.0.0.5: icmp_seq=0 ttl=253 time=0.866 ms
64 bytes from 10.0.0.5: icmp_seq=1 ttl=253 time=0.837 ms
64 bytes from 10.0.0.5: icmp_seq=2 ttl=253 time=0.796 ms
^C
--- 10.0.0.5 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.796/0.833/0.866/0.029 ms
```

```
user@R6> traceroute 10.0.0.5
traceroute to 10.0.0.5 (10.0.0.5), 30 hops max, 40 byte packets
 1  10.1.26.1 (10.1.26.1)  0.629 ms  0.538 ms  0.497 ms
 2  10.1.12.1 (10.1.12.1)  0.534 ms  0.538 ms  0.510 ms
 3  10.0.0.5 (10.0.0.5)   0.776 ms  0.705 ms  0.672 ms
```

**Meaning** The sample output shows that there is now a connection between R6 and R5. The `show route` command shows that the BGP route to R5 is preferred, as indicated by the asterisk (\*). The `ping` command is successful and the `traceroute` command shows that the path from R6 to R5 is through R2 (10.1.26.1), and then through R1 (10.1.12.1).

## **Part 2**

# **JUNOS Internet Software in the Network**

- Stop and Start JUNOS Software on page 33
- Display JUNOS Software Information on page 39
- Check Router Configuration on page 43
- Upgrade JUNOS Software on page 51
- Reinstall JUNOS Software on page 65



## Chapter 4

# Stop and Start JUNOS Software

This chapter describes how to stop and start the JUNOS software after it has been installed. (See Table 14 on page 33.)

- Stopping and Starting JUNOS Software on page 33
- Stop the JUNOS Software on page 33
- Reboot the JUNOS Software on page 34
- Restart a JUNOS Software Process on page 35

## Stopping and Starting JUNOS Software

This checklist provides the links to tasks for stopping and starting the JUNOS software after it has been installed, and a summary of the commands used in those tasks. (See Table 14 on page 33.)

**Table 14: Checklist for Stopping and Starting the JUNOS Software**

Tasks	Command or Action
1. Stop the JUNOS Software on page 33	request system halt
2. Reboot the JUNOS Software on page 34	request system reboot
<b>“Restart a JUNOS Software Process” on page 35</b>	
1. Display Information About Software Processes on page 35	show system processes extensive
2. Restart a JUNOS Software Process on page 36	restart (class-of-service   interface-control   mib-process   network-access-service   remote-operations   routing   sampling   snmp) <gracefully> <immediately> <soft>
3. Check That the Process Has Restarted on page 37	show system processes extensive

## Stop the JUNOS Software

**Purpose** To avoid damage to the file system, gracefully shut down the JUNOS software before powering down the router. If you have configured a backup Routing Engine, it must be shut down before the master Routing Engine.

**Action** To stop the JUNOS software, use the following JUNOS command-line interface (CLI) operational mode command:

```
user@host> request system halt
```

**Sample Output**

```
user@host> request system halt
Halt the system ? [yes,no] (no) yes
shutdown: [pid 3110]
Shutdown NOW!
*** FINAL System shutdown message from root@host ***
System going down IMMEDIATELY

user@host> Dec 17 17:28:40 init: syslogd (PID 2514) exited with status=0 Normal
Exit
  Waiting (max 60 seconds) for system process `bufdaemon' to stop...stopped
  Waiting (max 60 seconds) for system process `syncer' to stop...stopped
syncing disks... 4
done
Uptime: 3h31m41s
ata0: resetting devices .. done
The operating system has halted.
Please press any key to reboot.
```

**Meaning** The sample output shows that all system process have stopped and the operating system was halted immediately. For more detailed information on the `request system halt` command, see the *JUNOS System Basics and Services Command Reference*.

## Reboot the JUNOS Software

**Purpose** Reboot JUNOS software after a software upgrade and occasionally to recover from an error condition.

**Action** To reboot the JUNOS software, use the following JUNOS CLI operational mode command:

```
user@host> request system reboot
```

**Sample Output**

```
Reboot the system ? [yes,no] (no) yes
shutdown: [pid 845]
Shutdown NOW!
*** FINAL System shutdown message from root@host ***
System going down IMMEDIATELY
user@host> Dec 17 17:34:20 init: syslogd (PID 409) exited with status=0 Normal
Exit
  Waiting (max 60 seconds) for system process `bufdaemon' to stop...stopped
  Waiting (max 60 seconds) for system process `syncer' to stop...stopped
syncing disks... 10 6
done
Uptime: 2m45s
ata0: resetting devices .. done
Rebooting...
```

**Meaning** The sample output shows the final stages of the system shutdown and the execution of the reboot. Reboot requests are recorded to the system log files, which you can view with the `show log messages` command. You can view the process names with



the `show system processes` command. For more information about the `show system processes` command, see “Check That the Process Has Restarted” on page 37. For more detailed information about rebooting your system, see the *JUNOS System Basics and Services Command Reference*.

## Restart a JUNOS Software Process

**Purpose** Restart a JUNOS software process when you need to recover from an error condition



**NOTE:** Never restart any of the software processes unless instructed to do so by a customer support engineer.

To restart a JUNOS software process, follow these steps:

1. Display Information About Software Processes on page 35
2. Restart a JUNOS Software Process on page 36
3. Check That the Process Has Restarted on page 37

## Display Information About Software Processes

**Purpose** Display information about software processes to begin diagnosing an error condition.

**Action** To display information about the software processes that are running on the router, use the following JUNOS CLI operational mode command:

```
user@host> show system processes extensive
```

**Sample Output**

```
user@host>show system processes extensive
last pid: 750; load averages: 0.00, 0.00, 0.00 up 0+00:58:50 18:34:17
52 processes: 1 running, 51 sleeping
Mem: 50M Active, 19M Inact, 38M Wired, 264K Cache, 86M Buf, 642M Free
Swap: 768M Total, 768M Free
```

PID	USERNAME	PRI	NICE	SIZE	RES	STATE	TIME	WCPU	CPU	COMMAND
546	root	10	0	9096K	1720K	nanslp	0:21	0.00%	0.00%	chassisd
<b>685</b>	<b>root</b>	<b>2</b>	<b>0</b>	<b>12716K</b>	<b>3840K</b>	<b>kqread</b>	<b>0:01</b>	<b>0.00%</b>	<b>0.00%</b>	<b>rpd</b>
553	root	2	0	8792K	1544K	select	0:01	0.00%	0.00%	mib2d
552	root	2	0	8632K	1556K	select	0:01	0.00%	0.00%	snmpd
563	root	2	0	9316K	1564K	select	0:00	0.00%	0.00%	kmd
564	root	2	0	7736K	948K	select	0:00	0.00%	0.00%	fud
131	root	10	0	770M	25568K	mfsidl	0:00	0.00%	0.00%	newfs
547	root	2	0	7732K	888K	select	0:00	0.00%	0.00%	alarmd
545	root	2	0	10292K	2268K	select	0:00	0.00%	0.00%	dcd
550	root	2	-12	1308K	692K	select	0:00	0.00%	0.00%	ntpd
1	root	10	0	816K	520K	wait	0:00	0.00%	0.00%	init
750	root	32	0	21716K	828K	RUN	0:00	0.00%	0.00%	top
560	root	2	0	8208K	1088K	select	0:00	0.00%	0.00%	rmopd
561	root	2	0	8188K	1156K	select	0:00	0.00%	0.00%	cosd
559	root	2	0	1632K	840K	select	0:00	0.00%	0.00%	ilmid

**Meaning** The sample output shows the central processing unit (CPU) utilization and lists the processes in order of CPU utilization.

Table 15 on page 36 lists and describes the output fields included in the sample output for the `show processes extensive` command. The fields are listed in alphabetical order.

**Table 15: Show System Processes Extensive Output Fields**

Field	Description
COMMAND	Command that is running.
CPU	Raw (unweighted) CPU usage. The value of this field is used to sort the processes in the output.
last pid	Last process identifier assigned to the process.
load averages	Three load averages, followed by the current time.
Mem	Information about physical and virtual memory allocation.
NICE	UNIX “nice” value. The nice value allows a process to change its final scheduling priority.
PID	Process identifier.
PRI	Current kernel scheduling priority of the process. A lower number indicates a higher priority.
processes	Number of existing processes and the number of processes in each state (sleeping, running, starting, zombies, and stopped).
RES	Current amount of resident memory, in KB.
SIZE	Total size of the process (text, data, and stack), in KB.
STATE	Current state of the process (sleep, wait, run, idle, zombi, or stop).
Swap	Information about physical and virtual memory allocation.
USERNAME	Owner of the process.
WCPU	Weighted CPU usage.

For more details, see “Verify the Routing Engine CPU Memory” on page 165, and the *JUNOS System Basics Configuration Guide*.

## Restart a JUNOS Software Process

**Action** To restart a JUNOS software process, use the following JUNOS CLI operational mode command and include the process you wish to restart. For example:

```
user@host> restart routing
```

**Sample Output** user@host> **restart routing**  
Routing protocol daemon started, pid 751

**Meaning** The sample output shows that the routing protocol daemon was restarted and the process identification (PID) was changed from 685 in the previous sample output to 751.

Table 16 on page 37 lists and describes the options available for the **restart** command.

**Table 16: Options to Restart a JUNOS Software Process**

Option	Description
class-of-service	Restart the class-of-service process, which controls the router's class-of-service configuration.
gracefully	Restart the software process by sending the equivalent of a UNIX SIGTERM signal.
immediately	Immediately restart the process by sending the equivalent of a UNIX SIGKILL signal.
interface-control	Restart the interface process, which controls the router's physical interface devices and logical interfaces.
mib-process	Restart the Management Information Base (MIB) II process, which provides the router's MIB II agent.
network-access-service	Restart the network access process, which provides the router's Challenge Handshake Authentication Process (CHAP) authentication service.
remote-operations	Restart the remote operations process, which provides the ping and traceroute MIBs.
routing	Restart the routing protocol process, which controls the routing protocols that run on the router and maintains the routing tables.
sampling	Restart the sampling process, which performs packet sampling and cflowd export.
snmp	Restart the Simple Network Management Process (SNMP) process, which provides the router's SNMP master agent.
soft	Reread and reactivate the configuration without completely restarting the software processes. For example, Border Gateway Protocol (BGP) peers stay up and the routing table stays constant. This option is the equivalent of a UNIX SIGHUP signal; omitting this option is the equivalent of a UNIX SIGTERM (kill) operation.

### Check That the Process Has Restarted

**Purpose** After you have entered the **restart** command to restart a process, make sure that the process is up and running.

**Action** To check that a process has restarted, use the following JUNOS CLI operational mode command:

```
user@host> show system processes extensive
```

**Sample Output 1** user@host> show system processes extensive  
last pid: 750; load averages: 0.00, 0.00, 0.00 up 0+00:58:50 18:34:17  
52 processes: 1 running, 51 sleeping

Mem: 50M Active, 19M Inact, 38M Wired, 264K Cache, 86M Buf, 642M Free  
Swap: 768M Total, 768M Free

PID	USERNAME	PRI	NICE	SIZE	RES	STATE	TIME	WCPU	CPU	COMMAND
546	root	10	0	9096K	1720K	nanslp	0:21	0.00%	0.00%	chassisd
<b>685</b>	<b>root</b>	<b>2</b>	<b>0</b>	<b>12716K</b>	<b>3840K</b>	<b>kqread</b>	<b>0:01</b>	<b>0.00%</b>	<b>0.00%</b>	<b>rpd</b>
553	root	2	0	8792K	1544K	select	0:01	0.00%	0.00%	mib2d
552	root	2	0	8632K	1556K	select	0:01	0.00%	0.00%	snmpd
63	root	2	0	9316K	1564K	select	0:00	0.00%	0.00%	kmd
64	root	2	0	7736K	948K	select	0:00	0.00%	0.00%	fud
31	root	10	0	770M	25568K	mfsidl	0:00	0.00%	0.00%	newfs
47	root	2	0	7732K	888K	select	0:00	0.00%	0.00%	alarmd
45	root	2	0	10292K	2268K	select	0:00	0.00%	0.00%	dcd
50	root	2	-12	1308K	692K	select	0:00	0.00%	0.00%	ntpd
1	root	10	0	816K	520K	wait	0:00	0.00%	0.00%	init
50	root	32	0	21716K	828K	RUN	0:00	0.00%	0.00%	top
60	root	2	0	8208K	1088K	select	0:00	0.00%	0.00%	rmopd
61	root	2	0	8188K	1156K	select	0:00	0.00%	0.00%	cosd
59	root	2	0	1632K	840K	select	0:00	0.00%	0.00%	ilmid

**Sample Output 2** user@host> show system processes extensive  
last pid: 758; load averages: 0.00, 0.00, 0.00 up 0+01:01:48 18:37:15  
52 processes: 1 running, 51 sleeping  
Mem: 51M Active, 19M Inact, 38M Wired, 156K Cache, 86M Buf, 642M Free  
Swap: 768M Total, 768M Free

PID	USERNAME	PRI	NICE	SIZE	RES	STATE	TIME	WCPU	CPU	COMMAND
546	root	10	0	9096K	1720K	nanslp	0:22	0.05%	0.05%	chassisd
553	root	2	0	8792K	1544K	select	0:01	0.00%	0.00%	mib2d
552	root	2	0	8632K	1556K	select	0:01	0.00%	0.00%	snmpd
563	root	2	0	9316K	1564K	select	0:00	0.00%	0.00%	kmd
564	root	2	0	7736K	948K	select	0:00	0.00%	0.00%	fud
131	root	10	0	770M	25568K	mfsidl	0:00	0.00%	0.00%	newfs
547	root	2	0	7732K	888K	select	0:00	0.00%	0.00%	alarmd
545	root	2	0	10292K	2268K	select	0:00	0.00%	0.00%	dcd
1	root	10	0	816K	520K	wait	0:00	0.00%	0.00%	init
550	root	2	-12	1308K	692K	select	0:00	0.00%	0.00%	ntpd
758	root	32	0	21716K	832K	RUN	0:00	0.00%	0.00%	top
560	root	2	0	8208K	1088K	select	0:00	0.00%	0.00%	rmopd
561	root	2	0	8188K	1156K	select	0:00	0.00%	0.00%	cosd
559	root	2	0	1632K	840K	select	0:00	0.00%	0.00%	ilmid
573	lab	2	0	7480K	2580K	select	0:00	0.00%	0.00%	cli
<b>751</b>	<b>root</b>	<b>2</b>	<b>0</b>	<b>12716K</b>	<b>3944K</b>	<b>kqread</b>	<b>0:00</b>	<b>0.00%</b>	<b>0.00%</b>	<b>rpd</b>
558	root	2	20	8708K	1880K	select	0:00	0.00%	0.00%	sampled
555	root	2	0	1856K	932K	select	0:00	0.00%	0.00%	vrpd
686	root	2	0	7808K	940K	select	0:00	0.00%	0.00%	apds

**Meaning** The sample output shows that the routing protocol process (rpd) was restarted because the process identifier (PID) of the process was renamed from 685, as shown in the Sample Output 1, to 751 as shown in Sample Output 2.

Chapter 5

# Display JUNOS Software Information

This chapter describes how to display the hostname and version information for the JUNOS software running on a router.

- Displaying JUNOS Software Information on page 39
- Display JUNOS Software Information on page 39
- Display Version Information for JUNOS Software Packages on page 40

## Displaying JUNOS Software Information

**Purpose** This checklist provides the commands for displaying the hostname and version information for the JUNOS software running on a router. (See Table 17 on page 39.)

**Table 17: Checklist for Displaying JUNOS Software Information**

Tasks	Command or Action
“Display JUNOS Software Information” on page 39	show version
“Display Version Information for JUNOS Software Packages” on page 40	show version brief

## Display JUNOS Software Information

**Purpose** Display JUNOS software information and status to determine if the version of JUNOS software that you are running supports particular features or hardware. You can also determine whether particular software bugs will affect your version of JUNOS software.

**Action** To display JUNOS software information, use the following JUNOS command-line interface (CLI) operational mode command:

user@host> **show version**

**Sample Output**

```
user@host> show version
Hostname: my-router.net
Model: m160
JUNOS Base OS boot [5.5R2.3]
JUNOS Base OS Software Suite [5.5R2.3]
JUNOS Kernel Software Suite [5.5R2.3]
JUNOS Packet Forwarding Engine Support [5.5R2.3]
```

```

JUNOS Routing Software Suite [5.5R2.3]
JUNOS Online Documentation [5.5R2.3]
JUNOS Crypto Software Suite [5.5R2.3]
KERNEL 5.5R2.3 #0 built by builder on 2002-11-21 22:56:20 UTC
MGD release 5.5R2.3 built by builder on 2002-11-21 22:36:05 UTC
CLI release 5.5R2.3 built by builder on 2002-11-21 22:33:44 UTC
CHASSISD release 5.5R2.3 built by builder on 2002-11-21 22:32:10 UTC
DCD release 5.5R2.3 built by builder on 2002-11-21 22:30:06 UTC
RPD release 5.5R2.3 built by builder on 2002-11-21 22:37:08 UTC
SNMPD release 5.5R2.3 built by builder on 2002-11-21 22:43:14 UTC
MIB2D release 5.5R2.3 built by builder on 2002-11-21 22:36:10 UTC
APSD release 5.5R2.3 built by builder on 2002-11-21 22:32:07 UTC
VRRPD release 5.5R2.3 built by builder on 2002-11-21 22:43:26 UTC
ALARMD release 5.5R2.3 built by builder on 2002-11-21 22:32:01 UTC
PFED release 5.5R2.3 built by builder on 2002-11-21 22:36:53 UTC
CRAFTD release 5.5R2.3 built by builder on 2002-11-21 22:33:59 UTC
SAMPLED release 5.5R2.3 built by builder on 2002-11-21 22:43:01 UTC
ILMID release 5.5R2.3 built by builder on 2002-11-21 22:35:17 UTC
RMOPD release 5.5R2.3 built by builder on 2002-11-21 22:37:01 UTC
COSD release 5.5R2.3 built by builder on 2002-11-21 22:33:50 UTC
KMD release 5.5R2.3 built by builder on 2002-11-21 22:35:29 UTC
FSAD release 5.5R2.3 built by builder on 2002-11-21 22:34:14 UTC
SERVICED release 5.5R2.3 built by builder on 2002-11-21 22:43:07 UTC
IRSD release 5.5R2.3 built by builder on 2002-11-21 22:35:21 UTC
NASD release 5.5R2.3 built by builder on 2002-11-21 22:36:47 UTC
FUD release 5.5R2.3 built by builder on 2002-11-21 22:34:17 UTC
PPMD release 5.5R2.3 built by builder on 2002-11-21 22:36:58 UTC
LMPD release 5.5R2.3 built by builder on 2002-11-21 22:36:01 UTC
RTSPD release 5.5R2.3 built by builder on 2002-11-21 22:42:58 UTC
SMARTD release 5.5R2.3 built by builder on 2002-11-21 22:47:50 UTC
jkernel-dd release 5.5R2.3 built by builder on 2002-11-21 22:27:20 UTC
jroute-dd release 5.5R2.3 built by builder on 2002-11-21 22:27:34 UTC
jcrypto-dd release 5.5R2.3 built by builder on 2002-11-21 22:27:46 UTC

```

**Meaning** The sample output shows the hostname, the version information for the JUNOS software packages installed on the machine, and the version information for each software process.

## Display Version Information for JUNOS Software Packages

**Purpose** Display version information for JUNOS software packages to determine if they support particular features or hardware. You can also determine whether particular software bugs will affect your version of JUNOS software.

**Action** To display brief information and status for the kernel and Packet Forwarding Engine, use the following CLI operational mode command:

```
user@host> show version brief
```

The following sample output is for worldwide nonencrypted JUNOS software:

**Sample Output**

```

user@host> show version brief
  Hostname: my-router.net
  Model: m10
  JUNOS Base OS boot [5.5R2.3]
  JUNOS Base OS Software Suite [5.5R2.3]
  JUNOS Kernel Software Suite [5.5R2.3]
  JUNOS Packet Forwarding Engine Support [5.5R2.3]

```

```
JUNOS Routing Software Suite [5.5R2.3]  
JUNOS Online Documentation [5.5R2.3]
```

The following sample output is for Canada and USA encrypted JUNOS software:

```
user@host> show version brief  
Hostname: my-router.net  
Model: m10  
JUNOS Base OS boot [5.5R2.3]  
JUNOS Base OS Software Suite [5.5R2.3]  
JUNOS Kernel Software Suite [5.5R2.3]  
JUNOS Packet Forwarding Engine Support [5.5R2.3]  
JUNOS Routing Software Suite [5.5R2.3]  
JUNOS Online Documentation [5.5R2.3]  
JUNOS Crypto Software Suite [5.5R2.3]
```

**Meaning** The sample output shows version information for the JUNOS software packages installed on the router. If the **JUNOS Crypto Software Suite** is listed, the router has Canada and USA encrypted JUNOS software. If the **JUNOS Crypto Software Suite** is not listed, the router is running worldwide nonencrypted JUNOS software.





## Chapter 6

# Check Router Configuration

This chapter describes how to check the configuration on your router.

- Checklist for Checking the Router Configuration on page 43
- Display the Current Active Router Configuration on page 43
- Display a Specific Configuration Hierarchy on page 47
- Display Additional Information about the Configuration on page 48

## Checklist for Checking the Router Configuration

**Purpose** Table 18 on page 43 provides links and commands for checking the router configurations.

**Table 18: Checklist for Checking the Router Configuration**

Tasks	Command or Action
"Display the Current Active Router Configuration" on page 43	show configuration
"Display a Specific Configuration Hierarchy" on page 47	show configuration <i>statement-path</i>
"Display Additional Information about the Configuration" on page 48	[edit] show <hierarchy-level>   display detail

## Display the Current Active Router Configuration

**Purpose** Examine the current active router configuration.

**Action** To display the current, active router configuration, use the following command-line interface (CLI) operational mode command:

```
user@host> show configuration
```

**Sample Output**

```
user@host> show configuration
version "5.6I0";
groups {
  global {
    system {
      host-name potter;
      domain-name harry.potter.net;
      domain-search [ harry.potter.net potter.net hrypтр.net ];
```

```

backup-router 10.110.12.254;
time-zone America/Los_Angeles;
debugger-on-panic;
debugger-on-break;
dump-on-panic;
authentication-order [ tacplus password radius ];
root-authentication {
    encrypted-password "$1$0Ff5.$I7.kUgMmx/4WKwUAG"; # SECRET-DATA
}
name-server {
    172.17.28.101;
    172.17.28.100;
}
radius-server {
    10.168.5.73 {
        secret "$9$Nd-YoDjq.PT4oZjik5T369pBIhS1L7dC"; # SECRET-DATA
        timeout 5;
        retry 3;
    }
}
tacplus-server {
    10.168.5.73 {
        secret "$9$.539IRSM8701lMX-2gqmfTz6"; # SECRET-DATA
        timeout 15;
        single-connection;
    }
}
login {
    class superuser-local {
        permissions all;
    }
    class wheel {
        permissions [ admin clear field floppy interfacemaintenance
network reset routing shell snmp system trace view ];
    }
    class readonly {
        permissions [ interface network routing system trace view ];
    }
}
user rpe {
    uid 1230;
    class superuser;
    shell csh;
    authentication {
        encrypted-password FN5oyk/qZ07F2; # SECRET-DATA
    }
    [...Output truncated...]
}
}
static-host-mapping {
    crater sysid 0102.5524.5045;
    badlands sysid 0102.5524.5046;
    [...Output truncated...]
}
services {
    finger;
    ftp;
    rlogin;
    rsh;
    ssh;
}

```

```

telnet;
}
syslog {
  user * {
    any emergency;
  }
  host log {
    any notice;
    pfe info;
    interactive-commands any;
  }
  file messages {
    any notice;
    authorization info;
    pfe info;
    archive world-readable;
  }
  file security {
    interactive-commands any;
    archive world-readable;
  }
  file white_bx {
    daemon notice;
    archive size 40m world-readable;
  }
}
processes {
  routing enable;
  snmp enable;
  tnp-process enable;
  ntp enable;
  inet-process enable;
  mib-process enable;
  management enable;
  watchdog enable;
}
ntp {
  boot-server ntp.juniper.net;
  server 172.17.27.46;
}
}
chassis {
  dump-on-panic;
}
snmp {
  location "Systest lab";
  contact "Brian Matheson";
  interface fxp0.0;
  community public {
    authorization read-only;
  }
  community private {
    authorization read-write;
  }
}
routing-options {
  static {
    /* corporate and alpha net */
    route 172.16.0.0/12 {
      next-hop 10.168.14.254;
      retain;
    }
  }
}

```

```

                                no-readvertise; [...Output truncated...]
                                }
                            }
                        }
                    }
                }
            }
        }
    }
    re1;
}
apply-groups [ global re0 re1 ];
chassis {
    fpc 0 {
        pic 0 {
            mlfr-uni-nni-bundles 4;
        }
    }
}
interfaces {
    ls-0/0/0:0 {
        encapsulation multilink-frame-relay-uni-nni;
        unit 0 {
            dlci 100;
            family inet {
                address 10.53.99.2/32 {
                    destination 10.53.99.1;
                }
            }
        }
    }
    ct3-0/1/0 {
        partition 1 interface-type t1;
        partition 2 interface-type t1;
        partition 3 interface-type t1;
        partition 4 interface-type t1;
    }
    t1-0/1/0:1 {
        encapsulation multilink-frame-relay-uni-nni;
        unit 0 {
            family mlfr-uni-nni {
                bundle ls-0/0/0:0;
            }
        }
    }
}
routing-options {
    static {
        route 10.1.1.0/24 next-hop 10.53.99.1;
    }
    autonomous-system 69;
    forwarding-table {
        export pplb;
    }
}
protocols {
    bgp {
        disable;
        group int {
            type internal;
            neighbor 10.255.14.30;
            [...Output truncated...] }
    }
    isis {
        disable;
    }
}

```

```

        interface all {
            level 1 disable;
        }
        interface fxp0.0 {
            disable;
        }
    }
    inactive: ospf {
        traffic-engineering;
        reference-bandwidth 4g;
        area 0.0.0.0 {
            interface all;
            interface fxp0.0 {
                disable;
            }
        }
    }
}
policy-options {
    policy-statement pplb {
        then {
            load-balance per-packet;
        }
    }
}
[...Output truncated...]

```

**Meaning** The sample output shows the current, active configuration for the router. When displaying the configuration, the CLI indents each subordinate hierarchy level, inserts braces to indicate the beginning and end of each hierarchy level, and places semicolons at the end of statements that are at the lowest level of the hierarchy.

The configuration statements appear in a fixed order. Interfaces appear alphabetically by type, and then in numerical order by slot number, Physical Interface Card (PIC) number, and port number.

## Display a Specific Configuration Hierarchy

**Purpose** To examine a specific configuration hierarchy in the active router configuration.

**Action** To view a specific configuration hierarchy, use the following CLI operational mode command;

```
user@host> show configuration statement-path
```

**Sample Output**

```

user@host> show configuration protocols bgp
group ebgp {
type external;
peer-as 65001;
neighbor 10.168.20.1;
}

```

**Meaning** The sample output shows the active configuration under the [protocol bgp] hierarchy level.

## Display Additional Information about the Configuration

**Purpose** You can display additional information when you are not sure of the meaning of configuration statements and what permission bits are required to add and modify them.

**Action** To display additional information about the entire configuration, use the following CLI configuration mode command:

```
user@host# show | display detail
```

To display additional information about a specific hierarchy, use the following CLI configuration mode command:

```
user@host# show <hierarchy-level> | display detail
```

The following sample output is for the first command. The output for a particular hierarchy appears similar to its section in this sample output.

**Sample Output**

```
user@host> edit
user@host# show | display detail
##
##  version: Software version information
##  require: system
##
version "3.4R1 [tlim]";
system {
##
##  host-name: Host name for this router
##  match: ^[:alnum:].-]+$
##  require: system
##
host-name router-name;
##
##  domain-name: Domain name for this router
##  match: ^[:alnum:].-]+$
##  require: system
##
domain-name isp.net;
##
##  backup-router: Address of router to use while booting
##
backup-router 10.168.100.1;
root-authentication {
##
##  encrypted-password: Crypted password string
##
encrypted-password "$1$BYJQE$/ocQof8pmcm7MSGK0"; # SECRET-DATA
}
##
##  name-server: DNS name servers
##  require: system
##
name-server {
##
##  name-server: DNS name server address
##
208.197.1.0;
```

```

}
login {
##
## class: User name (login)
## match: ^[[:alnum:]]_-$
##
class superuser {
##
## permissions: Set of permitted operation categories
##
permissions all;
}
...
##
## services: System services
## require: system
##
services {
## services: Service name
##
ftp;
##
## services: Service name
##
telnet;
##
}
syslog {
##
## file-name: File to record logging data
##
file messages {
##
## Facility type
## Level name
##
any notice;
##
## Facility type
## Level name
##
authorization info;
}
}
}
chassis {
alarm {
sonet {
##
## lol: Loss of light
## alias: loss-of-light
##
lol red;
}
}
}
}
interfaces {
##
## Interface name
##

```

```

at-2/1/1 {
atm-options {
##
##  vpi: Virtual path index
## range: 0 .. 255
## maximum-vcs: Maximum number of virtual circuits on this VP
##
vpi 0 maximum-vcs 512;
}
##
##  unit: Logical unit number
## range: 0 .. 16384
##
unit 0 {
##
##  vci: ATM point-to-point virtual circuit identifier ([vpi.]vci)
## match: ^([[:digit:]]+.){0,1}[[:digit:]]+$
##
vci 0.128;
}
}
...

```

**Meaning** The sample output shows additional information that includes the help string explaining each configuration statement, and the permission bits required to add and modify the configuration statement.



## Chapter 7

# Upgrade JUNOS Software

As new features become available or as software problems are fixed, you might periodically upgrade the router software. (See .)

- Checklist for Upgrading JUNOS Software on page 51
- Logging Information Before You Upgrade JUNOS Software on page 52
- Upgrade JUNOS Software on page 61
- After You Upgrade JUNOS Internet Software on page 62

## Checklist for Upgrading JUNOS Software

Table 19 on page 51 provides links and commands for upgrading router software.

**Table 19: Checklist for Upgrading JUNOS Software**

Tasks	Command or Action
<b>“Logging Information Before You Upgrade JUNOS Software” on page 52</b>	
1. Log the Software Version Information on page 53	show version   save <i>filename</i>
2. Log the Hardware Version Information on page 53	show chassis hardware   save <i>filename</i>
3. Log the Active Configuration on page 54	show configuration   save <i>filename</i>
4. Log the Interfaces on the Router on page 55	show interface terse   save <i>filename</i>
5. Log the BGP, IS-IS, and OSPF Adjacency Information on page 55	show bgp summary   save <i>filename</i> show isis adjacency brief   save <i>filename</i> show ospf neighbor brief   save <i>filename</i>
6. Log the System Storage Information on page 56	show system storage   save <i>filename</i>
7. Back Up the Currently Running and Active File System on page 57	request system snapshot
8. Download JUNOS Software on page 57	<a href="http://www.juniper.net/support">http://www.juniper.net/support</a>
<b>“Upgrade JUNOS Software” on page 61</b>	
1. Copy JUNOS Software to the Router on page 61	file copy ftp://username:prompt@ftp.hostname. net/jbundle-package-name /var/tmp/jbundle-package-name

**Table 19: Checklist for Upgrading JUNOS Software** (continued)

Tasks	Command or Action
2. Add New Software on page 61	<code>request system software add/var/tmp/jbundle-package-name</code>
3. Start the New Software on page 62	<code>request system reboot</code>
<b>“After You Upgrade JUNOS Internet Software” on page 62</b>	
1. Compare Information Logged Before and After the Upgrade on page 62	<code>show version   save filename</code> <code>show chassis hardware   save filename</code> <code>show configuration   save filename</code> <code>show interface terse   save filename</code> <code>show bgp summary   save filename</code> <code>show isis adjacency brief   save filename</code> <code>show ospf neighbor brief   save filename</code> <code>show system storage   save filename</code>
2. Back Up the New Software on page 62	<code>request system snapshot</code>

## Logging Information Before You Upgrade JUNOS Software

**Purpose** Before you upgrade the JUNOS software, it is important to log information about the existing system so that after the upgrade you can compare the same information to verify that all components are installed and working as expected. Also, during the process of logging information, you might find an existing problem that you did not know about and might have thought was caused by the upgrade.

In all the logging steps, you can use your terminal program to save the output from the commands, or use the **save** command to redirect the output to an external file.

To save the output to a file on another machine, use the following JUNOS command-line interface (CLI) operational mode command:

```
user@host> command | save filename
```

By default, the file is placed in your home directory on the router. To redirect the output to a file on another machine, change the filename to include the path to that machine and file. For information about how you can specify the filename, see the *JUNOS System Basics and Services Command Reference*.

The following example stores the output of the **show version** command in a file:

```
user@host> show version | save filename
Wrote 1143 lines of output to 'filename'
```

To log important information about your system, follow these steps:

1. Log the Software Version Information on page 53
2. Log the Hardware Version Information on page 53
3. Log the Active Configuration on page 54
4. Log the Interfaces on the Router on page 55

5. Log the BGP, IS-IS, and OSPF Adjacency Information on page 55
6. Log the System Storage Information on page 56
7. Back Up the Currently Running and Active File System on page 57
8. Download JUNOS Software on page 57

## Log the Software Version Information

**Action** To log the JUNOS software version information, use the following JUNOS CLI operational mode command:

```
user@host> show version | save filename
```

**Sample Output** user@host> show version | save test  
Wrote 39 lines of output to 'test'

```
user@host> show version
Hostname: my-router.net
Model: m10
JUNOS Base OS boot [5.0R5]
JUNOS Base OS Software Suite [5.0R5]
JUNOS Kernel Software Suite [5.0R5]
JUNOS Routing Software Suite [5.0R5]
JUNOS Packet Forwarding Engine Support [5.0R5]
JUNOS Crypto Software Suite [5.0R5]
JUNOS Online Documentation [5.0R5]
KERNEL 5.0R5 #0 built by builder on 2002-03-02 05:10:28 UTC
MGD release 5.0R5 built by builder on 2002-03-02 04:45:32 UTC
CLI release 5.0R5 built by builder on 2002-03-02 04:44:22 UTC
CHASSISD release 5.0R5 built by builder on 2002-03-02 04:43:37 UTC
DCD release 5.0R5 built by builder on 2002-03-02 04:42:47 UTC
RPD release 5.0R5 built by builder on 2002-03-02 04:46:17 UTC
SNMPD release 5.0R5 built by builder on 2002-03-02 04:52:26 UTC
MIB2D release 5.0R5 built by builder on 2002-03-02 04:45:37 UTC
APSD release 5.0R5 built by builder on 2002-03-02 04:43:31 UTC
VRRPD release 5.0R5 built by builder on 2002-03-02 04:52:34 UTC
ALARM release 5.0R5 built by builder on 2002-03-02 04:43:24 UTC
PFED release 5.0R5 built by builder on 2002-03-02 04:46:06 UTC
CRAFTD release 5.0R5 built by builder on 2002-03-02 04:44:30 UTC
SAMPLED release 5.0R5 built by builder on 2002-03-02 04:52:20 UTC
ILMID release 5.0R5 built by builder on 2002-03-02 04:45:21 UTC
BPRELAYD release 5.0R5 built by builder on 2002-03-02 04:42:41 UTC
RMOPD release 5.0R5 built by builder on 2002-03-02 04:46:11 UTC
jkernel-dd release 5.0R5 built by builder on 2002-03-02 04:41:07 UTC
jroute-dd release 5.0R5 built by builder on 2002-03-02 04:41:21 UTC
jdocs-dd release 5.0R5 built by builder on 2002-03-02 04:39:11 UTC
```

**Meaning** The sample output shows the hostname, router model, and the different JUNOS software packages, processes, and documents.

## Log the Hardware Version Information

**Action** To log the router chassis hardware version information, use the following JUNOS CLI operational mode command:

```
user@host> show chassis hardware | save filename
```

**Sample Output** The output for the M-series routers varies depending on the chassis components of each router. All routers have a chassis, midplanes or backplanes, power supplies, and Flexible PIC Concentrators (FPCs). Refer to the hardware guides for information about the different chassis components.

```
user@host> show chassis hardware | save test
Wrote 43 lines of output to 'test'
```

```
user@host> show chassis hardware
Item              Version  Part number  Serial number  Description
Chassis                               101          M160
Midplane          REV 02    710-001245   S/N AB4107
FPM CMB           REV 01    710-001642   S/N AA2911
FPM Display       REV 01    710-001647   S/N AA2999
CIP               REV 02    710-001593   S/N AA9563
PEM 0             Rev 01    740-001243   S/N KJ35769    DC
PEM 1             Rev 01    740-001243   S/N KJ35765    DC
PCG 0             REV 01    710-001568   S/N AA9794
PCG 1             REV 01    710-001568   S/N AA9804
Host 1            da000004f8d57001  teknor
MCS 1             REV 03    710-001226   S/N AA9777
SFM 0 SPP         REV 04    710-001228   S/N AA2975
SFM 0 SPR         REV 02    710-001224   S/N AA9838      Internet Processor I
SFM 1 SPP         REV 04    710-001228   S/N AA2860
SFM 1 SPR         REV 01    710-001224   S/N AB0139      Internet Processor I
FPC 0             REV 03    710-001255   S/N AA9806      FPC Type 1
  CPU             REV 02    710-001217   S/N AA9590
  PIC 1           REV 05    750-000616   S/N AA1527      1x OC-12 ATM, MM
  PIC 2           REV 05    750-000616   S/N AA1535      1x OC-12 ATM, MM
  PIC 3           REV 01    750-000616   S/N AA1519      1x OC-12 ATM, MM
FPC 1             REV 02    710-001611   S/N AA9523      FPC Type 2
  CPU             REV 02    710-001217   S/N AA9571
  PIC 0           REV 03    750-001900   S/N AA9626      1x STM-16 SDH, SMIR
  PIC 1           REV 01    710-002381   S/N AD3633      2x G/E, 1000 BASE-SX
FPC 2             FPC Type 0C192
  CPU             REV 03    710-001217   S/N AB3329
  PIC 0           REV 01
```

**Meaning** The sample output shows the hardware inventory for an M160 router with a chassis serial number of 101. For each component, the output shows the version number, part number, serial number, and description.

## Log the Active Configuration

**Action** To log the active configuration on the router, use the following JUNOS CLI operational mode command:

```
user@host> show configuration | save filename
```

**Sample Output** user@host> show configuration | save test  
Wrote 4076 lines of output to 'test'

```
user@host> show configuration
system {
  host-name lab8;
  domain-name juniper.net;
  backup-router 10.1.1.254;
```

```

time-zone America/Los_Angeles;
default-address-selection;
dump-on-panic;
name-server {
[...Output truncated...]

```

**Meaning** The sample output shows the configuration currently running on the router, which is the last committed configuration.

## Log the Interfaces on the Router

**Action** To log the interfaces on the router, use the following JUNOS CLI operational mode command:

```
user@host> show interface terse | save filename
```

**Sample Output** user@host> show interface terse | save test  
Wrote 81 lines of output to 'test'

```

user@host> show interface terse
Interface      Admin Link Proto Local          Remote
at-1/3/0       up    up    inet  1.0.0.1          --> 1.0.0.2
at-1/3/0.0     up    up    inet  1.0.0.1          --> 1.0.0.2
                iso
fxp0           up    up
fxp0.0         up    up    inet  10.168.5.59/24
gre            down  up
ipip           down  up
lo0            up    up
lo0.0          up    up    inet  127.0.0.1        --> 0/0
                iso 47.0005.80ff.f800.0000.0108.0001.1921.6800.5059.00
so-1/2/0       up    down
so-1/2/1       down  down
so-1/2/2       down  down
so-1/2/3       down  down
so-2/0/0       up    up
so-2/0/0.0    up    up    inet  1.2.3.4          --> 1.2.3.5
                iso
[...Output truncated...]

```

**Meaning** The sample output shows summary information about the physical and logical interfaces on the router.

## Log the BGP, IS-IS, and OSPF Adjacency Information

**Purpose** The following commands log useful information about the Border Gateway Protocol (BGP), Intermediate System-to-Intermediate System (IS-IS), and Open Shortest Path First (OSPF) protocols. If you have other protocols installed, such as Multiprotocol Label Switching (MPLS), Resource Reservation Protocol (RSVP), or Protocol Independent Multicast (PIM), you also might log summary information for them.

**Action** To log protocol peer information, use the following JUNOS CLI operational mode commands:

```

user@host> show bgp summary | save filename
user@host> show isis adjacency brief | save filename

```

```
user@host> show ospf neighbor brief | save filename
```

**Sample Output 1** user@host> show bgp summary | save test  
Wrote 45 lines of output to 'test'

```
user@host> show bgp summary
Groups: 1 Peers: 1 Down peers: 0
Table          Tot Paths  Act Paths Suppressed  History Damp State   Pending
inet.0         4          4          0           0        0      0        0
Peer           AS           InPkt   OutPkt   OutQ   Flaps  Last Up/Dwn
State|#Active/Received/Damped...
9.9.3.1         2         2627    2628     0       0    21:50:12 4/4/0
0/0/0
```

**Sample Output 2** user@host> show isis adjacency brief | save test  
Wrote 10 lines of output to 'test'

```
user@host> show isis adjacency brief
IS-IS adjacency database:
Interface System      L State      Hold (secs) SNPA
so-1/0/0.0 1921.6800.5067 2 Up          13
so-1/1/0.0 1921.6800.5067 2 Up          25
so-1/2/0.0 1921.6800.5067 2 Up          20
so-1/3/0.0 1921.6800.5067 2 Up          19
so-2/0/0.0 1921.6800.5066 2 Up          19
so-2/1/0.0 1921.6800.5066 2 Up          17
so-2/2/0.0 1921.6800.5066 2 Up          20
so-2/3/0.0 1921.6800.5066 2 Up          20
so-5/0/0.0 ranier          2 Up          17
```

**Sample Output 3** user@host> show ospf neighbor brief | save test  
Wrote 10 lines of output to 'test'

```
user@host> show ospf neighbor brief
Address      Intf      State      ID          Pri  Dead
10.168.254.225 fxp3.0    2Way       10.250.240.32 128  36
10.168.254.230 fxp3.0    Full       10.250.240.8  128  38
10.168.254.229 fxp3.0    Full       10.250.240.35 128  33
10.1.1.129      fxp2.0    Full       10.250.240.12 128  37
10.1.1.131      fxp2.0    Full       10.250.240.11 128  38
10.1.2.1        fxp1.0    Full       10.250.240.9  128  32
10.1.2.81       fxp0.0    Full       10.250.240.10 128  33
```

**Meaning** Sample output 1 displays summary information about BGP and its neighbors. Sample output 2 displays information about IS-IS neighbors. Sample output 3 displays information about all OSPF neighbors.

## Log the System Storage Information

**Action** To log system storage statistics for the amount of free disk space in the router's file system, use the following JUNOS CLI operational mode command:

```
user@host> show system storage | save filename
```

**Sample Output** user@host> show system storage | save test  
Wrote 14 lines of output to 'test'

```

user@host> show system storage
Filesystem 1K-blocks    Used    Avail Capacity  Mounted on
/dev/ad0s1a 65687    26700   33733    44%      /
devfs       16        16        0    100%    /dev/
/dev/vn1    9310     9310        0    100%    /packages/mnt/jbase
/dev/vn2    8442     8442        0    100%    /packages/mnt/jkernel-5.0R5.1
/dev/vn3   11486    11486        0    100%    /packages/mnt/jpfe-5.0R5.1
/dev/vn4    5742     5742        0    100%    /packages/mnt/jroute-5.0R5.1
/dev/vn5    1488     1488        0    100%    /packages/mnt/jcrypto-5.0R5.1
/dev/vn6     792      792        0    100%    /packages/mnt/jdocs-5.0R5.1
mfs:2373   1015815      3   934547      0%    /tmp
/dev/ad0s1e 25263      11   23231      0%    /config
procfs      4         4        0    100%    /proc
/dev/ad1s1f 9825963  1811085  7228801    20%    /var

```

**Meaning** The sample output shows statistics about the amount of free disk space in the router's file system. Values are displayed in 1024-byte (1-KB) blocks.

## Back Up the Currently Running and Active File System

**Action** To back up the currently running and active file system so that you can recover to a known, stable environment in case there is a problem during the upgrade, use the following JUNOS CLI operational mode command:

```
user@host> request system snapshot
```

**Sample Output**

```

user@host> request system snapshot
umount: /altroot: not currently mounted
Copying / to /altroot.. (this may take a few minutes)
umount: /altconfig: not currently mounted
Copying /config to /altconfig.. (this may take a few minutes)
The following filesystems were archived: / /config

```

**Meaning** The root file system is backed up to `/altroot`, and `/config` is backed up to `/altconfig`. The root and `/config` file systems are on the router's internal flash drive, and the `/altroot` and `/altconfig` file systems are on the router's hard drive.



**NOTE:** After you issue the `request system snapshot` command, you cannot return to the previous version of the software because the running and backup copies of the software are identical.

## Download JUNOS Software



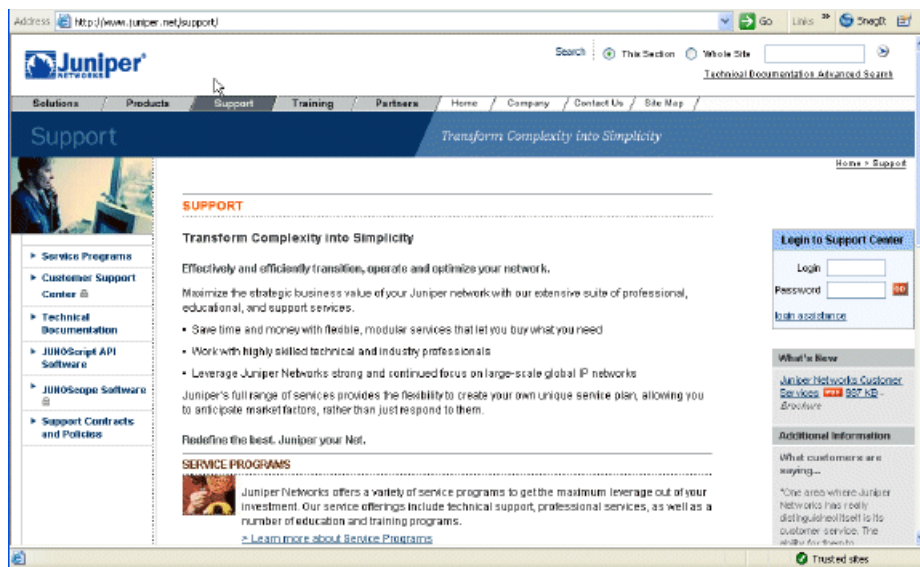
**NOTE:** To download the JUNOS software packages, you must have a service contract and an access account. Try to download the software packages a few days before you intend to install them, as you may need to verify your service contract and access account. If you need help obtaining an account, contact your Juniper Networks sales representative or send an e-mail to [logistics@juniper.net](mailto:logistics@juniper.net).

**Action** To download the software packages from the Juniper Networks Support Web site, follow these steps:

1. Enter the following site address:

<http://www.juniper.net/support>

The following screen appears.



2. In Login to Support Center, enter your login and password.

The customer support center screen appears.

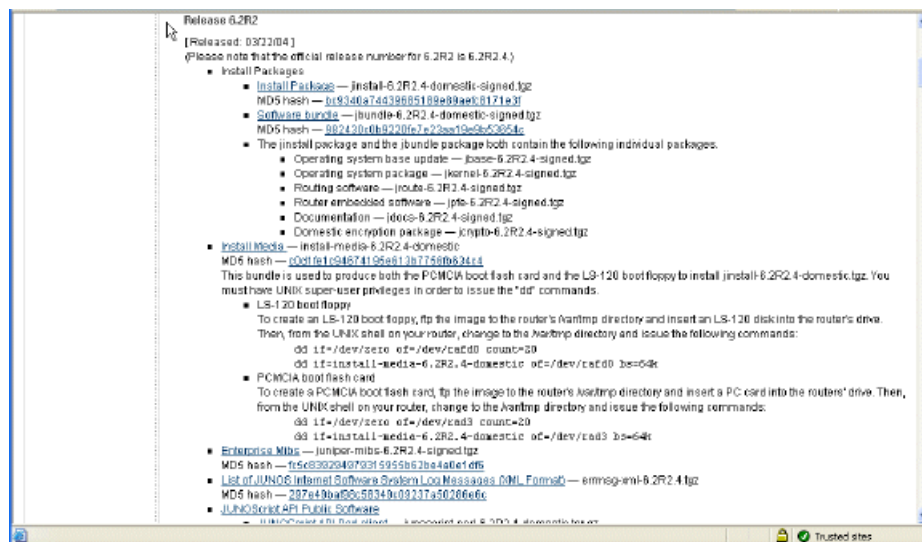




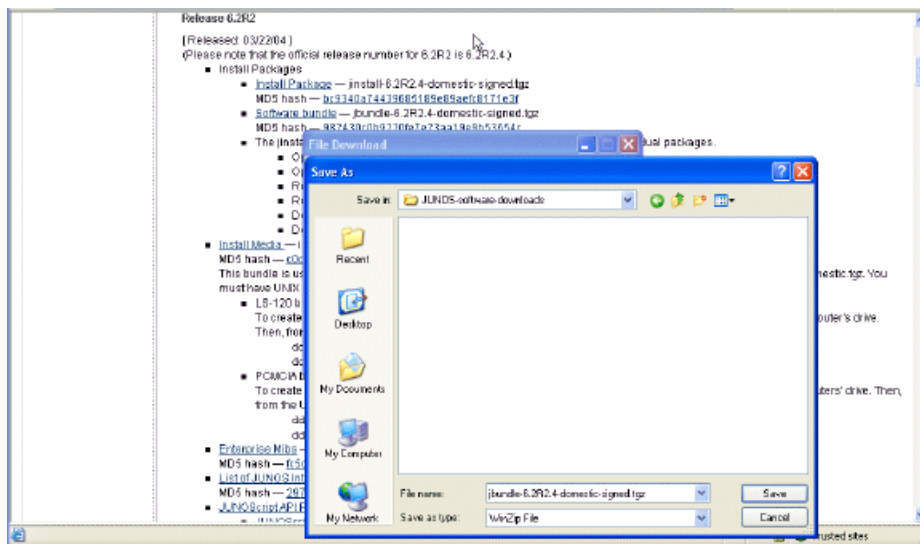
- From Download Software, select the M- & T-series link. The Software Download screen appears.



- From Available Releases, click the software release you want.  
The Software to Download screen appears.



- Click the software bundle you want to download. The Save As screen appears.



- Click Save to download the software packages. Download the software packages to a server, not to the router.

**Meaning** Each JUNOS software release consists of the following software packages:

- **jbase**—Additions to the operating system
- **kernel**—Operating system package
- **route**—Software that runs on the Routing Engine
- **pf**—Software that runs on the Packet Forwarding Engine
- **docs**—Documentation for the software
- **crypto**—Security software (in domestic software only)

The packages are also grouped together in a bundle, called **bundle**. Normally, you use the bundle to upgrade all of the software packages at the same time.



**NOTE:** If you are upgrading to Release 5.0 from Release 4.x or downgrading from Release 5.0 to Release 4.x, use the **install** package. Otherwise, use the **bundle** package to upgrade to a new release.

Downgrading from Release 5.0 to Release 4.x can be a two-step process. For more information, see *JUNOS System Basics Configuration Guide*.

You also can upgrade the software packages individually but this is not recommended. When upgrading to a new release, you must install the entire bundle; do not upgrade packages individually unless instructed to do so by the Juniper Networks Technical Assistance Center (JTAC).

Two sets of JUNOS software packages are provided: one for customers in the United States and Canada, and another for worldwide customers. The worldwide version does not include any capabilities that provide encryption of data leaving the router. Otherwise, the two packages are identical.

## Upgrade JUNOS Software

---

**Purpose** As new features become available or as software problems are fixed, you might periodically upgrade the router software.

To upgrade JUNOS software, follow these steps:

1. Copy JUNOS Software to the Router on page 61
2. Add New Software on page 61
3. Start the New Software on page 62

### Copy JUNOS Software to the Router

**Action** Copy the software packages from the server to the router. We recommend that you copy them to the `/var/tmp` directory, which is on the rotating medium (hard disk) and is a large file system. Use the following CLI command:

```
user@host> file copy ftp://username: prompt@ftp.hostname.
net/jbundle-package-name/var/tmp/jbundle-package-name
```

### Add New Software

**Action** To add new software packages, use the following JUNOS CLI operational mode command:

```
user@host> request system software add /var/tmp/jbundle-package-name
```

*package-name* is the full URL to the file and *release-number* is the major software release number; for example, 4.2R1. Before the new software is added, the existing software is automatically deleted.



**NOTE:** Even though you are adding the new software, the changes do not take effect until the router has completed rebooting.

---

**Sample Output**

```
user@host> request system software add /var/tmp/jinstall-5.2R2.3-domestic.tgz
Installing package '/var/tmp/jinstall-5.2R2.3-domestic.tgz
Auto-deleting old jroute...
Auto-deleting old jdocs...
Auto-deleting old jpfe...
Auto-deleting old jkernel...
Adding JUNOS base software 5.2R2.3
Adding jkernel...
Adding jpfe...
Adding jdocs...
```

```

Adding jroute...
NOTICE: uncommitted changes have been saved in
/var/db/config/juniper.conf.pre-install
Saving package file in /var/sw/pkg/jinstall-5.2R2.3-domestic.tgz

```

## Start the New Software

- Purpose** After you have added new software packages, you must reboot the router for the new software to take effect.
- Action** To reboot the router to complete the upgrade, use the following JUNOS CLI operational mode command:
- ```
user@host> request system reboot
```

## After You Upgrade JUNOS Internet Software

---

To verify that the new version of JUNOS software is running as expected after the upgrade, follow these steps:

1. Compare Information Logged Before and After the Upgrade on page 62
2. Back Up the New Software on page 62

## Compare Information Logged Before and After the Upgrade

- Purpose** Compare the operation of the system before and after the upgrade to ensure that everything is working as expected.
- Action** To obtain system information, use the following JUNOS CLI operational mode commands:
- ```

user@host> show version
user@host> show chassis hardware
user@host> show configuration
user@host> show interface terse
user@host> show bgp summary
user@host> show isis adjacency brief
user@host> show ospf neighbor brief
user@host> show system storage

```

Compare the information from these commands with the information you logged before the upgrade.

## Back Up the New Software

- Purpose** After a week or so, when you are satisfied that the new software is running successfully, we recommend that you back up the upgraded software.
- Action** To back up the upgraded software, use the following JUNOS CLI operational mode command:
- ```
user@host> request system snapshot
```

The root file system is backed up to `/altroot`, and `/config` is backed up to `/altconfig`. The root and `/config` file systems are on the router's internal flash drive, and the `/altroot` and `/altconfig` file systems are on the router's hard drive.



**NOTE:** After you issue the `request system snapshot` command, you cannot return to the previous version of the software because the running and backup copies of the software are identical.

---



## Chapter 8

# Reinstall JUNOS Software

If the JUNOS software becomes damaged, you must reinstall it.

- Checklist for Reinstalling JUNOS Software on page 65
- Before You Reinstall JUNOS Software on page 66
- Reinstall the JUNOS Software on page 74
- Reconfigure the JUNOS Software on page 75
- After You Reinstall JUNOS Software on page 77

## Checklist for Reinstalling JUNOS Software

Table 20 on page 65 provides links and commands for reinstalling JUNOS software.

**Table 20: Checklist for Reinstalling JUNOS Software**

| Tasks                                                              | Command or Action                                                                                                                              |
|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>“Before You Reinstall JUNOS Software” on page 66</b>            |                                                                                                                                                |
| 1. Log the Software Version Information on page 67                 | show version   save <i>filename</i>                                                                                                            |
| 2. Log the Hardware Version Information on page 68                 | show chassis hardware   save <i>filename</i>                                                                                                   |
| 3. Log the Chassis Environment Information on page 69              | show chassis environment   save <i>filename</i>                                                                                                |
| 4. Log the System Boot-Message Information on page 70              | show system boot-messages   save <i>filename</i>                                                                                               |
| 5. Log the Active Configuration on page 71                         | show configuration   save <i>filename</i>                                                                                                      |
| 6. Log the Interfaces on the Router on page 72                     | show interface terse   save <i>filename</i>                                                                                                    |
| 7. Log the BGP, IS-IS, and OSPF Adjacency Information on page 72   | show bgp summary   save <i>filename</i><br>show isis adjacency brief   save <i>filename</i><br>show ospf neighbor brief   save <i>filename</i> |
| 8. Log the System Storage Information on page 73                   | show system storage   save <i>filename</i>                                                                                                     |
| 9. Back Up the Currently Running and Active File System on page 74 | request system snapshot                                                                                                                        |
| 10.                                                                | <a href="http://www.juniper.net/support">http://www.juniper.net/support</a>                                                                    |

**Table 20: Checklist for Reinstalling JUNOS Software** *(continued)*

| Tasks                                                                   | Command or Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>“Reinstall the JUNOS Software” on page 74</b>                        | Insert the floppy and reboot the system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>“Reconfigure the JUNOS Software” on page 75</b>                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1. Configure Names and Addresses on page 75                             | Log in as root.<br>Start the CLI.<br>Enter configuration mode: <code>configure</code><br><code>set system host-name <i>host-name</i></code><br><code>set system domain-name <i>domain-name</i></code><br><code>set interfaces fxp0 unit 0 family inet address <i>address/prefix-length</i></code><br><code>set system backup-router <i>address</i></code><br><code>set system name-server <i>address</i></code>                                                                                                                                                             |
| 2. Set the Root Password on page 76                                     | <code>set system root-authentication plain-text-password</code><br><code>set system root-authentication encrypted-password <i>password</i></code><br><code>set system root-authentication ssh-rsa <i>key</i></code><br><code>commit</code><br><code>exit</code>                                                                                                                                                                                                                                                                                                             |
| 3. Check Network Connectivity on page 77                                | <code>ping <i>address</i></code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 4. Copy Backup Configurations to the Router on page 77                  | <code>file copy var/tmp</code><br><code>configure</code><br><br><code>[edit]</code><br><code>load merge /config/<i>filename</i> or load replace /config/<i>filename</i></code><br><br><code>[edit]</code><br><code>commit</code>                                                                                                                                                                                                                                                                                                                                            |
| <b>“After You Reinstall JUNOS Software” on page 77</b>                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1. Compare Information Logged Before and After the Reinstall on page 77 | <code>show version   save <i>filename</i></code><br><code>show chassis hardware   save <i>filename</i></code><br><code>show chassis environment   save <i>filename</i></code><br><code>show system boot-messages   save <i>filename</i></code><br><code>show configuration   save <i>filename</i></code><br><code>show interfaces terse   save <i>filename</i></code><br><code>show bgp summary</code><br><code>show isis adjacency brief</code><br><code>show ospf neighbor brief   save <i>filename</i></code><br><code>show system storage   save <i>filename</i></code> |
| 2. Back Up the New Software on page 78                                  | <code>request system snapshot</code>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## Before You Reinstall JUNOS Software

**Purpose** Before you reinstall the JUNOS software, it is important to log information about the existing system so that after the reinstall you can verify that all software components are installed and working as expected. Also, while logging information, you might find an existing problem that you did not know about and might have thought was caused by the reinstall.



In all of the logging steps, you can use your terminal program to save the output from the commands, or use the **save** command to redirect the output to an external file.

To save the output to a file on another machine, use the following JUNOS command-line interface (CLI) operational mode command:

```
user@host> command | save filename
```

By default, the file is placed in your home directory on the router. To redirect the output to a file on another machine, change the filename to include the path to that machine and file. For information about how you can specify the filename, see the *JUNOS System Basics and Services Command Reference*.

The following example stores the output of the **show version** command in a file:

```
user@host> show version | save filename
Wrote 1143 lines of output to 'filename'
```

To log important information about your system, follow these steps:

1. Log the Software Version Information on page 67
2. Log the Hardware Version Information on page 68
3. Log the Chassis Environment Information on page 69
4. Log the System Boot-Message Information on page 70
5. Log the Active Configuration on page 71
6. Log the Interfaces on the Router on page 72
7. Log the BGP, IS-IS, and OSPF Adjacency Information on page 72
8. Log the System Storage Information on page 73
9. Back Up the Currently Running and Active File System on page 74
10. Have the Boot Floppy or PCMCIA Card Ready on page 74

## Log the Software Version Information

**Action** To log the JUNOS software version information, use the following JUNOS CLI operational mode command:

```
user@host> show version | save filename
```

**Sample Output** user@host> **show version | save test**  
Wrote 39 lines of output to 'test'

```
user@host> show version
Hostname: my-router.net
Model: m10
JUNOS Base OS boot [5.0R5]
JUNOS Base OS Software Suite [5.0R5]
JUNOS Kernel Software Suite [5.0R5]
JUNOS Routing Software Suite [5.0R5]
JUNOS Packet Forwarding Engine Support [5.0R5]
JUNOS Crypto Software Suite [5.0R5]
```

```

JUNOS Online Documentation [5.0R5]
KERNEL 5.0R5 #0 built by builder on 2002-03-02 05:10:28 UTC
MGD release 5.0R5 built by builder on 2002-03-02 04:45:32 UTC
CLI release 5.0R5 built by builder on 2002-03-02 04:44:22 UTC
CHASSISD release 5.0R5 built by builder on 2002-03-02 04:43:37 UTC
DCD release 5.0R5 built by builder on 2002-03-02 04:42:47 UTC
RPD release 5.0R5 built by builder on 2002-03-02 04:46:17 UTC
SNMPD release 5.0R5 built by builder on 2002-03-02 04:52:26 UTC
MIB2D release 5.0R5 built by builder on 2002-03-02 04:45:37 UTC
APSD release 5.0R5 built by builder on 2002-03-02 04:43:31 UTC
VRRPD release 5.0R5 built by builder on 2002-03-02 04:52:34 UTC
ALARMD release 5.0R5 built by builder on 2002-03-02 04:43:24 UTC
PFED release 5.0R5 built by builder on 2002-03-02 04:46:06 UTC
CRAFTD release 5.0R5 built by builder on 2002-03-02 04:44:30 UTC
SAMPLED release 5.0R5 built by builder on 2002-03-02 04:52:20 UTC
ILMID release 5.0R5 built by builder on 2002-03-02 04:45:21 UTC
BPRELAYD release 5.0R5 built by builder on 2002-03-02 04:42:41 UTC
RMOPD release 5.0R5 built by builder on 2002-03-02 04:46:11 UTC
jkernel-dd release 5.0R5 built by builder on 2002-03-02 04:41:07 UTC
jroute-dd release 5.0R5 built by builder on 2002-03-02 04:41:21 UTC
jdocs-dd release 5.0R5 built by builder on 2002-03-02 04:39:11 UTC

```

**Meaning** The sample output shows the hostname, router model, and the different JUNOS software packages, processes, and documents.

## Log the Hardware Version Information

**Purpose** You should log hardware version information in the rare event that a router cannot successfully reboot and you cannot obtain the Routing Engine serial number. The Routing Engine serial number is necessary for Juniper Networks Technical Assistance Center (JTAC) to issue a return to manufacturing authorization (RMA). Without the Routing Engine serial number, an onsite technician must be dispatched to issue the RMA.

**Action** To log the router chassis hardware version information, use the following JUNOS CLI operational mode command:

```
user@host> show chassis hardware | save filename
```

**Sample Output** The output for the M-series routers varies depending on the chassis components of each router. All routers have a chassis, midplanes or backplanes, power supplies, and Flexible PIC Concentrators (FPCs). Refer to the hardware guides for information about the different chassis components.

```
user@host> show chassis hardware | save test
Wrote 43 lines of output to 'test'
```

```

user@host> show chassis hardware
Item          Version  Part number  Serial number  Description
Chassis                               101           M160
Midplane      REV 02   710-001245   S/N AB4107
FPM CMB       REV 01   710-001642   S/N AA2911
FPM Display   REV 01   710-001647   S/N AA2999
CIP           REV 02   710-001593   S/N AA9563
PEM 0         Rev 01   740-001243   S/N KJ35769   DC
PEM 1         Rev 01   740-001243   S/N KJ35765   DC
PCG 0         REV 01   710-001568   S/N AA9794

```

|           |        |            |                  |                      |
|-----------|--------|------------|------------------|----------------------|
| PCG 1     | REV 01 | 710-001568 | S/N AA9804       |                      |
| Host 1    |        |            | da000004f8d57001 | teknor               |
| MCS 1     | REV 03 | 710-001226 | S/N AA9777       |                      |
| SFM 0 SPP | REV 04 | 710-001228 | S/N AA2975       |                      |
| SFM 0 SPR | REV 02 | 710-001224 | S/N AA9838       | Internet Processor I |
| SFM 1 SPP | REV 04 | 710-001228 | S/N AA2860       |                      |
| SFM 1 SPR | REV 01 | 710-001224 | S/N AB0139       | Internet Processor I |
| FPC 0     | REV 03 | 710-001255 | S/N AA9806       | FPC Type 1           |
| CPU       | REV 02 | 710-001217 | S/N AA9590       |                      |
| PIC 1     | REV 05 | 750-000616 | S/N AA1527       | 1x OC-12 ATM, MM     |
| PIC 2     | REV 05 | 750-000616 | S/N AA1535       | 1x OC-12 ATM, MM     |
| PIC 3     | REV 01 | 750-000616 | S/N AA1519       | 1x OC-12 ATM, MM     |
| FPC 1     | REV 02 | 710-001611 | S/N AA9523       | FPC Type 2           |
| CPU       | REV 02 | 710-001217 | S/N AA9571       |                      |
| PIC 0     | REV 03 | 750-001900 | S/N AA9626       | 1x STM-16 SDH, SMIR  |
| PIC 1     | REV 01 | 710-002381 | S/N AD3633       | 2x G/E, 1000 BASE-SX |
| FPC 2     |        |            |                  | FPC Type OC192       |
| CPU       | REV 03 | 710-001217 | S/N AB3329       |                      |
| PIC 0     | REV 01 |            |                  | 1x OC-192 SM SR-2    |

**Meaning** The sample output shows the hardware inventory for an M160 router with a chassis serial number of 101. For each component, the output shows the version number, part number, serial number, and description.

## Log the Chassis Environment Information

**Action** To log the router chassis environment information, use the following JUNOS CLI operational mode command:

```
user@host> show chassis environment | save filename
```

**Sample Output** The following example shows output from the show chassis environment command for an M5 router:

```
user@m5-host> show chassis environment | save test
Wrote 14 lines of output to 'test'
```

```
user@m5-host> show chassis environment
Class Item                Status    Measurement
Power Power Supply A      OK
Power Power Supply B      OK
Temp  FPC Slot 0             OK        32 degrees C / 89 degrees F
      FEB                 OK        31 degrees C / 87 degrees F
      PS Intake            OK        26 degrees C / 78 degrees F
      PS Exhaust           OK        31 degrees C / 87 degrees F
Fans  Left Fan 1           OK        Spinning at normal speed
      Left Fan 2           OK        Spinning at normal speed
      Left Fan 3           OK        Spinning at normal speed
      Left Fan 4           OK        Spinning at normal speed
```

**Meaning** The sample output shows the environmental information about the router chassis, including the temperature and information about the fans, power supplies, and Routing Engine.

## Log the System Boot-Message Information

**Action** To log the system boot-message information, use the following JUNOS CLI operational mode command:

```
user@host> show system boot-messages | save filename
```

**Sample Output** user@host> show system boot-messages | save test  
Wrote 80 lines of output to 'test'

```
user@host> show system boot-messages
Copyright (c) 1992-1998 FreeBSD Inc.
Copyright (c) 1996-2000 Juniper Networks, Inc.
All rights reserved.
Copyright (c) 1982, 1986, 1989, 1991, 1993
    The Regents of the University of California. All rights reserved.

JUNOS 4.1-20000216-Zf8469 #0: 2000-02-16 12:57:28 UTC

tlim@single.juniper.net:/p/build/20000216-0905/4.1/release_kernel/sys/compile/GENERIC
CPU: Pentium Pro (332.55-MHz 686-class CPU)
    Origin = "GenuineIntel" Id = 0x66a Stepping=10

Features=0x183f9ff<FPU,VME,DE,PSE,TSC,MSR,PAE,MCE,CX8,SEP,MTRR,PGE,MCA,CMOV,<b16>,<b17>,MMX,<b24>>
Teknor CPU Card Recognized
real memory = 805306368 (786432K bytes)
avail memory = 786280448 (767852K bytes)
Probing for devices on PCI bus 0:
chip0 <generic PCI bridge (vendor=8086 device=7192 subclass=0)> rev 3 class 60000
    on pci0:0:0
chip1 <Intel 82371AB PCI-ISA bridge> rev 1 class 60100 on pci0:7:0
chip2 <Intel 82371AB IDE interface> rev 1 class 10180 on pci0:7:1
chip3 <Intel 82371AB USB interface> rev 1 class c0300 int d irq 11 on pci0:7:2
smb0 <Intel 82371AB SMB controller> rev 1 class 68000 on pci0:7:3
pcic0 <TI PCI-1131 PCI-CardBus Bridge> rev 1 class 60700 int a irq 15 on pci0:13:0
TI1131 PCI Config Reg: [pci only][FUNC0 pci int]
pcic1 <TI PCI-1131 PCI-CardBus Bridge> rev 1 class 60700 int b irq 12 on pci0:13:1
TI1131 PCI Config Reg: [pci only][FUNC1 pci int]
fxp0 <Intel EtherExpress Pro 10/100B Ethernet> rev 8 class 20000 int a irq 12 on
    pci0:16:0
chip4 <generic PCI bridge (vendor=1011 device=0022 subclass=4)> rev 4 class 60400
    on pci0:17:0
fxp1 <Intel EtherExpress Pro 10/100B Ethernet> rev 8 class 20000 int a irq 10 on
    pci0:19:0
Probing for devices on PCI bus 1:mcs0 <Miscellaneous Control Subsystem> rev 12
class ff0000 int a irq 12 on pci1:13:0
fxp2 <Intel EtherExpress Pro 10/100B Ethernet> rev 8 class 20000 int a irq 10 on
    pci1:14:0
Probing for devices on the ISA bus:
sc0 at 0x60-0x6f irq 1 on motherboard
sc0: EGA color <16 virtual consoles, flags=0x0>
ed0 not found at 0x300
ed1 not found at 0x280
ed2 not found at 0x340
psm0 not found at 0x60
sio0 at 0x3f8-0x3ff irq 4 flags 0x20010 on isa
sio0: type 16550A, console
sio1 at 0x3e8-0x3ef irq 5 flags 0x20000 on isa
```

```

sio1: type 16550A
sio2 at 0x2f8-0x2ff irq 3 flags 0x20000 on isa
sio2: type 16550A
pcic0 at 0x3e0-0x3e1 on isa
PC-Card ctlr(0) TI PCI-1131 [CardBus bridge mode] (5 mem & 2 I/O windows)
pcic0: slot 0 controller I/O address 0x3e0
npx0 flags 0x1 on motherboard
npx0: INT 16 interface
fdc0: direction bit not set
fdc0: cmd 3 failed at out byte 1 of 3
fdc0 not found at 0x3f0
wdc0 at 0x1f0-0x1f7 irq 14 on isa
wdc0: unit 0 (wd0): <SunDisk SDCFB-80>, single-sector-i/o
wd0: 76MB (156672 sectors), 612 cyls, 8 heads, 32 S/T, 512 B/S
wdc0: unit 1 (wd1): <IBM-DCXA-210000>
wd1: 8063MB (16514064 sectors), 16383 cyls, 16 heads, 63 S/T, 512 B/S
wdc1 not found at 0x170
wdc2 not found at 0x180
ep0 not found at 0x300
fxp0: Ethernet address 00:a0:a5:12:05:5a
fxp1: Ethernet address 00:a0:a5:12:05:59
fxp2: Ethernet address 02:00:00:00:00:01
swapon: adding /dev/wd1s1b as swap device
Automatic reboot in progress...
/dev/rwd0s1a: clean, 16599 free (95 frags, 2063 blocks, 0.1% fragmentation)
/dev/rwd0s1e: clean, 9233 free (9 frags, 1153 blocks, 0.1% fragmentation)
/dev/rwd0s1a: clean, 16599 free (95 frags, 2063 blocks, 0.1% fragmentation)
/dev/rwd1s1f: clean, 4301055 free (335 frags, 537590 blocks, 0.0% fragmentation)

```

**Meaning** The sample output shows the initial messages generated by the system kernel upon boot. This is the content of the `/var/run/dmesg.boot` file.

## Log the Active Configuration

**Action** To log the active configuration on the router, use the following JUNOS CLI operational mode command:

```
user@host> show configuration | save filename
```

**Sample Output** user@host> **show configuration | save test**  
Wrote 4076 lines of output to 'test'

```

user@host> show configuration
system {
  host-name lab8;
  domain-name juniper.net;
  backup-router 10.1.1.254;
    time-zone America/Los_Angeles;
  default-address-selection;
    dump-on-panic;
  name-server {
    [...]Output truncated...

```

**Meaning** The sample output shows the configuration currently running on the router, which is the last committed configuration.

## Log the Interfaces on the Router

**Action** To log the interfaces on the router, use the following JUNOS CLI operational mode command:

```
user@host> show interface terse | save filename
```

**Sample Output** user@host> show interfaces terse | save test  
Wrote 81 lines of output to 'test'

```
user@host> show interfaces terse
Interface      Admin Link Proto Local Remote
at-1/3/0       up    up
at-1/3/0.0     up    up   inet  1.0.0.1    --> 1.0.0.2
               iso
fxp0           up    up
fxp0.0         up    up   inet  10.168.5.59/24
gre            down  up
ipip           down  up
lo0            up    up
lo0.0          up    up   inet  127.0.0.1    --> 0/0
               iso 47.0005.80ff.f800.0000.0108.0001.1921.6800.5059.00
so-1/2/0       up    down
so-1/2/1       down  down
so-1/2/2       down  down
so-1/2/3       down  down
so-2/0/0       up    up
so-2/0/0.0     up    up   inet  1.2.3.4      --> 1.2.3.5
               iso
[...Output truncated...]
```

**Meaning** The sample output displays summary information about the physical and logical interfaces on the router.

## Log the BGP, IS-IS, and OSPF Adjacency Information

**Purpose** The following commands log useful information about Border Gateway Protocol (BGP), Intermediate System-to-Intermediate System (IS-IS), and Open Shortest Path First (OSPF) protocols. If you have other protocols installed, such as Multiprotocol Label Switching (MPLS), Resource Reservation Protocol (RSVP), or Protocol Independent Multicast (PIM), you also might log summary information for them.

**Action** To log the protocol peer information, use the following JUNOS CLI operational mode commands:

```
user@host> show bgp summary | save filename
user@host> show isis adjacency brief | save filename
user@host> show ospf neighbor brief | save filename
```

**Sample Output 1** user@host> show bgp summary | save test  
Wrote 45 lines of output to 'test'

```
user@host> show bgp summary
Groups: 1 Peers: 1 Down peers: 0
```

```

Table          Tot Paths  Act Paths  Suppressed  History Damp State  Pending
inet.0         4          4          0          0          0          0
Peer           AS      InPkt      OutPkt      OutQ      Flaps  Last Up/Dwn
State|#Active/Received/Damped..
9.9.3.1         2      2627      2628        0          0    21:50:12 4/4/0
0/0/0

```

**Sample Output 2** user@host> **show isis adjacency brief | save test**  
Wrote 7 lines of output to 'test'

```

user@host> show isis adjacency brief
IS-IS adjacency database:
Interface System L State Hold (secs) SNPA
so-1/0/0.0 1921.6800.5067 2 Up 13
so-1/1/0.0 1921.6800.5067 2 Up 25
so-1/2/0.0 1921.6800.5067 2 Up 20
so-1/3/0.0 1921.6800.5067 2 Up 19
so-2/0/0.0 1921.6800.5066 2 Up 19
so-2/1/0.0 1921.6800.5066 2 Up 17
so-2/2/0.0 1921.6800.5066 2 Up 20
so-2/3/0.0 1921.6800.5066 2 Up 20
so-5/0/0.0 ranier 2 Up 17

```

**Sample Output 3** user@host> **show ospf neighbor brief | save test**  
Wrote 10 lines of output to 'test'

```

user@host> show ospf neighbor brief
Address Intf State ID Pri Dead
10.168.254.225 fxp3.0 2Way 10.250.240.32 128 36
10.168.254.230 fxp3.0 Full 10.250.240.8 128 38
10.168.254.229 fxp3.0 Full 10.250.240.35 128 33
10.1.1.129 fxp2.0 Full 10.250.240.12 128 37
10.1.1.131 fxp2.0 Full 10.250.240.11 128 38
10.1.2.1 fxp1.0 Full 10.250.240.9 128 32
10.1.2.81 fxp0.0 Full 10.250.240.10 128 33

```

**Meaning** Sample output 1 displays summary information about BGP and its neighbors. Sample output 2 displays information about IS-IS neighbors. Sample output 3 displays information about all OSPF neighbors.

## Log the System Storage Information

**Action** To log the system storage statistics for the amount of free disk space in the router's file system, use the following JUNOS CLI operational mode command:

```
user@host> show system storage | save filename
```

**Sample Output** user@host> **show system storage | save test**  
Wrote 14 lines of output to 'test'

```

user@host> show system storage
Filesystem 1K-blocks Used Avail Capacity Mounted on
/dev/ad0s1a 65687 26700 33733 44% /
devfs 16 16 0 100% /dev/
/dev/vn1 9310 9310 0 100% /packages/mnt/jbase
/dev/vn2 8442 8442 0 100% /packages/mnt/jkernel-5.0R5.1
/dev/vn3 11486 11486 0 100% /packages/mnt/jpfe-5.0R5.1

```

|             |         |         |         |      |                               |
|-------------|---------|---------|---------|------|-------------------------------|
| /dev/vn4    | 5742    | 5742    | 0       | 100% | /packages/mnt/jroute-5.0R5.1  |
| /dev/vn5    | 1488    | 1488    | 0       | 100% | /packages/mnt/jcrypto-5.0R5.1 |
| /dev/vn6    | 792     | 792     | 0       | 100% | /packages/mnt/jdocs-5.0R5.1   |
| mfs:2373    | 1015815 | 3       | 934547  | 0%   | /tmp                          |
| /dev/ad0s1e | 25263   | 11      | 23231   | 0%   | /config                       |
| procfs      | 4       | 4       | 0       | 100% | /proc                         |
| /dev/ad1s1f | 9825963 | 1811085 | 7228801 | 20%  | /var                          |

**Meaning** The sample output displays statistics about the amount of free disk space in the router's file system. Values are displayed in 1024-byte (1-KB) blocks.

## Back Up the Currently Running and Active File System

**Action** To back up the currently running and active file system so that you can recover to a known, stable environment in case there is a problem during the reinstall, use the following JUNOS CLI operational mode command:

```
user@host> request system snapshot
```

**Sample Output**

```
user@host> request system snapshot
umount: /altroot: not currently mounted
Copying / to /altroot.. (this may take a few minutes)
umount: /altconfig: not currently mounted
Copying /config to /altconfig.. (this may take a few minutes)
The following filesystems were archived: / /config
```

**Meaning** The root file system is backed up to /altroot, and /config is backed up to /altconfig. The root and /config file systems are on the router's internal flash drive, and the /altroot and /altconfig file systems are on the router's hard drive.



**NOTE:** After you issue the `request system snapshot` command, you cannot return to the previous version of the software because the running and backup copies of the software are identical.

## Have the Boot Floppy or PCMCIA Card Ready

**Action** Have available the removable medium that shipped with the router (also called a boot floppy) or the Personal Computer Memory Card International Association (PCMCIA) card. If you do not have a boot floppy, contact customer support at <http://www.juniper.net/support>.

## Reinstall the JUNOS Software

**Action** To reinstall the JUNOS software, follow these steps:

1. Insert the removable medium (boot floppy) into the router.
2. Reboot the router, either by power-cycling it or by issuing the `request system reboot` command from the CLI.
3. At the following prompt, type `y`:



**WARNING:** The installation will erase the contents of your disk. Do you wish to continue (y/n)?

The router copies the software from the removable medium onto your system, occasionally displaying status messages. This can take up to 10 minutes.

4. Remove the removable medium when prompted.

The router reboots from the primary boot device on which the software is installed. When the reboot is complete, the router displays the login prompt.

## Reconfigure the JUNOS Software

---

**Purpose** After you have reinstalled the software, you must copy the router's configuration files back to the router. (You also can configure the router from scratch, as described in *JUNOS System Basics Configuration Guide*) However, before you can copy the configuration files, you must establish network connectivity.

To reconfigure the software, follow these steps:

1. Configure Names and Addresses on page 75
2. Set the Root Password on page 76
3. Check Network Connectivity on page 77
4. Copy Backup Configurations to the Router on page 77

### Configure Names and Addresses

**Action** To configure the machine name, domain name, and various addresses, follow these steps:

1. Log in as **root**. There is no password.
2. Start the CLI:

```
root# cli
root@>
```

3. Enter configuration mode:

```
cli> configure
[edit]
root@#
```

4. Configure the name of the machine. If the name includes spaces, enclose the entire name in quotation marks (" "):

```
[edit]
root@# set system host-name host-name
```

5. Configure the machine's domain name:

```
[edit]
```

```
root@# set system domain-name domain-name
```

6. Configure the IP address and prefix length for the router's management Ethernet interface:

```
[edit]
root@# set interfaces fxp0 unit 0 family inet address address / prefix-length
```

7. Configure the IP address of a default router. This system is called the backup router because it is used only while the routing protocol process is not running.

```
[edit]
root@# set system backup-router address
```

8. Configure the IP address of a Domain Name Server (DNS) server:

```
[edit]
root@# set system name-server address
```

## Set the Root Password

**Action** To set the root password, follow these steps:

1. To set the root password, enter a clear-text password that the system will encrypt, a password that is already encrypted, or a secure shell (ssh) public key string.
2. To enter a password that is already encrypted, use the following command to set the root password:

```
[edit]
root@# set system root-authentication encrypted-password
New Password: password
Retype new password: password
```

3. To enter a password that is already encrypted, use the following command to set the root password:

```
[edit]
root@# set system root-authentication encrypted-password password
```

4. To enter an ssh public string, use the following command to set the root password:

```
[edit]
root@# set system root-authentication ssh-rsa key
```

5. Commit the changes:

```
[edit]
root@# commit
```

6. Exit from configuration mode:

```
[edit]
root@# exit
root@>
```

## Check Network Connectivity

**Purpose** Establish that the router has network connectivity.

**Action** To check that the router has network connectivity, issue a **ping** command to a system on the network:

```
root@> ping address
```

If there is no response, verify that there is a route to the **address** using the **show route** command. If the address is outside your **fxp0** subnet, add a static route. Once the backup configuration is loaded and committed, the static route is no longer needed and should be deleted.

## Copy Backup Configurations to the Router

**Action** To copy backup configurations to the router, follow these steps:

1. To copy the existing configuration and any backup configurations back onto the router, use the **file copy** command. Place the files in the **/var/tmp** directory.

```
user@host> file copy var/tmp/filename
```

2. Load and activate the desired configuration:

```
root@> configure
[edit]
root@# load merge/config/filename or load replace/config/filename
[edit]
root@# commit
```

## After You Reinstall JUNOS Software

---

To verify that the new version of the JUNOS software is running as expected after the reinstall, follow these steps:

1. Compare Information Logged Before and After the Reinstall on page 77
2. Back Up the New Software on page 78

## Compare Information Logged Before and After the Reinstall

**Purpose** Compare the operation of the system before and after the reinstall to ensure that everything is working as expected.

**Action** To obtain system information, use the following commands:

```
user@host> show version
user@host> show chassis hardware
user@host> show chassis environment
user@host> show system boot-messages
user@host> show configuration
```

```
user@host> show interface terse
user@host> show bgp summary
user@host> show isis adjacency brief
user@host> show ospf neighbor brief
user@host> show system storage
```

Compare the information from these commands with the information you obtained before the reinstall.

## Back Up the New Software

**Purpose** After a week or so, when you are satisfied that the new software is running successfully, we recommend that you back up the reinstalled software.

**Action** To back up the reinstalled software, use the following JUNOS CLI operational mode command:

```
user@host> request system snapshot
```

The root file system is backed up to `/altroot`, and `/config` is backed up to `/altconfig`. The root and `/config` file systems are on the router's internal flash drive, and the `/altroot` and `/altconfig` file systems are on the router's hard drive.



**NOTE:** After you issue the `request system snapshot` command, you cannot return to the previous version of the software because the running and backup copies of the software are identical.

---

## **Part 3**

# **Verify Your Network Topology**

- Verify Juniper Networks Routers on page 81
- Verify Physical Interfaces on the Router on page 93
- Verify the IS-IS Protocol and Adjacencies on page 101
- Verify the OSPF Protocol and Neighbors on page 117
- Verify the BGP Protocol and Peers on page 143
- Verify the Routing Engine CPU Memory on page 165
- Verify Traffic and Packets Through the Router on page 175
- Use the ping and traceroute Commands on page 183
- Use MIBs on page 189



## Chapter 9

# Verify Juniper Networks Routers

This chapter describes how to check the hardware components of Juniper Networks routers on your network.

- Checklist for Verifying Juniper Networks Routers on page 81
- Check Router Components on page 82
- Check the Router Component Status on page 83
- Gather Component Alarm Information on page 87
- Verify the Component Problem on page 89
- Fix the Problem on page 89
- Contact JTAC on page 89
- Return the Failed Component on page 90

## Checklist for Verifying Juniper Networks Routers

**Purpose** Table 21 on page 81 provides links and commands for verifying Juniper Networks routers.

**Table 21: Checklist for Verifying Juniper Networks Routers**

| Tasks                                                                   | Command or Action                              |
|-------------------------------------------------------------------------|------------------------------------------------|
| <b>“Check Router Components” on page 82</b>                             |                                                |
| 1. Check the Router Component Status on page 83                         |                                                |
| a. Check the Router Craft Interface on page 83                          | show chassis craft-interface                   |
| b. Check the Component LEDs on page 84                                  | show chassis craft-interface                   |
| c. Display Detailed Component Environmental Information on page 85      | show chassis environment <i>component-name</i> |
| d. Display Detailed Operational Information About Components on page 86 | show chassis <i>component-name</i>             |
| 2. Gather Component Alarm Information on page 87                        |                                                |
| a. Display the Current Router Alarms on page 87                         | show chassis alarms                            |

**Table 21: Checklist for Verifying Juniper Networks Routers** *(continued)*

| Tasks                                                         | Command or Action                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| b. Display Error Messages in the Messages Log File on page 88 | <code>show log messages</code>                                                                                                                                                                                                                                                                            |
| c. Display Error Messages in the Messages Log File on page 88 | <code>show log chassisd</code>                                                                                                                                                                                                                                                                            |
| 3. Verify the Component Problem on page 89                    | <p>Make sure that the component is well seated in its slot and connected to the router midplane.</p> <p>Perform a swap test on the component with a problem.</p>                                                                                                                                          |
| 4. Fix the Problem on page 89                                 | Take action and correct the problem. For example, replace a dirty air filter, clean a fiber-optic cable, connect the component securely to the midplane, or reset the component. Otherwise, escalate the alarm condition and contact JTAC. Do not straighten bent pins.                                   |
| 5. Contact JTAC on page 89                                    | <code>request support information</code><br><code>request support information   save filename</code>                                                                                                                                                                                                      |
| 6. Return the Failed Component on page 90                     | <code>show chassis hardware</code><br><br><p>Obtain a Return Material Authorization (RMA) number from JTAC. You can send e-mail to <a href="mailto:support@juniper.net">support@juniper.net</a> or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).</p> |

## Check Router Components

**Purpose** When you monitor router components, you are making sure that there are no hardware problems with the router. In the event of a minor problem, you can try to fix it. For more difficult situations, you can call for assistance from the Juniper Networks Technical Assistance Center (JTAC).

**Action** To monitor M-series and T-series router components, follow these steps:

1. Check the Router Component Status on page 83
2. Gather Component Alarm Information on page 87
3. Verify the Component Problem on page 89
4. Fix the Problem on page 89
5. Contact JTAC on page 89
6. Return the Failed Component on page 90



## Check the Router Component Status

**Purpose** When you check the router craft interface, the component LEDs, and the environmental and operational information, you are either physically inspecting the components or obtaining output about their status from commands you issue from the command-line interface (CLI).

To check router component status, follow these steps:

1. Check the Router Craft Interface on page 83
2. Check the Component LEDs on page 84
3. Display Detailed Component Environmental Information on page 85
4. Display Detailed Operational Information About Components on page 86

## Check the Router Craft Interface

**Purpose** To confirm that the craft interface is functioning properly by checking the alarm indicator status or by checking the craft interface physically.

**Action** To check the craft interface information for router status, do one of the following:

- Use the following CLI command:

```
user@host> show chassis craft-interface
```

The command output displays the router alarm indicator status, the LCD display information (router name, router uptime, and status message that rotate at 2-second intervals), and the major component LED status.

- Physically look at the router craft interface. Table 22 on page 83 shows the component characteristics of the craft interface for each M-series router and T-series platform.

**Table 22: Craft Interface Components for the M-series Routers and T-series Platforms**

| Component                          | M5 and M10 | M20 | M40 | M40e | M160 | T320 | T640 |
|------------------------------------|------------|-----|-----|------|------|------|------|
| Alarm LEDs                         | X          | X   | X   | X    | X    | X    | X    |
| Lamp test button                   | X          |     |     |      |      | X    | X    |
| Alarm cutoff button                |            | X   |     | X    | X    | X    |      |
| Alarm relay contacts               |            | X   | X   |      |      |      |      |
| Link and activity status lights    | X          | X   |     |      |      |      |      |
| LCD display and navigation buttons |            |     | X   | X    | X    | X    | X    |
| Routing Engine ports               | X          | X   | X   |      |      |      |      |

**Table 22: Craft Interface Components for the M-series Routers and T-series Platforms** *(continued)*

| Component                                                | M5 and M10 | M20 | M40 | M40e | M160 | T320 | T640 |
|----------------------------------------------------------|------------|-----|-----|------|------|------|------|
| Routing Engine LEDs                                      |            | X   | X   |      |      | X    |      |
| Host module LEDs                                         |            |     |     | X    |      |      |      |
| Host subsystem LEDs                                      |            |     |     |      |      | X    | X    |
| Physical Interface Card (PIC) online and offline buttons | X          |     |     |      |      |      |      |
| Flexible PIC Concentrator (FPC) LEDs                     |            | X   | X   | X    | X    | X    | X    |
| FPC offline buttons                                      |            | X   |     | X    |      | X    | X    |
| FPC online buttons                                       |            |     |     |      |      | X    | X    |
| Switch Interface Board (SIB) LEDs                        |            |     |     |      |      | X    | X    |

### Check the Component LEDs

**Purpose** To confirm that the component LEDs are functioning properly by checking either that the output messages, physically checking the craft interface or examining the LEDs on the component faceplate.

**Action** To check the component LED status, do one of the following:

- Use the following CLI command:

```
user@host> show chassis craft-interface
```

The output shows the messages that are currently displayed on the craft interface (for routers that have a display on the craft interface).

For examples of sample output, see the *JUNOS System Basics and Services Command Reference*.

- Physically look at the craft interface. You see the following component LEDs: Routing Engine, FPCs, PICs, host module (for M40e and M160 routers), and host subsystem and SIB (for T-series platforms).
- Look at the LEDs on the component faceplate. Table 23 on page 84 describes where the LEDs are located on the router or platform.

**Table 23: Component LED Location on the Router or Platform**

| Component | LED Location on the Router           | Router or Platform                |
|-----------|--------------------------------------|-----------------------------------|
| CB        | On the Control Board (CB) faceplate. | T320 router and T640 routing node |

**Table 23: Component LED Location on the Router or Platform** *(continued)*

| Component      | LED Location on the Router                                                                                           | Router or Platform                             |
|----------------|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| FPC            | On the FPC faceplate at the front of the router.                                                                     | M20, M40, M40e, and M160 routers               |
| Host module    | On the craft interface. Remove the component cover.                                                                  | M40e and M160 routers                          |
| MCS            | On the Miscellaneous Control System (MCS) faceplate at the rear of the router. Remove the component cover.           | M40e and M160 routers                          |
| PIC            | On the craft interface.<br>On the PIC faceplate at the front of the router.                                          | M5 and M10 routers<br>All other routers        |
| PCG            | On the PFE clock generator (PCG) faceplate at the rear of the router. Remove the component cover.                    | M40e and M160 routers                          |
| Power supply   | On the power supply faceplate at the bottom rear of the router.                                                      | All routers                                    |
| Routing Engine | On the rear Routing Engine panel.<br>On the craft interface.                                                         | M20 router<br>M20, M40, M40e, and M160 routers |
| SCB            | On the System Control Board (SCB) faceplate at the front of the router, vertical in the middle of the FPC card cage. | M40 router                                     |
| SCG            | On the SONET Clock Generator (SCG) faceplate.                                                                        | T320 router and T640 routing node              |
| SFM            | On the Switching and Forwarding Module (SFM) faceplate at the rear of the router. Remove the component cover.        | M40e and M160 routers                          |
| SIB            | On the SIB faceplate.                                                                                                | T320 router and T640 routing node              |
| SSB            | On the System and Switch Board (SSB) faceplate at the top front of the router.                                       | M20 router                                     |

## Display Detailed Component Environmental Information

**Purpose** To check the component environmental information for the uptime to determine if it is functioning properly.

**Action** To display detailed environmental status information about a component, use the following CLI command:

```
user@host> show chassis environment component-name
```

The command output displays the temperature of the air passing by the component, in degrees Centigrade. It also displays the total percentage of CPU, interrupt, heap space, and buffer space being used by the component processor, including the total DRAM available to the component processor. The command output displays the time when the component started running and how long the component has been running. A short uptime can indicate a problem with the component.

For examples of sample output, see the *JUNOS System Basics and Services Command Reference*.

Table 24 on page 86 lists the operational mode CLI commands that display more detailed information for each router and platform component.

**Table 24: CLI Commands for Detailed Component Environment Status**

| Component                                   | Operational Mode CLI Command            | Router or Platform                            |
|---------------------------------------------|-----------------------------------------|-----------------------------------------------|
| CB                                          | show chassis environment cb             | T320 and T640 platforms                       |
| Forwarding Engine Board (FEB)               | show chassis feb                        | M5 and M10 routers                            |
| FPC                                         | show chassis environment fpc            | M40e and M160 routers, and T-series platforms |
| Front panel module (FPM) or craft interface | show chassis environment fpm            | M40e and M160 routers, and T-series platforms |
| MCS                                         | show chassis environment mcs            | M40e and M160 routers                         |
| PCG                                         | show chassis environment pcg            | M40e and M160 routers                         |
| Power Entry Module (PEM) or power supply    | show chassis environment pem            | M40e and M160 routers, and T-series platforms |
| Routing Engine                              | show chassis environment routing-engine | M40e and M160 routers, and T-series platforms |
| SONET Clock Generator (SCG)                 | show chassis environment scg            | T320 and T640 platforms                       |
| SFM                                         | show chassis environment sfm            | M40e and M160 routers                         |
| SIG                                         | show chassis environment sib            | T320 and T640 platforms                       |

## Display Detailed Operational Information About Components

**Purpose** To check the component environmental information for the uptime to determine if it is functioning properly.

**Action** To display detailed operational information about a component, use the following CLI command:

```
user@host> show chassis component-name
```

The command output displays the temperature of the air passing by the component, in degrees Centigrade and Fahrenheit. It displays the total percentage of CPU, interrupt, heap space, and buffer space being used by the component processor, including the total DRAM available to the component processor. The command output displays the time when the component started running and how long the component has been running. A short uptime can indicate a problem with the component.

For examples of sample output, see the *JUNOS System Basics and Services Command Reference*.

Table 25 on page 87 lists the components for which you can display more detailed operational status information.

**Table 25: CLI Commands for Detailed Operational Status of Components**

| Component                               | Operational Mode CLI Command |                                               |
|-----------------------------------------|------------------------------|-----------------------------------------------|
| FEB                                     | show chassis feb             | M5 and M10 routers                            |
| FPC                                     | show chassis fpc             | M40e and M160 routers, and T-series platforms |
| Routing Engine                          | show chassis routing-engine  | M40e and M160 routers, and T-series platforms |
| SCB                                     | show chassis scb             | M40 routers                                   |
| SFM                                     | show chassis sfm             | M40e and M160 routers                         |
| SSB                                     | show chassis ssb             | M20 routers                                   |
| Switch Processor Mezzanine Board (SPMB) | show chassis spmb            | T320 and T640 platforms                       |

## Gather Component Alarm Information

**Purpose** When you obtain information about component alarms and error messages, you determine when a problem with a component first appeared and the details of the situation.

To gather component alarm information, follow these steps:

1. Display the Current Router Alarms on page 87
2. Display Error Messages in the Messages Log File on page 88
3. Display Error Messages in the Chassis Process Log File on page 88

### Display the Current Router Alarms

**Purpose** To determine the details of the alarms and when they first appeared in the component.

**Action** To display the current router component alarms, use the following CLI command:

```
user@host> show chassis alarms
```

The command output displays the number of alarms currently active, the time when the alarm began, the severity level, and an alarm description. Note the date and time of an alarm so that you can correlate it with error messages in the **messages** system log file.

For examples of sample output, see the *JUNOS System Basics and Services Command Reference*.

## Display Error Messages in the Messages Log File

**Purpose** To determine the details of the error messages in the Messages Log File.

**Action** To display router component error messages in the `messages` system log file, use the following CLI command:

```
user@host> show log messages
```

The `messages` system log file records the time the failure or event occurred, the severity level, a code, and a message description. Error messages in the `messages` system log file are logged at least 5 minutes before and after the alarm event.

To search for specific information in the log file, use the `| match component-name` command; for example, use `show log messages | match fpc`. If there is a space in the component name, enclose the component name in quotation marks; for example, `| match "power supply"`.

To search for multiple items in the log file, use the `| match` command followed by the multiple items, separated by the `|` (pipe), and enclosed in quotation marks; for example, `| match "fpc | sfp | kernel | tnp"`.

To monitor the `messages` file in real time, use the `monitor start messages` CLI command. This command displays the new entries in the file until you stop monitoring by using the `monitor stop messages` CLI command.

For more information about system log messages, see the *JUNOS System Log Messages Reference*.

## Display Error Messages in the Chassis Process Log File

**Purpose** To determine the details of the error messages in the Chassis Process Log File.

**Action** To display router component errors in the chassis process (`chassisd`) system log file, use the following CLI command:

```
user@host> show log chassisd
```

The chassis process (`chassisd`) log file tracks the state of each chassis component. For examples of sample output, see the *JUNOS System Basics and Services Command Reference*.

To search for specific information in the log file, use the `| match component-name` command; for example, `show log messages | match fpc`. If there is a space in the component name, enclose the component name in quotation marks; for example, `| match "power supply"`.

To search for multiple items in the log file, use the `| match` command followed by the multiple items, separated by the `|` (pipe), and enclosed in quotation marks; for example, `| match "fpc | sfp | kernel | tnp"`.

To monitor the `chassisd` file in real time, use the `monitor start chassisd` CLI command. This command displays the new entries in the file until you stop monitoring by using the `monitor stop chassisd` CLI command.

## Verify the Component Problem

**Purpose** Test a component only if it is not associated with a previously reported router component failure case and if testing will not compromise the integrity of the router and other components.

**Action** To verify component failure, follow these steps:

1. Make sure that the component is well seated in its slot and connected to the router midplane.
2. Perform a swap test on the component that has failed or has a problem. Take the component offline if necessary, remove it, and replace it with one that you know works. If the replaced component works, it confirms that there was a problem with the component you removed.



**NOTE:** Before performing a swap test, always check for bent pins in the midplane and check the component for stuck pins in the connector. Pins stuck in the component connector can damage other good slots during a swap test.

## Fix the Problem

**Problem** If the router alarm condition is your responsibility, take action and correct it.

**Solution** For example, replace a dirty air filter, clean a fiber-optic cable, connect the component securely to the midplane, or reset the component. Otherwise, escalate the alarm condition and contact JTAC.



**NOTE:** Do not straighten component pins. If the pins on a component are bent, return the component with a Return Material Authorization (RMA). Straightening the pins may cause intermittent problems in the future.

## Contact JTAC

**Action** If you cannot determine the cause of a problem or need additional assistance, contact JTAC at [support@juniper](mailto:support@juniper) ., or at 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).

To provide JTAC with information about the system, use the following CLI command:

```
user@host> request support information
```

Include the command output in your support request.

Because the output of this command is generally quite long, you can redirect the output to a file by using the following CLI command:

```
user@host> request support information | save filename
```

The **request support information** command is a combination of the following CLI operational mode commands:

- **show version**—Displays version information for the JUNOS software packages and the software for each software process.
- **show chassis firmware**—Displays the version levels of the firmware running on the SCB, SFM, SSB, FEB, and FPCs.
- **show chassis hardware**—Displays a list of all components installed in the router chassis. The output includes the component name, version, part number, serial number, and a brief description.
- **show chassis environment**—Displays environmental information about the router chassis, including the temperature and information about the fans, power supplies, and Routing Engine.
- **show interfaces extensive**—Displays static status information about router interfaces.
- **show configuration** (excluding any **SECRET-DATA**)—Displays the configuration that currently is running on the router, which is the last committed configuration. If you have modified the configuration since you last committed it, the configuration information displayed by the **show configuration** command will be different from that displayed with the **show** command from the **[edit]** hierarchy level in JUNOS software CLI configuration mode.
- **show system virtual-memory**—Displays the usage of JUNOS kernel memory, listed first by size of allocation and then by type of usage.

## Return the Failed Component

**Action** To return a failed component, follow these steps:

1. Determine the part number and serial number of the component. To list the numbers for all components installed in the chassis, use the following CLI command:

```
user@host> show chassis hardware
```

If the component does not appear in the hardware inventory listing, check the failed component for the attached serial number ID label.



**NOTE:** The cooling system components (fans and impellers) do not have serial numbers. Therefore, you will not see a serial number listed in the hardware inventory or a serial number ID label on the component.



2. Obtain a Return Material Authorization (RMA) number from JTAC. You can send e-mail to [support@juniper.net](mailto:support@juniper.net), or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).

Provide the following information in your e-mail message or during the telephone call:

- Part number, description, and serial number of the component
- Your name, organization name, telephone number, fax number, and e-mail address
- Shipping address for the replacement component, including a contact name, phone number, and e-mail address
- Description of the failure, including log messages

The support representative will validate your request and issue an RMA number for the return of the component

3. Pack the router or component for shipment, as described in the appropriate router hardware guide. Label the package with the corresponding RMA number.



Chapter 10

Verify Physical Interfaces on the Router

This chapter describes how to check the physical interfaces on a Juniper Networks router.

- Checklist for Verifying Physical Interfaces on a Router on page 93
- Check Physical Interfaces on a Router on page 93
- Display Real-Time Statistics about a Physical Interface on page 98
- Check System Logging on page 100

Checklist for Verifying Physical Interfaces on a Router

**Purpose** Table 26 on page 93 provides links and commands for verifying physical interfaces on a router.

Table 26: Checklist for Verifying Physical Interfaces on a Router

| Tasks                                                                       | Command or Action                                                        |
|-----------------------------------------------------------------------------|--------------------------------------------------------------------------|
| <b>“Check Physical Interfaces on a Router” on page 93</b>                   |                                                                          |
| 1. Display Summary Interface Information on page 94                         | show interfaces terse<br><br>show interfaces terse <i>interface-name</i> |
| 2. Display Detailed Interface Information on page 95                        | show interfaces <i>interface-name</i> extensive                          |
| <b>“Display Real-Time Statistics about a Physical Interface” on page 98</b> | monitor interface <i>interface-name</i>                                  |
| <b>“Check System Logging” on page 100</b>                                   | show log messages   match <i>interface-name</i>                          |

Check Physical Interfaces on a Router

**Purpose** When you check the physical interfaces on a router, you gather information to quickly diagnose problems.

To check the physical interfaces on a router, follow these steps:

1. Display Summary Interface Information on page 94
2. Display Detailed Interface Information on page 95

## Display Summary Interface Information

**Purpose** By displaying a summary of the interfaces on a router, you begin the process of isolating problems when they occur.

**Action** To display a summary of all interfaces on a router or a specific group of interfaces, use one of the following JUNOS command-line interface (CLI) operational mode commands:

```
user@host> show interfaces terse
user@host> show interfaces terse interface-name
```

**Sample Output** The following sample output shows all interfaces on a router:

```
user@host> show interfaces terse
Interface           Admin Link Proto Local Remote
so-5/0/0            up   down
t3-6/0/0            up   down
t3-6/0/1            up   down
t3-6/0/2            up   down
t3-6/0/3            up   down
at-6/1/0            up   down
fe-7/0/0            up   up
fe-7/0/0.0          up   up   vpls
fe-7/0/1            up   up
fe-7/0/2            up   up
fe-7/0/3            up   up
t3-7/1/0            up   down
t3-7/1/1            up   down
t3-7/1/2            up   down
t3-7/1/3            up   down
dsc                 up   up
fxp0                up   up
fxp0.0              up   up   inet  10.168.4.32/24
fxp1                up   up
fxp1.0              up   up   tnp   4
gre                 up   up
ipip                up   up
lo0                 up   up
lo0.0               up   up   inet  127.0.0.1      --> 0/0
lsi                 up   up
mtun                up   up
pimd                up   up
ptime               up   up
tap                 up   up
```

The following sample output is for a specific group of SONET interfaces on a router:

```
Sample Output user@host> show interfaces terse so*
so-0/0/0            up   up
so-0/0/0.1          up   down inet  10.1.13.2/30
                    iso
so-0/0/0.2          up   down inet  10.1.23.2/30
                    iso
so-0/0/0.4          up   down inet  10.1.34.1/30
                    iso
so-0/0/0.5          up   up   inet  10.1.35.1/30
                    iso
so-0/0/1            up   up
```

```

so-0/0/2      up    up
so-0/0/3      up    up
               iso
               iso
               iso
               iso
               iso
               iso
47.0005.80ff.f800.0000.0108.0001.0102.5524.5219.00

```

**Meaning** The sample output shows summary information about the interfaces on the router listed in order of type of interface. The information includes the name of the interface, whether it is turned on (up) or off (down), whether the state of the link is up or down, the protocol configured on the interface, the local address of the interface, and the address of the remote side of the connection if the interface is a point-to-point interface.

## Display Detailed Interface Information

**Purpose** Detailed interface information is useful when you need to further investigate the status of an interface after you have determined that there might be a problem.

**Action** To display detailed information about the status of an interface, use the following JUNOS CLI operational mode command:

```
user@host> show interfaces interface-name extensive
```

The sample output is for an ATM interface. The fields vary depending on the type of interface.

**Sample Output**

```

user@host> show interfaces at-7/0/0 extensive
Physical interface: at-7/0/0, Enabled, Physical link is Up
  Interface index: 101, SNMP ifIndex: 106, Generation: 100
  Description: bangkok51 at-1/1/0
  Link-level type: ATM-PVC, MTU: 4482, Clocking: Internal, SONET mode,
Speed: OC12, Loopback: None,
  Payload scrambler: Enabled
  Device flags   : Present Running
  Link flags     : None
  Hold-times    : Up 0 ms, Down 0 ms
  Current address: 00:90:69:10:c7:72
  Last flapped  : 2002-05-23 12:12:18 PDT (1d 03:20 ago)
  Statistics last cleared: Never
  Traffic statistics:
    Input bytes   :          9526697          744 bps
    Output bytes  :         10458384          496 bps
    Input packets :          129969           0 pps
    Output packets:          126940           0 pps
  Input errors:
    Errors: 0, Drops: 0, Invalid VCs: 0, Framing errors: 0, Policed
discards: 0, L3 incompletes: 0,
    L2 channel errors: 0, L2 mismatch timeouts: 0
  Output errors:
    Carrier transitions: 0, Errors: 0, Drops: 0, Aged packets: 0
  SONET alarms   : None
  SONET defects  : None
  SONET PHY:
    Seconds      Count  State
    PLL Lock      0       0 OK

```

```

PHY Light                0          0 OK
SONET section:
  BIP-B1                  1          9
  SEF                     0          0 OK
  LOS                     0          0 OK
  LOF                     0          0 OK
  ES-S                    1
  SES-S                   0
  SEFS-S                  0
SONET line:
  BIP-B2                  1          183
  REI-L                   1          323
  RDI-L                   0          0 OK
  AIS-L                   0          0 OK
  BERR-SF                 0          0 OK
  BERR-SD                 0          0 OK
  ES-L                    1
  SES-L                   0
  UAS-L                   0
  ES-LFE                  1
  SES-LFE                 0
  UAS-LFE                 0
SONET path:
  BIP-B3                  1          31
  REI-P                   1          216
  LOP-P                   0          0 OK
  AIS-P                   0          0 OK
  RDI-P                   0          0 OK
  UNEQ-P                  0          0 OK
  PLM-P                   0          0 OK
  ES-P                    1
  SES-P                   0
  UAS-P                   0
  ES-PFE                  1
  SES-PFE                 0
  UAS-PFE                 0
Received SONET overhead:
  F1      : 0x00, J0      : 0x00, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0x13, C2(cmp) : 0x13, F2      : 0x00
  Z3      : 0x00, Z4      : 0x00, S1(cmp) : 0x00, V5      : 0x00
  V5(cmp) : 0x00
Transmitted SONET overhead:
  F1      : 0x00, J0      : 0x01, K1      : 0x00, K2      : 0x00
  S1      : 0x00, C2      : 0x13, F2      : 0x00, Z3      : 0x00
  Z4      : 0x00, V5      : 0x00
ATM status:
  HCS state: Sync
  LOC      : OK
ATM Statistics:
  Uncorrectable HCS errors: 77, Correctable HCS errors: 5, Tx cell
FIFO overruns: 0,
  Rx cell FIFO overruns: 1, Rx cell FIFO underruns: 0, Input cell
count: 421980,
  Output cell count: 139110927341, Output idle cell count: 1671702365,
Output VC queue drops: 0,
  Input no buffers: 0, Input length errors: 0, Input timeouts: 0,
Input invalid VCs: 143301,
  Input bad CRCs: 0, Input OAM cell no buffers: 0
Packet Forwarding Engine configuration:
  Destination slot: 7
  CoS transmit queue      Bandwidth      Buffer      Priority

```

```

Limit
          %      bps  %      bytes
0 best-effort      0      0  0      0
low  none
1 expedited-forwarding  0      0  0      0
low  none
2 assured-forwarding   0      0  0      0
low  none
3 network-control      0      0  0      0
low  none
Logical interface at-7/0/0.100 (Index 49) (SNMP ifIndex 143) (Generation 76)
Flags: Point-To-Point Inverse-ARP SNMP-Traps Encapsulation: ATM-SNAP
Traffic statistics:
  Input bytes :          9993
  Output bytes :         16246
  Input packets:          151
  Output packets:         136
Local statistics:
  Input bytes :          9993
  Output bytes :         16246
  Input packets:          151
  Output packets:         136
Transit statistics:
  Input bytes :          0      0 bps
  Output bytes :          0      0 bps
  Input packets:          0      0 pps
  Output packets:         0      0 pps
Protocol inet, MTU: 4470, Flags: None, Generation: 200 Route table: 0
  Addresses, Flags: Is-Preferred Is-Primary
    Destination: 10.9.140.1, Local: 10.9.140.2, Broadcast:
Unspecified, Generation: 106
Protocol iso, MTU: 4470, Flags: None, Generation: 201 Route table: 0
Protocol mpls, MTU: 4458, Flags: None, Generation: 202 Route table: 0
VCI 0.200
  Flags: Active, Inverse-ARP, OAM, Shaping
  VBR, Peak: 12mbps, Sustained: 10mbps, Burst size: 24, Queue length: 0
  OAM, Period 10 sec, Up count: 5, Down count: 4
  Total down time: 0 sec, Last down: Never
  ATM per-VC transmit statistics:
    Tail queue packet drops: 0
  OAM F5 cell statistics:
    Total received: 49, Total sent: 49
    Loopback received: 49, Loopback sent: 49
    Last received: 00:00:08, Last sent: 00:00:08
    RDI received: 0, RDI sent: 0
    AIS received: 0
  Traffic statistics:
    Input bytes :          9993
    Output bytes :         16246
    Input packets:          151
    Output packets:         136

```

**Meaning** The sample output shows static status information about this particular ATM interface. For examples of sample output for supported interfaces, see the *JUNOS Network Interfaces Configuration Guide*.

Table 27 on page 98 lists the interface types supported by the JUNOS software and shows the interface name as it appears in the output.

**Table 27: Interface Types Supported by the JUNOS Software**

| Interface Group | Interface Type                                                                                                                                   | Format of <i>interface-name</i>                                                                                                                                                                      |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ATM             | ATM                                                                                                                                              | <i>at-fpc/pic/port</i>                                                                                                                                                                               |
| Channelized     | Channelized DS3 to DS0<br>Channelized DS3 to DS1<br>Channelized E1<br>Channelized OC3 to T1<br>Channelized OC12 to DS3<br>Channelized STM1 to E1 | <i>ds-fpc/pic/port :T1channel:DS-0 channel t1</i><br><i>t1-fpc/pic/port:channel t1</i><br><i>ds-fpc/pic/port:ds-0 channel e1</i><br><i>t3-fpc/pic/port:channel</i><br><i>e1-fpc/pic/port:channel</i> |
| T1, T3, E1, E3  | E1<br>E3<br>T1<br>T3                                                                                                                             | <i>e1-fpc/pic/port</i><br><i>e3-fpc/pic/port</i><br><i>t1-fpc/pic/port</i><br><i>t3-fpc/pic/port</i>                                                                                                 |
| Ethernet        | Aggregated Ethernet<br>Fast Ethernet<br>Gigabit Ethernet<br>10-Gigabit Ethernet<br>Internal Ethernet<br>Management Ethernet                      | <i>ae-fpc/pic/port</i><br><i>fe-fpc/pic/port</i><br><i>ge-fpc/pic/port</i><br><i>ge-fpc/pic/port</i><br><i>fxp</i><br><i>fxp</i>                                                                     |
| Multilink       | Frame Relay<br>PPP                                                                                                                               | <i>ml-fpc/pic/port</i><br><i>ml-fpc/pic/port</i>                                                                                                                                                     |
| SONET/SDH       | Aggregated SONET/SDH<br>SONET/SDH                                                                                                                | <i>as-fpc/pic/port</i><br><i>so-fpc/pic/port</i>                                                                                                                                                     |
| Other           | Encryption<br>GRE tunnel<br>IP-IP tunnel<br>Loopback                                                                                             | <i>es-fpc/pic/port:es</i> <i>gr-fpc/pic/port</i><br><i>ip-fpc/pic/port</i><br><i>lo</i>                                                                                                              |

## Display Real-Time Statistics about a Physical Interface

**Purpose** Displaying real-time statistics about a physical interface is useful when you need to narrow down possible causes of an interface problem. The **monitor** command checks for and displays common interface failures, indicates whether loopback is detected, and shows any increases in framing errors.



**NOTE:** If you are accessing the router from the console connection, make sure you set the CLI terminal type using the **set cli terminal** command.

**Action** To display real-time statistics about a physical interface, use the following JUNOS CLI operational mode command:

```
user@host> monitor interface interface-name
```

**Sample Output** 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]
  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'

```

**Meaning** The sample output displays real-time statistics about the physical interface (updating them every second), the amount that each field has changed since you started the command or since you cleared the counters by using the **C** key. It also checks for and displays common interface failures, such as SONET/SDH and T3 alarms, detected loopbacks, and increases in framing errors.

To control the output of the command while it is running, use the keys shown in Table 28 on page 100.

**Table 28: Monitor Interface Output Control Keys**

| Key | Action                                                                                                                                                                                                                       |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| N   | Display information about the next interface. The <b>monitor interface</b> command scrolls through the physical or logical interfaces in the same order that they are displayed by the <b>show interfaces terse</b> command. |
| I   | Display information about a different interface. The command prompts you for the name of a specific interface.                                                                                                               |
| F   | Freeze the display, halting the display of updated statistics.                                                                                                                                                               |
| T   | Thaw the display, resuming the display of updated statistics.                                                                                                                                                                |
| C   | Clear (zero) the current delta counters since <b>monitor interface</b> was started. It does not clear the cumulative counter.                                                                                                |
| Q   | Stop the <b>monitor interface</b> command.                                                                                                                                                                                   |

## Check System Logging

**Purpose** By looking through the messages file for any entries pertaining to the interface that you are interested in, you can further investigate a problem with an interface.

**Action** To check system logging, use the following JUNOS CLI operational mode command:

```
user@host> show log messages | match interface-name
```

**Sample Output**

```
user@host> show log messages | match so-0/3/1
May 2 12:10:58 router rpd[729]: RPD_ISIS_ADJDOWN: IS-IS lost L2 adjacency to
ABC-CORE-RTR1 on so-0/3/1.0, reason: Interface Down
May 2 12:11:27 router mib2d[575]: SNMP_TRAP_LINK_DOWN: ifIndex 25, ifAdminStatus
up(1), ifOperStatus down(2), ifName so-0/3/1
May 2 12:11:27 router rpd[729]: RPD_ISIS_ADJDOWN: IS-IS lost L2 adjacency to
ABC-CORE-RTR1 on so-0/3/1.0, reason: Interface Down
May 2 12:11:31 router rpd[729]: RPD_LDP_NBRDOWN: LDP neighbor 130.81.4.109
(so-0/3/1.0) is down
```

**Meaning** The sample output shows entries in the messages file pertaining to the SONET interface, **so-0/3/1**, and its Intermediate System-to-Intermediate System (IS-IS) adjacencies and Label Distribution Protocol (LDP) neighbors. The entries indicate that the interface went down on May 2 at 12:11:27, and that both the IS-IS adjacency and the LDP neighbor are down.

## Chapter 11

# Verify the IS-IS Protocol and Adjacencies

This chapter describes how to check whether the Intermediate System-to-Intermediate System (IS-IS) protocol is configured correctly on a Juniper Networks router and that the proper adjacencies are formed in a network.

- Checklist for Verifying the IS-IS Protocol and Adjacencies on page 101
- Verify the IS-IS Configuration on a Router in a Network on page 102
- Display the Status of IS-IS Adjacencies on page 108

## Checklist for Verifying the IS-IS Protocol and Adjacencies

**Purpose** Table 29 on page 101 provides links and commands for verifying the IS-IS protocol and adjacencies.

**Table 29: Checklist for Verifying the IS-IS Protocol and Adjacencies**

| Tasks                                                                        | Command or Action                                                                                                                |
|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>“Verify the IS-IS Configuration on a Router in a Network” on page 102</b> |                                                                                                                                  |
| 1. Check the Configuration of a Level 1/Level 2 Router on page 103           | [edit protocols isis] show<br>[edit protocols isis] run show isis interface<br>[edit] edit interfaces<br>[edit interfaces] show  |
| 2. Check the Configuration of a Level 1 Router on page 105                   | [edit protocols isis] show<br>[edit protocols isis] run show isis interface<br>[edit] edit interfaces<br>[edit interfaces] show  |
| 3. Check the Configuration of a Level 2 Router on page 106                   | [edit protocols isis] show<br>[edit protocols isis] run show isis interface<br>[edit] edit interfaces<br>[edit interfaces] show  |
| <b>“Display the Status of IS-IS Adjacencies” on page 108</b>                 |                                                                                                                                  |
| 1. Verify Adjacent Routers on page 109                                       | show isis adjacency                                                                                                              |
| 2. Examine a Route on page 110                                               | show route <i>destination-prefix</i><br>show route detail <i>destination-prefix</i><br>show isis route <i>destination-prefix</i> |
| 3. Examine the Forwarding Table on page 112                                  | show route forwarding-table destination <i>destination-prefix</i>                                                                |

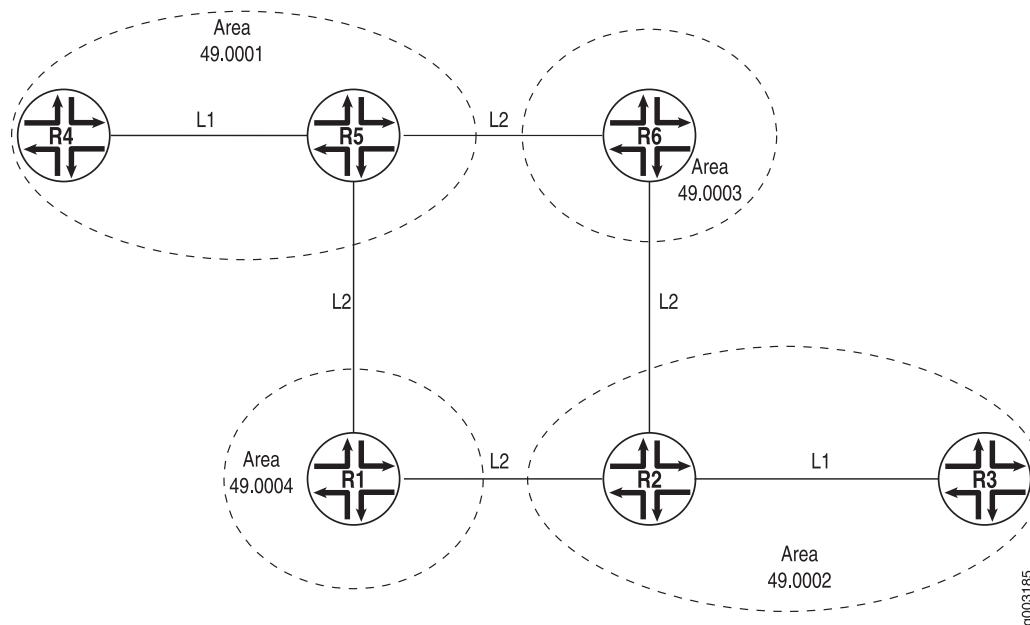
**Table 29: Checklist for Verifying the IS-IS Protocol and Adjacencies** *(continued)*

| Tasks                                                         | Command or Action            |
|---------------------------------------------------------------|------------------------------|
| 4. Examine the Link-State Database on page 113                | show isis database           |
| 5. Examine a Link-State Protocol Data Unit Header on page 114 | show isis database extensive |

## Verify the IS-IS Configuration on a Router in a Network

**Purpose** For IS-IS to run on a router (intermediate system) in your network, you must enable IS-IS on the router, configure a network entity title (NET) on the loopback interface (lo0), and configure **family iso** on all interfaces on which you want to run IS-IS. When you enable IS-IS on a router, Level 1 and Level 2 are enabled by default.

Figure 7 on page 102 illustrates an example of routers at different levels in an IS-IS topology.

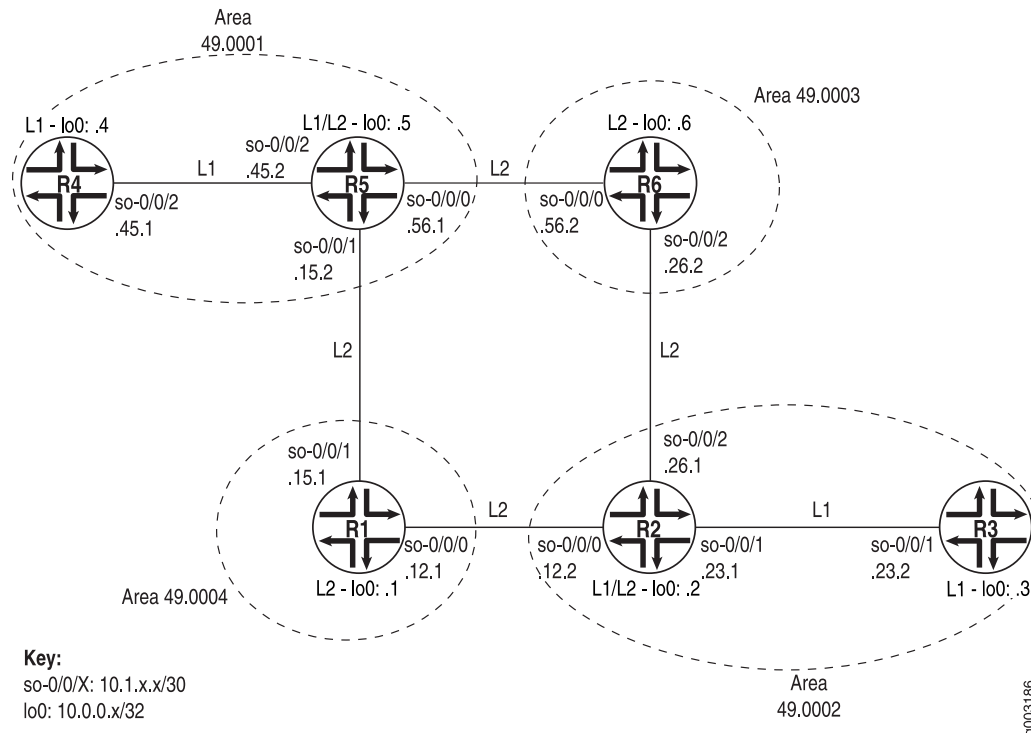
**Figure 7: Levels in an IS-IS Network Topology**

The network in Figure 7 on page 102 is organized hierarchically and consists of Level 2, Level 1/Level 2, and Level 1 routers in one autonomous system (AS) divided into four areas: 49.0001, 49.0002, 49.0003, and 49.0004. The Level 2 routers route toward other autonomous systems. The Level 1/Level 2 routers route between areas and to other autonomous systems. The Level 1 routers route within an area, and when the destination is outside the local area, they route toward a Level1/Level2 system.

In the following steps, the configuration of the various types of routers is examined.

Figure 8 on page 103 provides more details about the IS-IS network topology on Figure 7 on page 102 so that you can verify the configuration output of the various routers.

**Figure 8: IS-IS Network Topology with Details**



To verify that IS-IS is configured correctly on routers at different levels, follow these steps:

1. Check the Configuration of a Level 1/Level 2 Router on page 103
2. Check the Configuration of a Level 1 Router on page 105
3. Check the Configuration of a Level 2 Router on page 106

### Check the Configuration of a Level 1/Level 2 Router

**Purpose** To check the configuration of a Level 1/Level 2 router.

**Action** To verify the IS-IS configuration of a Level 1/Level 2 router in your network, enter the following JUNOS command-line interface (CLI) commands:

```
user@host# [edit protocols isis] show
user@host# [edit protocols isis]run show isis interface
user@host# [edit] edit interfaces
user@host# [edit interfaces] show
```

The following output is for an IS-IS configuration on R2, a Level 1/Level 2 router in the network shown in Figure 7 on page 102:

```

Sample Output [edit protocols isis]
user@R2# show
interface so-0/0/0.0 {
    level 2 metric 10;
    level 1 disable;
}
interface so-0/0/1.0 {
    level 2 disable;
    level 1 metric 10;
}
interface so-0/0/2.0 {
    level 2 metric 10;
    level 1 disable;
}
interface fxp0.0 {
    disable;
}
interface lo0.0;

[edit protocols isis]
user@R2# run show isis interface
IS-IS interface database:
Interface          L CirID Level 1 DR      Level 2 DR      L1/L2 Metric
lo0.0              0   0x1 Passive           Passive         0/0
so-0/0/0.0         2   0x1 Disabled          Point to Point  10/10
so-0/0/1.0         3   0x1 Point to Point    Point to Point  10/10
so-0/0/2.0         2   0x1 Disabled          Point to Point  10/10
[edit interfaces]

user@R2# show
so-0/0/0 {
    unit 0 {
        family inet {
            address 10.1.12.2/30;
        }
        family iso;
    }
}
so-0/0/1 {
    unit 0 {
        family inet {
            address 10.1.23.1/30;
        }
        family iso;
    }
}
so-0/0/2 {
    unit 0 {
        family inet {
            address 10.1.26.1/30;
        }
        family iso;
    }
}
lo0 {
    unit 0 {
        family inet {
            address 10.0.0.2/32;
        }
        family iso {
            address 49.0002.1000.0000.0002.00;
        }
    }
}

```

```

    }
  }
}

```

**Meaning** The sample output shows a basic configuration of IS-IS on R2, a Level 1/Level 2 router. The basic configuration is at the [edit protocols isis] and [edit interfaces] hierarchy levels.

At the [edit protocols isis] level, five interfaces are included: so-0/0/0, so-0/0/1, so-0/0/2, fxp0, and the loopback (lo0) interface. Two interfaces, so-0/0/0.0 and so-0/0/2.0, have Level 1 disabled, making them Level 2 interfaces. One interface, so-0/0/1.0, has Level 2 disabled, making it a Level 1 interface. The management interface (fxp0) is disabled so that IS-IS packets are not sent over it, and the loopback interface (lo0) is included because it becomes a point of connection from the router to the IS-IS network.

At the [edit interfaces] hierarchy level, all of the interfaces included in the [edit protocols isis] hierarchy level are configured with family iso, and the loopback (lo0) interface is configured with the NET address 49.0002.1000.0000.0002.00. Every router in an IS-IS network must have at least one NET address that identifies a point of connection to the IS-IS network. The NET address is generally configured on the loopback (lo0) interface. Routers that participate in multiple areas can have multiple NET addresses.

See the *JUNOS Routing Protocols Configuration Guide* for more information on configuring IS-IS on a router.

## Check the Configuration of a Level 1 Router

**Purpose** To check the configuration of a Level 1 router.

**Action** To check the configuration of a Level 1 router, enter the following CLI commands:

```

user@host# [edit protocols isis] show
user@host# [edit protocols isis] run show isis interface
user@host# [edit] edit interfaces
user@host# [edit interfaces] show

```

The following sample output is for R4, a Level 1 router in the network shown in Figure 7 on page 102:

**Sample Output** [edit protocols isis]

```

user@R4# show
level 2 disable;
interface so-0/0/2.0 {
    level 1 metric 10;
}
interface fxp0.0 {
    disable;
}
interface lo0.0;
[edit protocols isis]

user@R4# run show isis interface
IS-IS interface database:

```

| Interface  | L | CirID | Level 1 DR     | Level 2 DR      | L1/L2 Metric |
|------------|---|-------|----------------|-----------------|--------------|
| lo0.0      | 0 | 0x1   | Passive        | Passive         | 0/0          |
| so-0/0/2.0 | 1 | 0x1   | Point to Point | <b>Disabled</b> | 10/10        |

[edit interfaces]

```

user@R4# show
so-0/0/2 {
    unit 0 {
        family inet {
            address 10.1.45.1/30;
        }
        family iso;
    }
}
lo0 {
    unit 0 {
        family inet {
            address 10.0.0.4/32;
        }
        family iso {
            address 49.0001.1000.0000.0004.00;
        }
    }
}

```

**Meaning** The sample output shows a basic configuration of IS-IS on R4, a Level 1 router. The basic configuration is at the [edit protocols isis] and [edit interfaces] hierarchy levels.

At the [edit protocols isis] hierarchy level, three interfaces are included: so-0/0/2.0, fxp0, and the loopback (lo0) interface. Level 2 is disabled on the router, making it a Level 1 router that sends packets within its local area, 49.0001. When a packet destination is outside the local area, R4 establishes an adjacency with the nearest Level 1/Level 2 router (R5) that forwards the packets. For more information on adjacencies, see “Display the Status of IS-IS Adjacencies” on page 108.

One interface, so-0/0/2.0, is configured for IS-IS. The management interface (fxp0) is disabled so that IS-IS packets are not sent over it, and the loopback interface (lo0) is included because it becomes a point of connection from the router to the IS-IS network.

At the [edit interfaces] hierarchy level, the interface included in the [edit protocols isis] hierarchy level is also configured with family iso, and the loopback (lo0) interface is configured with the NET address of 49.0001.1000.0000.0004.00. Every router in an IS-IS network must have at least one NET address that identifies a point of connection to the IS-IS network. The NET address is generally configured on the loopback (lo0) interface. Routers that participate in multiple areas can have multiple NET addresses.

See the *JUNOS Routing Protocols Configuration Guide* for more information on configuring IS-IS on a router.

## Check the Configuration of a Level 2 Router

**Purpose** To check the configuration of a Level 2 router.



**Action** To check the configuration of a Level 2 router, enter the following CLI commands:

```
user@host# [edit protocols isis] show
user@host# [edit protocols isis] run show isis interface
user@host# [edit] edit interfaces
user@host# [edit interfaces] show
```

The following sample output is for R6, a Level 2 router in the network shown in Figure 7 on page 102:

**Sample Output**

```
[edit protocols isis]
user@R6# show
level 1 disable;
interface so-0/0/0.0 {
    level 2 metric 10;
}
interface so-0/0/2.0 {
    level 2 metric 10;
}
interface fxp0.0 {
    disable;
}
interface lo0.0;
```

```
[edit protocols isis]
user@R6# run show isis interface
IS-IS interface database:
```

| Interface  | L | CirID | Level 1         | DR | Level 2        | DR | L1/L2 | Metric |
|------------|---|-------|-----------------|----|----------------|----|-------|--------|
| lo0.0      | 0 | 0x1   | Passive         |    | Passive        |    | 0/0   |        |
| so-0/0/0.0 | 2 | 0x1   | <b>Disabled</b> |    | Point to Point |    | 10/10 |        |
| so-0/0/2.0 | 2 | 0x1   | <b>Disabled</b> |    | Point to Point |    | 10/10 |        |

```
[edit interfaces]
user@R6# show
so-0/0/0 {
    unit 0 {
        family inet {
            address 10.1.56.2/30;
        }
        family iso;
    }
}
so-0/0/2 {
    unit 0 {
        family inet {
            address 10.1.26.2/30;
        }
        family iso;
    }
}
lo0 {
    unit 0 {
        family inet {
            address 10.0.0.6/32;
        }
        family iso {
            address 49.0003.1000.0000.0006.00;
        }
    }
}
```

**Meaning** The sample output shows a basic configuration of IS-IS on R6, a Level 2 router. The basic configuration is at the [edit protocols isis] and [edit interfaces] hierarchy levels.

At the [edit protocols isis] level, four interfaces are included: so-0/0/0.0, so-0/0/2.0, fxp0, and the loopback (lo0) interface. Level 1 is disabled on the two SONET interfaces, making this a Level 2 router that routes between areas and towards other ASs. The management interface (fxp0) is disabled so that IS-IS packets are not sent over it, and the loopback interface (lo0) is included because it becomes a point of connection from the router to the IS-IS network.

At the [edit interfaces] hierarchy level, the interfaces included in the [edit protocols isis] hierarchy level are also configured with family iso, and the loopback (lo0) interface is configured with the NET address of 49.0003.1000.0000.0006.00. Every router in an IS-IS network must have at least one NET address that identifies a point of connection to the IS-IS network. The NET address is generally configured on the loopback (lo0) interface. Routers that participate in multiple areas can have multiple NET addresses.

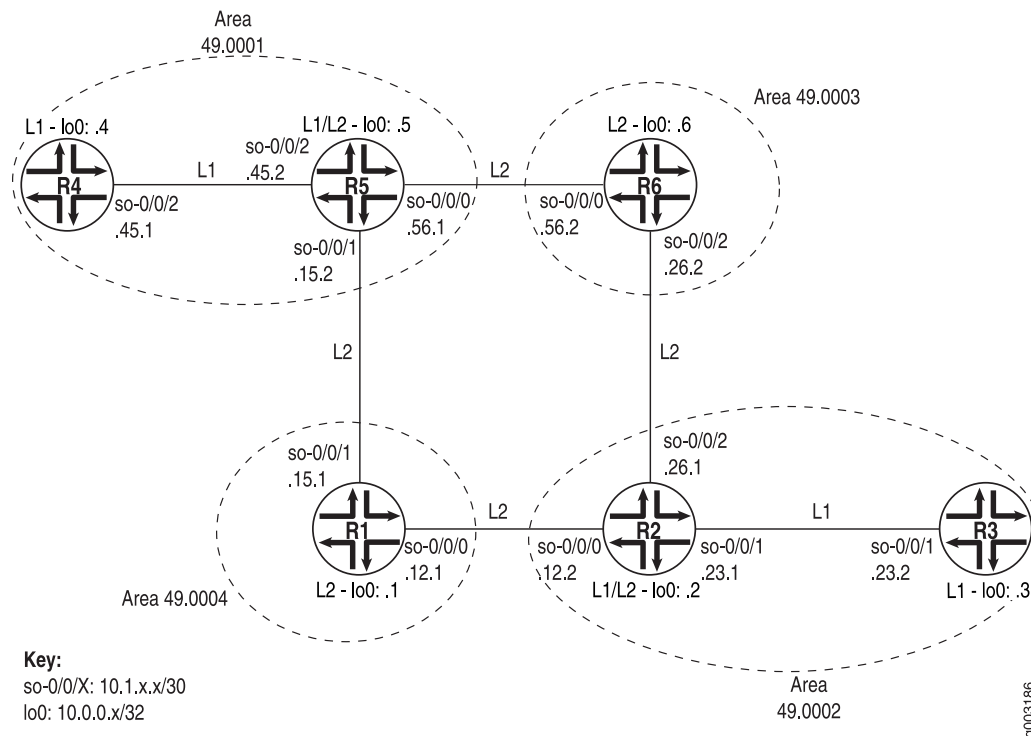
See the *JUNOS Routing Protocols Configuration Guide* for more information on configuring IS-IS on a router.

## Display the Status of IS-IS Adjacencies

---

**Purpose** Assuming that all the routers are correctly configured for IS-IS, you can verify which neighbors are adjacent and able to exchange IS-IS data. In addition, you can examine the set of routes installed in the forwarding table to verify that the routing protocol process (rpd) has relayed the correct information into the forwarding table.

Figure 9 on page 109 illustrates the example IS-IS topology used for the procedures in this topic.

**Figure 9: IS-IS Network Topology**

The network consists of Level 1 and Level 2 adjacencies. Level 1 adjacencies are within areas 49.0001 and 49.0002. Level 2 adjacencies occur between all directly connected Level 2 routers regardless of which area they are in. For example, R5 is in area 49.0001, R6 is in area 49.0003, R1 is in area 49.0004, and R2 is in area 49.0002. The network in Figure 9 on page 109 should have the following adjacencies:

- Level 2 adjacencies between all directly connected Level 2 routers (R1, R2, R5, and R6).
- Level 1 adjacencies between routers in area 49.0001 (R4 and R5) and between routers in area 49.0002 (R2 and R3).

To verify that routers are adjacent and able to exchange IS-IS data, follow these steps:

1. Verify Adjacent Routers on page 109
2. Examine a Route on page 110
3. Examine the Forwarding Table on page 112
4. Examine the Link-State Database on page 113
5. Examine a Link-State Protocol Data Unit Header on page 114

## Verify Adjacent Routers

**Purpose** To verify that routers are adjacent and able to exchange IS-IS data.

**Action** To verify that routers are adjacent and able to exchange IS-IS data, enter the following CLI operational mode command:

```
user@host> show isis adjacency
```

The following sample output shows the adjacencies that formed for all routers shown in Figure 9 on page 109:

**Sample Output**

```
user@R1> show isis adjacency
Interface          System      L State      Hold (secs) SNPA
so-0/0/0.0         R2          2 Up         19
so-0/0/1.0         R5          2 Up         18

user@R2> show isis adjacency
Interface          System      L State      Hold (secs) SNPA
so-0/0/0.0         R1          2 Up         19
so-0/0/1.0         R3          1 Up         26
so-0/0/2.0         R6          2 Up         21

user@R3> show isis adjacency
Interface          System      L State      Hold (secs) SNPA
so-0/0/1.0         R2          1 Up         24

user@R4> show isis adjacency
Interface          System      L State      Hold (secs) SNPA
so-0/0/2.0         R5          1 Up         23

user@R5> show isis adjacency
Interface          System      L State      Hold (secs) SNPA
so-0/0/0.0         R6          2 Up         22
so-0/0/1.0         R1          2 Up         20
so-0/0/2.0         R4          1 Up         20

user@R6> show isis adjacency
Interface          System      L State      Hold (secs) SNPA
so-0/0/0.0         R5          2 Up         21
so-0/0/2.0         R2          2 Up         20
```

**Meaning** The sample output shows the adjacencies that formed in the network illustrated in Figure 9 on page 109. The Level 1/Level 2 routers (R2 and R5) formed Level 1 adjacencies with Level 1 routers (R3 and R4), and Level 2 adjacencies with the Level 2 routers (R1 and R6). To view the status of the adjacency, examine the **State** column. In this example, all adjacencies in the network are up.

If the state is not **Up** for a particular neighbor, you must first examine the IS-IS configuration for the particular interface. Make sure that the NET address is correct and that the loopback (lo0) interface is configured. Use the **show isis interface** or **show isis interface detail** command to display the IS-IS parameters for all interfaces configured with IS-IS. With these two commands, you can see which interfaces are configured for IS-IS, whether they are configured for Level 1 or Level 2, the IS-IS metric, and other IS-IS information.

## Examine a Route

**Purpose** You can determine the cost associated with a route and the selection of a route. In this step, the path from router R5 to R3 is examined in two situations. In the first

example, all metrics in the network are set to the default of 10; in the second example, all metrics on a transit router (R6) are set to 5.

**Action** To examine a route in an IS-IS network, enter one or all of the following CLI commands:

```
user@host> show route destination-prefix
user@host> show route detail destination-prefix
user@host> show isis route destination-prefix
```

**Sample Output 1** The following sample output shows the route from R5 to R3 when all metrics across interfaces are set to the default of 10:

**Sample Output**

```
[edit protocols isis]
user@R6# show
level 1 disable;
interface so-0/0/0.0 {
  level 2 metric 10;
}
interface so-0/0/2.0 {
  level 2 metric 5;
}
interface fxp0.0 {
  disable;
}
interface lo0.0;
```

**Sample Output 2** The following sample output shows the route from R5 to R3 after the metric on R6 is changed from the default of 10 to 5:

**Sample Output**

```
user@R5> show route 10.0.0.3
inet.0: 28 destinations, 28 routes (28 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.0.0.3/32      *IS-IS/18] 00:00:10, metric 25
                  > to 10.1.56.2 via so-0/0/0.0

user@R5> show route detail 10.0.0.3
inet.0: 28 destinations, 28 routes (28 active, 0 holddown, 0 hidden)
10.0.0.3/32 (1 entry, 1 announced)
  *IS-IS Preference: 18
    Level: 2
      Next hop: 10.1.56.2 via so-0/0/0.0, selected
    State: <Active Int>
    Age: 4:57      Metric: 25
    Task: IS-IS
    Announcement bits (1): 0-KRT
    AS path: I

user@R5> show isis route detail 10.0.0.3
IS-IS routing table                               Current version: L1: 250 L2: 257
Prefix      L Version  Metric  Type Interface  Via
10.0.0.3/32  2      257      25    int  so-0/0/0.0  R6
```

**Meaning** Sample output 1 shows the cost for each route and the preferred next hop. In this example, there are two next hops, one through R1 and the other through R6. Both have an equal cost (30) to the destination. The cost is indicated in the **Metric** field. The preferred next hop is randomly chosen. In this case, the preferred next hop is through R1, interface so-0/0/1.0. In the output for the **show route** command, the selected next hop is indicated by a forward arrow (>). With the **show route detail**

command, the next hop is indicated by the key word **selected**. The output for the **show isis route** command shows the selected interface and indicates that the IS-IS protocol is building the correct routing table from the link-state database.

After the metric on **R6** is changed to a lower value, sample output 2 shows a different cost and next hop. With IS-IS, routes with lower total path metrics are preferred over those with higher path metrics. The path through **R6** (**so-0/0/0.0**) is now lower (**25**) than the path through **R1** (**so-0/0/1.0**) (**30**). In the output for the **show route** command, the lower cost (**25**) is indicated in the **Metric** field, and the preferred path is indicated by the forward arrow (**>**) and the keyword **selected**. The output for the **show isis route** command shows the selected interface and indicates that the IS-IS protocol is building the correct routing table from the link-state database.

In general, the output for the **show route** commands shows all active entries in the routing table. The information displayed includes the name of the routing table (**inet.0**), the number of destinations for which there are routes in the routing table (**28**), how the route was learned, and the route preference value, such as [**IS-IS/18**]. In addition, any metric associated with the route (**metric 30**), and the name of the interface through which the route was learned are displayed.

## Examine the Forwarding Table

**Purpose** You can display the set of routes installed in the forwarding table to verify that the routing protocol process (**ripd**) has relayed the correct information into the forwarding table. This is especially important when there are network problems, such as connectivity. In this procedure, you verify that the routes displayed in Step 2 appear in the forwarding table for router **R5**.

**Action** To examine the forwarding table for a router, enter the following CLI command:

```
user@host> show route forwarding-table destination destination-prefix
```

**Sample Output**

```
user@R5> show route forwarding-table destination 10.0.0.3
Routing table: inet
Internet:
Destination          Type RtRef Next hop          Type Index NhRef Netif
10.0.0.3/32          user   0 10.1.15.0          ucst  285   7 so-0/0/1.0
user@R5> show route forwarding-table destination 10.0.0.3
Routing table: inet
Internet:
Destination          Type RtRef Next hop          Type Index NhRef Netif
10.0.0.3/32          user   0 10.1.56.0          ucst  281   9 so-0/0/0.0
```

**Meaning** The sample output shows the selected next hop between routers **R5** and **R3** sent from the **inet** routing table and installed into the forwarding table. The first instance shows the route through **R1** and the second instance shows the route through **R6**. In both instances, the preferred route displayed in Step 2 is installed in the forwarding table.

In general, the sample output includes the destination address and destination type, the next-hop address and next-hop type, the number of references to the next hop, an index number into an internal next-hop database, and the interface used to reach the next hop.

## Examine the Link-State Database

**Purpose** You can examine the entire link-state database to obtain important information about the network. In this step, you verify that the key word **Attached** appears in the output of the Level 1 routers (R3 and R4) and the Level 1/Level 2 routers (R2 and R5).

**Action** To examine the link-state database for routers at different levels of the network, enter the following CLI command:

```
user@host> show isis database
```

### Sample Output

```
user@R1> show isis database
```

```
IS-IS level 1 link-state database:
```

```
0 LSPs
```

```
IS-IS level 2 link-state database:
```

| LSP ID   | Sequence | Checksum | Lifetime | Attributes |
|----------|----------|----------|----------|------------|
| R1.00-00 | 0x1b     | 0xd4b5   | 583      | L1 L2      |
| R2.00-00 | 0x1d     | 0x1a4f   | 1131     | L1 L2      |
| R5.00-00 | 0x1b     | 0x6245   | 883      | L1 L2      |
| R6.00-00 | 0x20     | 0xf7c    | 919      | L1 L2      |

```
4 LSPs
```

```
user@R2> show isis database
```

```
IS-IS level 1 link-state database:
```

| LSP ID   | Sequence | Checksum | Lifetime | Attributes            |
|----------|----------|----------|----------|-----------------------|
| R2.00-00 | 0x56     | 0xbd8c   | 862      | L1 L2 <b>Attached</b> |
| R3.00-00 | 0x58     | 0xaca1   | 463      | <b>L1</b>             |

```
2 LSPs
```

```
IS-IS level 2 link-state database:
```

| LSP ID   | Sequence | Checksum | Lifetime | Attributes |
|----------|----------|----------|----------|------------|
| R1.00-00 | 0x57     | 0x3e10   | 871      | L1 L2      |
| R2.00-00 | 0x5e     | 0x9790   | 1150     | L1 L2      |
| R5.00-00 | 0x5a     | 0xadba   | 1162     | L1 L2      |
| R6.00-00 | 0x56     | 0xa2b2   | 484      | L1 L2      |

```
4 LSPs
```

```
user@R3> show isis database
```

```
IS-IS level 1 link-state database:
```

| LSP ID   | Sequence | Checksum | Lifetime | Attributes            |
|----------|----------|----------|----------|-----------------------|
| R2.00-00 | 0x56     | 0xbd8c   | 792      | L1 L2 <b>Attached</b> |
| R3.00-00 | 0x58     | 0xaca1   | 397      | <b>L1</b>             |

```
2 LSPs
```

```
IS-IS level 2 link-state database:
```

```
0 LSPs
```

```
[edit protocols isis]
```

```
user@R4> show isis database
```

```
IS-IS level 1 link-state database:
```

| LSP ID   | Sequence | Checksum | Lifetime | Attributes            |
|----------|----------|----------|----------|-----------------------|
| R4.00-00 | 0x56     | 0x34b8   | 1125     | <b>L1</b>             |
| R5.00-00 | 0x57     | 0x22bb   | 795      | L1 L2 <b>Attached</b> |

```
2 LSPs
```

```
IS-IS level 2 link-state database:
```

```
0 LSPs
```

```
user@R5> show isis database
```

```
IS-IS level 1 link-state database:
```

| LSP ID   | Sequence | Checksum | Lifetime | Attributes |
|----------|----------|----------|----------|------------|
| R4.00-00 | 0x56     | 0x34b8   | 1071     | <b>L1</b>  |

```

R5.00-00                                0x57  0x22bb      745 L1 L2  Attached
  2 LSPs
IS-IS level 2 link-state database:
LSP ID          Sequence Checksum Lifetime Attributes
R1.00-00        0x57    0x3e10      707 L1 L2
R2.00-00        0x5e    0x9790      982 L1 L2
R5.00-00        0x5a    0xadba     1002 L1 L2
R6.00-00        0x57    0xa0b3     1064 L1 L2
  4 LSPs

user@R6> show isis database
IS-IS level 1 link-state database:
  0 LSPs
IS-IS level 2 link-state database:
LSP ID          Sequence Checksum Lifetime Attributes
R1.00-00        0x1b    0xd4b5      728 L1 L2
R2.00-00        0x1c    0x1c4e      604 L1 L2
R5.00-00        0x1b    0x6245     1032 L1 L2
R6.00-00        0x20    0xf7c      1072 L1 L2
  4 LSPs

```

**Meaning** The sample output shows the details of the Level 1 and Level 2 IS-IS databases for routers R1, R2, R3, R4, R5, and R6. Whether a router is configured for Level 1, Level 2 or Level 1/Level 2 is indicated by the type of IS-IS link-state database(s) in the output for the **show isis database** command for that router. For example, R3 and R4 are Level 1 routers because they do not have LSPs in the Level 2 link-state database, and the R1 and R6 are Level 2 routers because they do not have LSPs in the Level 1 link-state database. R2 and R5 are have LSPs in both Level 1/Level 2 link-state databases, indicating they are Level 1/Level 2 routers.

In addition, the output for R2 shows that it is a Level 1/Level 2 router because it has R3 in its Level 1 database, while R3 does not have the L2 notation in the **Attributes** field, indicating that it is configured for Level 1.

The details of the Level 2 IS-IS database are the same for all Level 2 routers in the network.

The key word **Attached** appears in the Level 1 link-state database for R2, R3, R4, and R5, indicating that the Level 2 routers (R2 and R5) can communicate with other Level 2 systems and act as gateways for the Level 1 routers (R3 and R4) in their respective areas. If the links that connect R2 and R5 to the other Level 2 routers (R1 and R6) are broken, the key word **Attached** will not appear in the output because R2 and R5 will no longer act as gateways for the Level 1 routers.

## Examine a Link-State Protocol Data Unit Header

**Purpose** By using the key word **extensive**, you can examine each header field of a link-state protocol data unit (LSP) and gather important details about the network. In this step, you examine the IS-IS database for router R2.

**Action** To examine an LSP header, enter the following CLI command:

```
user@host> show isis database extensive
```

**Sample Output** user@R2> show isis database extensive



```

IS-IS level 1 link-state database:
[...Output truncated...]
Header: LSP ID: R2.00-00 , Length: 139 bytes
  Allocated length: 1492 bytes, Router ID: 10.0.0.2
  Remaining lifetime: 1071 secs, Level: 1 ,Interface: 0
  Estimated free bytes: 1353, Actual free bytes: 1353
  Aging timer expires in: 1071 secs
  Protocols: IP, IPv6
Packet: LSP ID: R2.00-00, Length: 139 bytes, Lifetime : 1198 secs
  Checksum: 0xbb8d, Sequence: 0x57, Attributes: 0xb <L1 L2 Attached>
  NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
  Packet type: 18 , Packet version: 1, Max area: 0
[...Output truncated...]
Header: LSP ID: R3.00-00 , Length: 139 bytes
  Allocated length: 284 bytes, Router ID: 10.0.0.3
  Remaining lifetime: 823 secs, Level: 1 ,Interface: 68
  Estimated free bytes: 145, Actual free bytes: 145
  Aging timer expires in: 823 secs
  Protocols: IP, IPv6
Packet: LSP ID: R3.00-00, Length: 139 bytes, Lifetime : 1198 secs
  Checksum: 0xaa2, Sequence: 0x59, Attributes: 0x1 <L1>
  NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
  Packet type: 18, Packet version: 1, Max area: 0
[...Output truncated...]
IS-IS level 2 link-state database:
[...Output truncated...]
Header: LSP ID: R1.00-00, Length: 194 bytes
  Allocated length: 284 bytes, Router ID: 10.0.0.1
  Remaining lifetime: 398 secs, Level: 2 ,Interface: 67
  Estimated free bytes: 145, Actual free bytes: 90
  Aging timer expires in: 398 secs
  Protocols: IP, IPv6
Packet: LSP ID: R1.00-00, Length: 194 bytes, Lifetime : 1196 secs
  Checksum: 0x3e10, Sequence: 0x57, Attributes: 0x3 <L1 L2>
  NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
  Packet type: 20 , Packet version: 1, Max area: 0
[...Output truncated...]
Header: LSP ID: R2.00-00 , Length: 236 bytes
  Allocated length: 1492 bytes, Router ID: 10.0.0.2
  Remaining lifetime: 677 secs, Level: 2 ,Interface: 0
  Estimated free bytes: 1256, Actual free bytes: 1256
  Aging timer expires in: 677 secs
  Protocols: IP, IPv6
Packet: LSP ID: R2.00-00, Length: 236 bytes, Lifetime : 1198 secs
  Checksum: 0x9790, Sequence: 0x5e, Attributes: 0x3 <L1 L2>
  NLPID: 0x83, Fixed length: 27 bytes, Version: 1, Sysid length: 0 bytes
  Packet type: 20, Packet version: 1, Max area: 0
[...Output truncated...]

```

**Meaning** The sample output is from router R2 and shows extensive information about the Level 1 and Level 2 link-state databases, which are identical across all Level 2 routers. Level 1 routers only include information for the Level 1 link-state database, which is identical to the Level 1 information in the output for a Level 2 router. The sample output shows the details of four LSPs. Level 1 and Level 2 LSPs include identical types of information except for the packet type. A Level 2 LSP has a packet type of 20 and a Level 1 LSP has a packet type of 18.

The first three examples illustrate different values in the **Attributes** field:

- <L1 L2> and the key word **Attached** in the first example, **R2.00-00**, indicate that router **R2** is a Level1/Level 2 router acting as a gateway for Level 1 routers.
- <L1> in the second example, **R3.00-00**, indicates that **R3** is a Level 1 router.
- <L1 L2> in the third example, **R1.00-00**, indicates that **R1** is a Level 2 router (the fourth example is also for a Level 2 router).

The fourth example, **R2.00-00**, is included to show that a Level 1/Level 2 router appears in both the Level 1 and the Level 2 link-state databases. Note that in the Level 2 link-state database, the key word **Attached** is not included in the **Attributes** field.

It is useful to examine one LSP in greater detail. The third LSP, **R1.00-00**, was originated by **R1** as indicated by the **LSP ID** field. **R1** is the hostname of the router. The first **00** indicates that the LSP is for the router itself, and the final **00** denotes that the LSP is not fragmented. Both IPv4 and IPv6 are supported by this router, as indicated in the **Protocols** field. The **Attributes** field shows that the router is capable of both Level 1 and Level 2 routing, is not connected to Level 1 routers in other areas, and is not overloaded. The key words **Attached** and **Overloaded** would appear in the **Attributes** field if this were the case. The remaining lifetime of the LSP is 1196 seconds. IS-IS lifetimes start at a configured age (1200 seconds by default) and count down to zero.

## Chapter 12

# Verify the OSPF Protocol and Neighbors

This chapter describes how to check whether the Open Shortest Path First protocol (OSPF) is configured correctly on a Juniper Networks router, the proper adjacencies are formed in a network, and the appropriate link-state advertisements (LSAs) are flooded throughout different parts of the OSPF autonomous system (AS).

- Checklist for Verifying the OSPF Protocol and Neighbors on page 117
- Verify the OSPF Protocol on page 118
- Check OSPF Neighbors on page 129
- Examine Link-State Advertisements in Detail on page 138

### Checklist for Verifying the OSPF Protocol and Neighbors

**Purpose** You can use the commands provided in Table 30 on page 117 for verifying the OSPF protocol and neighbors.

**Table 30: Checklist for Verifying the OSPF Protocol and Neighbors**

| Tasks                                               | Command or Action                                                                                                   |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| <b>“Verify the OSPF Protocol” on page 118</b>       |                                                                                                                     |
| 1. Check OSPF on an ASBR on page 120                | show configuration<br>show ospf interface                                                                           |
| 2. Check OSPF on an ABR on page 123                 | show configuration<br>show ospf interface                                                                           |
| 3. Check OSPF on a Stub Router on page 127          | show configuration<br>show ospf interface                                                                           |
| <b>“Check OSPF Neighbors” on page 129</b>           |                                                                                                                     |
| 1. Verify OSPF Neighbors on page 130                | show ospf neighbor                                                                                                  |
| 2. Examine the OSPF Link-State Database on page 131 | show ospf database                                                                                                  |
| 3. Examine OSPF Routes on page 135                  | show route <i>destination-prefix</i><br>show ospf database                                                          |
| 4. Examine the Forwarding Table on page 137         | show route <i>destination-prefix</i> extensive<br>show route forwarding-table destination <i>destination-prefix</i> |

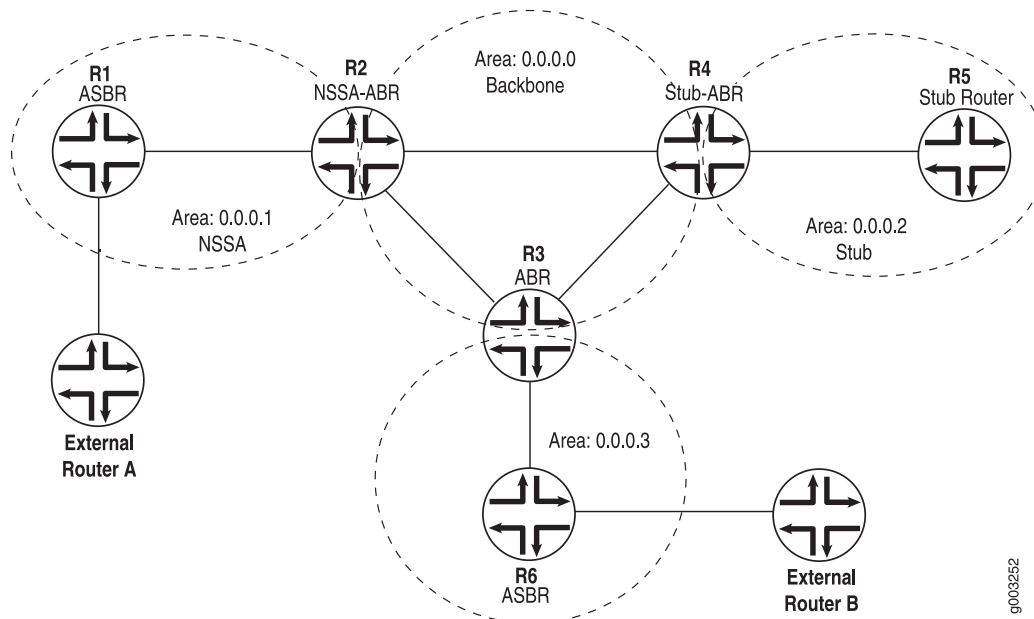
**Table 30: Checklist for Verifying the OSPF Protocol and Neighbors** (continued)

| Tasks                                                      | Command or Action                        |
|------------------------------------------------------------|------------------------------------------|
| 5. Examine Link-State Advertisements in Detail on page 138 |                                          |
| a. Examine a Type 1 Router LSA on page 138                 | show ospf database router extensive      |
| b. Examine a Type 3 Summary LSA on page 139                | show ospf database netsummary extensive  |
| c. Examine a Type 4 ASBR Summary LSA on page 140           | show ospf database asbrsummary extensive |
| d. Examine a Type 5 AS External LSA on page 141            | show ospf database extern extensive      |
| e. Examine Type 7 NSSA External LSA on page 141            | show ospf database nssa extensive        |

## Verify the OSPF Protocol

**Purpose** For OSPF to run on a router in your network, you must include the interfaces that run OSPF at the [edit protocols ospf] hierarchy level and, for those interfaces, the family inet statement must be included at the [edit interfaces *interface-name* unit *logical-unit-number*] hierarchy level.

Figure 10 on page 118 illustrates an example an OSPF autonomous system (AS) consisting of multiple areas and different types of OSPF routers.

**Figure 10: Multi-Area OSPF Network Topology**

The AS in Figure 10 on page 118 is organized hierarchically around a backbone area, 0.0.0.0. Portions of the network are designated as separate areas: 0.0.0.1, 0.0.0.2, and 0.0.0.3. The backbone is the connecting point for all other areas, and each area must attach to the backbone in at least one location. OSPF is based on the concept of a link-state database in which each OSPF router attempts to form adjacencies with its OSPF neighbor. Once the adjacencies are in place, each router generates and floods LSAs into the network. The LSAs are placed into the link-state database on each router where the shortest path first (SPF) algorithm is calculated to find the best path to each end node in the network.

All non-backbone areas (0.0.0.1, 0.0.0.2, and 0.0.0.3) contain routers internal to that area (**R1**, **R5**, and **R6**) as well as a single area border router (ABR) (**R2**, **R3**, and **R4**). Internal routers generate LSAs within their area. The ABR translates these internal LSAs into summary LSAs that represent the LSAs within its non-backbone area and floods the summary LSAs to the backbone. The ABR is also responsible for generating summary LSAs that represent the backbone LSAs and injecting them into its attached areas. Because the ABR belongs to more than one area, it maintains a separate topological database for each area to which it is connected.

In Figure 10 on page 118, the ABRs belong to different non-backbone areas. **R2** is in area 0.0.0.1, a not-so-stubby area (NSSA); **R3** is in area 0.0.0.3; and **R4** is in area 0.0.0.2, a stub area.

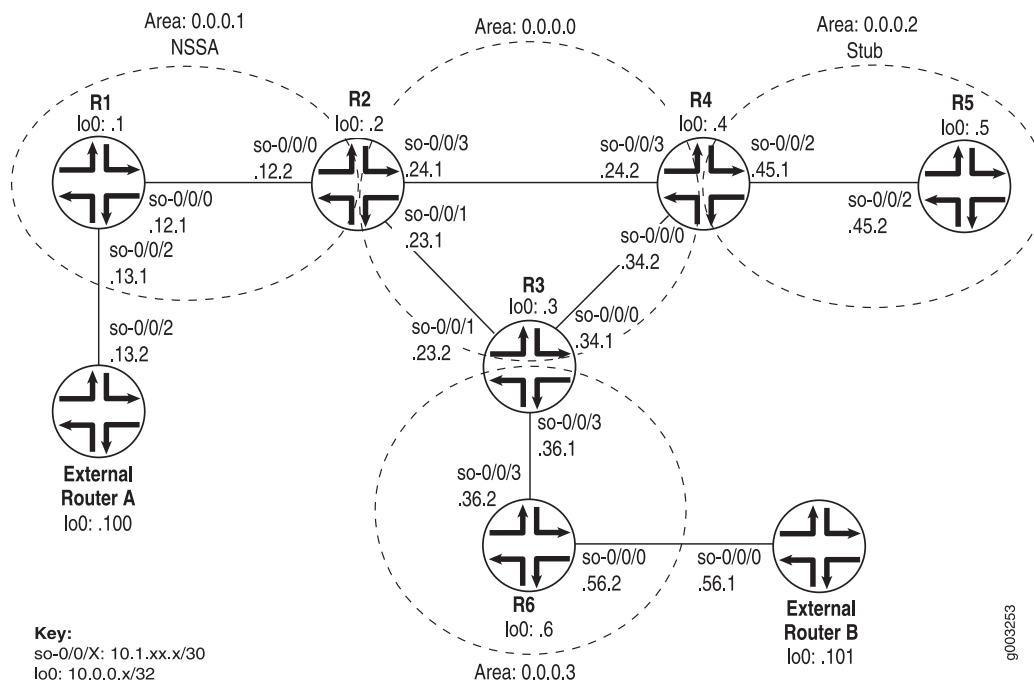
The NSSA (0.0.0.1) consists of two routers: **R1** and **R2**. An NSSA allows external routes to be flooded within its area. These routes are then leaked to other areas within the AS. However, external routes learned from other areas within the AS do not enter the NSSA.

The stub area (0.0.0.2) consists of two routers: **R4** and **R5**. A stub area does not allow external routes to be flooded within its area. A stub area is useful when much of the AS consists of external LSAs because it reduces the size of the topological database within the stub area and subsequently the amount of memory required by the routers in the area.

Area 0.0.0.3 is a non-backbone area consisting of two routers: **R3** and **R6**.

External Routers A and B reside outside the AS. When an OSPF router exchanges routing information with routers in other ASs, that router is called an autonomous system boundary router (ASBR). The ASBRs shown in Figure 10 on page 118 are **R1** and **R6**.

Figure 11 on page 120 provides interface and IP address information for the example OSPF network topology used for the procedures in this topic.

**Figure 11: OSPF Network Topology with Details**

To verify that OSPF is configured correctly on routers in different areas of the network, follow these steps:

1. Check OSPF on an ASBR on page 120
2. Check OSPF on an ABR on page 123
3. Check OSPF on a Stub Router on page 127

### Check OSPF on an ASBR

**Purpose** To verify the OSPF configuration on an ASBR router.

**Action** To verify the OSPF configuration on an ASBR router in your network, enter the following JUNOS command-line interface (CLI) operational mode commands:

```
user@host> show configuration
user@host> show ospf interface
```

The following sample output is for an OSPF configuration on R1, an ASBR router shown in Figure 11 on page 120:

**Sample Output**

```
user@R1> show configuration
[...Output truncated...]
interfaces {
    so-0/0/0 {
        unit 0 {
            family inet {
                address 10.1.12.1/30;
            }
        }
    }
}
```

```

so-0/0/2 {
  unit 0 {
    family inet {
      address 10.1.13.1/30;
    }
  }
}
lo0 {
  unit 0 {
    family inet {
      address 10.0.0.1/32;
    }
  }
}
}
routing-options {
  static {
[...Output truncated...]
    route 10.0.0.100/32 next-hop 10.1.13.2;
  }
  router-id 10.0.0.1;
}
protocols {
  ospf {
    export export-to-ospf;
    area 0.0.0.1 {
      nssa;
      interface so-0/0/0.0;
      interface lo0.0 {
        passive;
      }
    }
  }
}
}
policy-options {
  policy-statement export-to-ospf {
    term external-router {
      from {
        route-filter 10.0.0.100/32 exact;
      }
      then accept;
    }
  }
}
}

```

```

user@R1> show ospf interface

```

| Interface  | State   | Area    | DR ID   | BDR ID  | Nbrs |
|------------|---------|---------|---------|---------|------|
| lo0.0      | DRother | 0.0.0.1 | 0.0.0.0 | 0.0.0.0 | 0    |
| so-0/0/0.0 | PtToPt  | 0.0.0.1 | 0.0.0.0 | 0.0.0.0 | 1    |

The following sample output is for an OSPF configuration on R6, an ASBR router shown in Figure 11 on page 120:

#### Sample Output

```

user@R6> show configuration
[...Output truncated...]
interfaces {
  so-0/0/0 {
    unit 0 {
      family inet {
        address 10.1.56.2/30;
      }
    }
  }
}

```

```

    }
  }
  so-0/0/3 {
    unit 0 {
      family inet {
        address 10.1.36.2/30;
      }
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.0.0.6/32;
      }
    }
  }
}
routing-options {
  static {
[...Output truncated...]
    route 10.0.0.101/32 next-hop 10.1.56.1;
  }
  router-id 10.0.0.6;
}
protocols {
  ospf {
    export export-to-ospf;
    area 0.0.0.3 {
      interface so-0/0/3.0;
      interface lo0.0 {
        passive;
      }
    }
  }
}
policy-options {
  policy-statement export-to-ospf {
    term external-router {
      from {
        route-filter 10.0.0.101/32 exact;
      }
      then accept;
    }
  }
}

```

```

user@R6> show ospf interface
Interface      State      Area      DR ID      BDR ID      Nbrs
lo0.0          DROther   0.0.0.3   0.0.0.0    0.0.0.0     0
so-0/0/3.0     PtToPt    0.0.0.3   0.0.0.0    0.0.0.0     1

```

**Meaning** The sample output shows a basic OSPF configuration at the [edit protocols ospf] and [edit interfaces] hierarchy levels on the R1 and R6 ASBR routers. In addition, both routers have an export policy, **export-to-ospf**, configured. The export policy allows external routes to be injected into the OSPF database and communicated throughout the AS.

R1 has two interfaces included at the [edit protocols ospf] hierarchy level: **so-0/0/0** and the loopback interface (**lo0**). Both interfaces have the **family inet** statement



included at the `[edit interfaces]` hierarchy level and are in area 0.0.0.1. Area 0.0.0.1 is attached to the backbone through R2, an ABR.

In addition, R1 has the `nssa` statement included at the `[edit protocols ospf]` hierarchy level indicating that it is an ASBR running in an NSSA. An NSSA allows external routes from outside the AS to be flooded within it. In this instance, the routes learned from external router B through the export policy `export-to-ospf` are injected into the R1 OSPF database and communicated throughout the AS. For more information on OSPF routes, see “Examine OSPF Routes” on page 135.

R6 has two interfaces included at the `[edit protocols ospf]` hierarchy level: `so-0/0/3` and the loopback interface (lo0). Both interfaces have the `family inet` statement included at the `[edit interfaces]` hierarchy level and are in area 0.0.0.3. Area 0.0.0.3 is attached to the backbone through R3, an ABR. In addition, external router B is attached to R6 which has the export policy `export-to-ospf` configured. The export policy allows external routes to be injected into the R6 OSPF database and communicated throughout the AS.

Both routers (R1 and R6) have the router ID configured manually to avoid possible problems when the OSPF router ID (RID) changes: for example, when multiple loopback addresses are configured. The RID uniquely identifies the router within the OSPF network. It is transmitted within the LSAs used to populate the link-state database and calculate the shortest-path tree. In a link-state network, it is important that two routers do not share the same RID value, otherwise IP routing problems may occur.

An ASBR exchanges routing information with routers in other autonomous systems. ASBRs advertise externally learned routes throughout the AS. With the exception of routers in stub areas, any router in the AS—an internal router, an area border router, or a backbone router—can be an ASBR.

See the *JUNOS Routing Protocols Configuration Guide* for more information on configuring OSPF on a router.

## Check OSPF on an ABR

**Purpose** To verify the OSPF configuration on an ABR router.

**Action** To verify the OSPF configuration on an ABR router in your network, enter the following JUNOS CLI operational mode commands:

```
user@host> show configuration
user@host> show ospf interface
```

The following sample output is for an OSPF configuration on R2, an NSSA ABR shown in Figure 11 on page 120:

**Sample Output**

```
user@R2> show configuration
[...Output truncated...]
interfaces {
  so-0/0/0 {
    unit 0 {
      family inet {
        address 10.1.12.2/30;
      }
    }
  }
}
```

```

    }
  }
  so-0/0/1 {
    unit 0 {
      family inet {
        address 10.1.23.1/30;
      }
    }
  }
  so-0/0/3 {
    unit 0 {
      family inet {
        address 10.1.24.1/30;
      }
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.0.0.2/32;
      }
    }
  }
}
routing-options {
}
router-id 10.0.0.2;
}
protocols {
  ospf {
    area 0.0.0.1 {
      nssa {
        default-lsa default-metric 10;
      }
      interface so-0/0/0.0;
    }
    area 0.0.0.0 {
      interface so-0/0/3.0;
      interface so-0/0/1.0;
      interface lo0.0 {
        passive;
      }
    }
  }
}
}

```

```
user@R2> show ospf interface
```

| Interface  | State   | Area    | DR ID   | BDR ID  | Nbrs |
|------------|---------|---------|---------|---------|------|
| lo0.0      | DRother | 0.0.0.0 | 0.0.0.0 | 0.0.0.0 | 0    |
| so-0/0/1.0 | PtToPt  | 0.0.0.0 | 0.0.0.0 | 0.0.0.0 | 1    |
| so-0/0/3.0 | PtToPt  | 0.0.0.0 | 0.0.0.0 | 0.0.0.0 | 1    |
| so-0/0/0.0 | PtToPt  | 0.0.0.1 | 0.0.0.0 | 0.0.0.0 | 1    |

**Sample Output** The following sample output is for an OSPF configuration on R3, an ABR shown in Figure 11 on page 120:

```
user@R3> show configuration
```

```

interfaces {
  so-0/0/0 {
    unit 0 {

```

```

        family inet {
            address 10.1.34.1/30;
        }
    }
}
so-0/0/1 {
    unit 0 {
        family inet {
            address 10.1.23.2/30;
        }
    }
}
so-0/0/3 {
    unit 0 {
        family inet {
            address 10.1.36.1/30;
        }
    }
}
lo0 {
    unit 0 {
        family inet {
            address 10.0.0.3/32;
        }
    }
}
}
routing-options {
    router-id 10.0.0.3;
}
protocols {
    ospf {
        area 0.0.0.0 {
            interface so-0/0/0.0;
            interface so-0/0/1.0;
            interface lo0.0 {
                passive;
            }
        }
        area 0.0.0.3 {
            interface so-0/0/3.0;
        }
    }
}

```

```
user@R3> show ospf interface
```

| Interface  | State   | Area    | DR ID   | BDR ID  | Nbrs |
|------------|---------|---------|---------|---------|------|
| lo0.0      | DRother | 0.0.0.0 | 0.0.0.0 | 0.0.0.0 | 0    |
| so-0/0/0.0 | PtToPt  | 0.0.0.0 | 0.0.0.0 | 0.0.0.0 | 1    |
| so-0/0/1.0 | PtToPt  | 0.0.0.0 | 0.0.0.0 | 0.0.0.0 | 1    |
| so-0/0/3.0 | PtToPt  | 0.0.0.3 | 0.0.0.0 | 0.0.0.0 | 1    |

**Sample Output** The following sample output is for an OSPF configuration on R4, an ABR shown in Figure 11 on page 120:

```

user@R4> show configuration
[...Output truncated...]
interfaces {
    so-0/0/0 {
        unit 0 {
            family inet {

```

```

        address 10.1.34.2/30;
    }
}
so-0/0/2 {
    unit 0 {
        family inet {
            address 10.1.45.1/30;
        }
    }
}
so-0/0/3 {
    unit 0 {
        family inet {
            address 10.1.24.2/30;
        }
    }
}
lo0 {
    unit 0 {
        family inet {
            address 10.0.0.4/32;
        }
    }
}
}
routing-options {
    router-id 10.0.0.4;
}
protocols {
    ospf {
        area 0.0.0.0 {
            interface so-0/0/0.0;
            interface so-0/0/3.0;
            interface lo0.0 {
                passive;
            }
        }
        area 0.0.0.2 {
            stub default-metric 10;
            interface so-0/0/2.0;
        }
    }
}
}

```

```
user@R4> show ospf interface
```

| Interface  | State   | Area    | DR ID   | BDR ID  | Nbrs |
|------------|---------|---------|---------|---------|------|
| lo0.0      | DRother | 0.0.0.0 | 0.0.0.0 | 0.0.0.0 | 0    |
| so-0/0/0.0 | PtToPt  | 0.0.0.0 | 0.0.0.0 | 0.0.0.0 | 1    |
| so-0/0/3.0 | PtToPt  | 0.0.0.0 | 0.0.0.0 | 0.0.0.0 | 1    |
| so-0/0/2.0 | PtToPt  | 0.0.0.2 | 0.0.0.0 | 0.0.0.0 | 1    |

**Meaning** The sample output shows a basic OSPF configuration at the [edit protocols ospf] and [edit interfaces] hierarchy levels on the R2, R3, and R4 ABR routers.

R2 has four interfaces included at the [edit protocols ospf] hierarchy level, and those interfaces have the **family inet** statement included at the [edit interfaces] hierarchy level. Three interfaces—so-0/0/1.0, so-0/0/3.0, and the loopback (lo0) interface—are in the backbone (0.0.0.0). One interface, so-0/0/0.0, is in the NSSA (0.0.0.1). Because

R2 has one interface configured for an NSSA, external routes learned from outside the AS (through R1) are redistributed throughout the network. For more information on OSPF routes, see “Examine OSPF Routes” on page 135.

R3 has four interfaces included at the `[edit protocols ospf]` hierarchy level, and those interfaces have the `family inet` statement included at the `[edit interfaces]` hierarchy level. Three interfaces—`so-0/0/0.0`, `so-0/0/1.0`, and the loopback (`lo0`) interface—are in the backbone (`0.0.0.0`). One interface, `so-0/0/3.0`, is in a non-backbone area (`0.0.0.3`).

R4 has four interfaces included at the `[edit protocols ospf]` hierarchy level, and those interfaces have the `family inet` statement included at the `[edit interfaces]` hierarchy level. Two interfaces, `so-0/0/0.0` and `so-0/0/3.0`, are in the backbone (`0.0.0.0`). One interface, `so-0/0/2.0`, is in the stub area (`0.0.0.2`). Because internal routers within a stub area do not receive external LSA information, they must rely on either direct static routes or a default route to get to external destinations. A default route can be statically configured on the internal router or learned from the stub ABR. To advertise a default LSA from the stub ABR, include the stub `default-metric` statement at the `[edit protocols ospf area area-id]` hierarchy level to activate the default route.

All routers (R2, R3, and R4) have the router ID configured manually to avoid possible problems when the OSPF router ID (RID) changes; for example, when multiple loopback addresses are configured. The RID uniquely identifies the router within the OSPF network. It is transmitted within the LSAs used to populate the link-state database and calculate the shortest-path tree. In a link-state network, it is important that two routers do not share the same RID value, otherwise IP routing problems may occur.

An ABR belongs to more than one area and maintains a separate topological database for each area to which it is connected. For more information on the OSPF database, see “Examine the OSPF Link-State Database” on page 131.

See the *JUNOS Routing Protocols Configuration Guide* for more information on configuring OSPF on a router.

## Check OSPF on a Stub Router

**Purpose** To verify the OSPF configuration on a stub router.

**Action** To verify the OSPF configuration on a stub router in your network, enter the following commands:

```
user@host> show configuration
user@host> show ospf interface
```

The following sample output is for an OSPF configuration on R5, a stub router shown in Figure 11 on page 120:

**Sample Output**

```
user@R5> show configuration
[...Output truncated...]
interfaces {
    so-0/0/2 {
        unit 0 {
            family inet {
```

```

        address 10.1.45.2/30;
    }
}
lo0 {
    unit 0 {
        family inet {
            address 10.0.0.5/32;
        }
    }
}
routing-options {
    router-id 10.0.0.5;
}
protocols {
    ospf {
        area 0.0.0.2 {
            stub;
            interface so-0/0/2.0;
            interface lo0.0 {
                passive;
            }
        }
    }
}

```

```
user@R5> show ospf interface
```

| Interface  | State   | Area    | DR ID   | BDR ID  | Nbrs |
|------------|---------|---------|---------|---------|------|
| lo0.0      | DRother | 0.0.0.2 | 0.0.0.0 | 0.0.0.0 | 0    |
| so-0/0/2.0 | PtToPt  | 0.0.0.2 | 0.0.0.0 | 0.0.0.0 | 1    |

**Meaning** The sample output shows a basic OSPF configuration at the [edit protocols ospf] and [edit interfaces] hierarchy levels on R5, a stub router.

R5 has two interfaces included at the [edit protocols ospf] hierarchy level, and those interfaces have the **family inet** statement included at the [edit interfaces] hierarchy level. Both interfaces, **so-0/0/2.0** and the loopback interface (**lo0**), are in the stub area (0.0.0.2).

R5 has the router ID configured manually to avoid possible problems when the OSPF router ID (RID) changes; for example, when multiple loopback addresses are configured. The RID uniquely identifies the router within the OSPF network. It is transmitted within the LSAs used to populate the link-state database and calculate the shortest-path tree. In a link-state network, it is important that two routers do not share the same RID value, otherwise IP routing problems may occur.

A stub area does not allow AS external advertisements to flood within that area. R5 relies on a default route (0.0.0.0/0) to reach destinations outside the AS. The default route can be statically configured on R5 or advertised by an ABR (R4). In this network, the default LSA is advertised by R4.

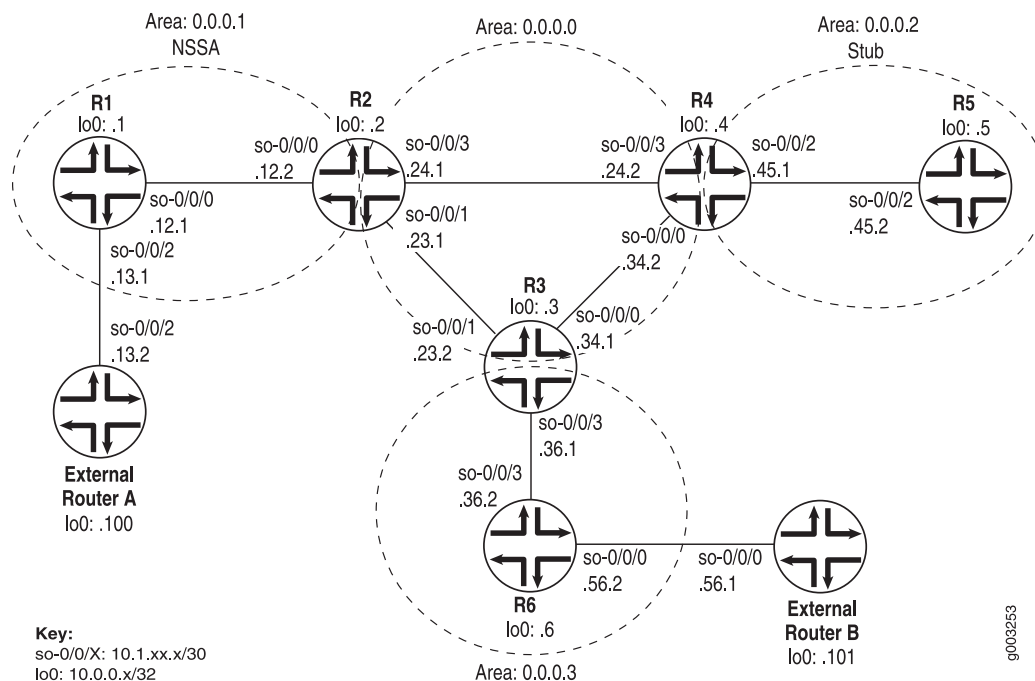
A stub area is useful if you want to reduce the size of the topological database and therefore the amount of memory required from the routers in the stub area. However, some restrictions apply to a stub area. You cannot create a virtual link through a stub area, and a stub area cannot contain an ASBR.

## Check OSPF Neighbors

**Purpose** Assuming that all the routers are correctly configured for OSPF, you can verify which neighbors are adjacent and what type of LSAs are contained in the OSPF link-state database. In addition, you can examine the set of routes installed in the forwarding table to verify that the routing protocol process (rpd) has relayed the correct information into the forwarding table.

Figure 12 on page 129 illustrates an example OSPF network topology used in this topic.

**Figure 12: OSPF Network Topology**



The network consists of various types of routers that form adjacencies with neighboring OSPF routers. Once these adjacencies are in place, each router generates and floods LSAs into the network. The LSAs are placed into the link-state database on each router where the shortest path first (SPF) algorithm is calculated to find the best path to each router in the network. The network in Figure 12 on page 129 should have the following adjacencies and LSA distribution:

- ABR routers R2, R3, and R4 should form adjacencies with routers in all areas to which they are connected (0.0.0.0, 0.0.0.1, 0.0.0.2, and 0.0.0.3). See “Check OSPF on an ABR” on page 123.
- Internal routers (R1, R5, and R6) should form adjacencies with routers inside their local area only. See “Check OSPF on a Stub Router” on page 127 and “Check OSPF on an ASBR” on page 120.
- Backbone area 0.0.0.0 should have Type 1, Type 3, Type 4, and Type 5 LSAs.
- NSSA area 0.0.0.1 should have Type 1, Type 3, and Type 7 LSAs.

- Stub area 0.0.0.2 should have Type 1 and Type 3 LSAs.
- Area 0.0.0.3 should have Type 1, Type 3, Type 4, and Type 5 LSAs.

To verify that routers are adjacent and have the correct exchange of LSAs, follow these steps:

1. Verify OSPF Neighbors on page 130
2. Examine the OSPF Link-State Database on page 131
3. Examine OSPF Routes on page 135
4. Examine the Forwarding Table on page 137

## Verify OSPF Neighbors

**Purpose** To verify that routers are adjacent and able to exchange OSPF data.

**Action** To verify that routers are adjacent and able to exchange OSPF data, enter the following CLI operational mode command:

```
user@host> show ospf neighbor
```

The following sample output shows the adjacencies that formed for all routers in Figure 12 on page 129:

**Sample Output**

```
user@R1> show ospf neighbor
  Address      Interface      State      ID              Pri  Dead
  10.1.12.2     so-0/0/0.0    Full      10.0.0.2        128  36

user@R2> show ospf neighbor
  Address      Interface      State      ID              Pri  Dead
  10.1.23.2     so-0/0/1.0    Full      10.0.0.3        128  32
  10.1.24.2     so-0/0/3.0    Full      10.0.0.4        128  33
  10.1.12.1     so-0/0/0.0    Full      10.0.0.1        128  33

user@R3> show ospf neighbor
  Address      Interface      State      ID              Pri  Dead
  10.1.34.2     so-0/0/0.0    Full      10.0.0.4        128  36
  10.1.23.1     so-0/0/1.0    Full      10.0.0.2        128  38
  10.1.36.2     so-0/0/3.0    Full      10.0.0.6        128  33

user@R4> show ospf neighbor
  Address      Interface      State      ID              Pri  Dead
  10.1.34.1     so-0/0/0.0    Full      10.0.0.3        128  31
  10.1.24.1     so-0/0/3.0    Full      10.0.0.2        128  36
  10.1.45.2     so-0/0/2.0    Full      10.0.0.5        128  39

user@R5> show ospf neighbor
  Address      Interface      State      ID              Pri  Dead
  10.1.45.1     so-0/0/2.0    Full      10.0.0.4        128  35

user@R6> show ospf neighbor
  Address      Interface      State      ID              Pri  Dead
  10.1.36.1     so-0/0/3.0    Full      10.0.0.3        128  31
```



**Meaning** The sample output shows that ABR routers R2, R3, and R4 have formed adjacencies with routers in all areas to which they are directly connected. Internal routers (R1, R5, and R6) have formed an adjacency with the other router inside their local area.

Adjacencies are formed after OSPF hello packets are sent and received by neighbors. Adjacencies determine the type of LSAs sent and received, and what topological database updates are sent. When adjacencies are established, pairs of adjacent routers synchronize their topological databases.

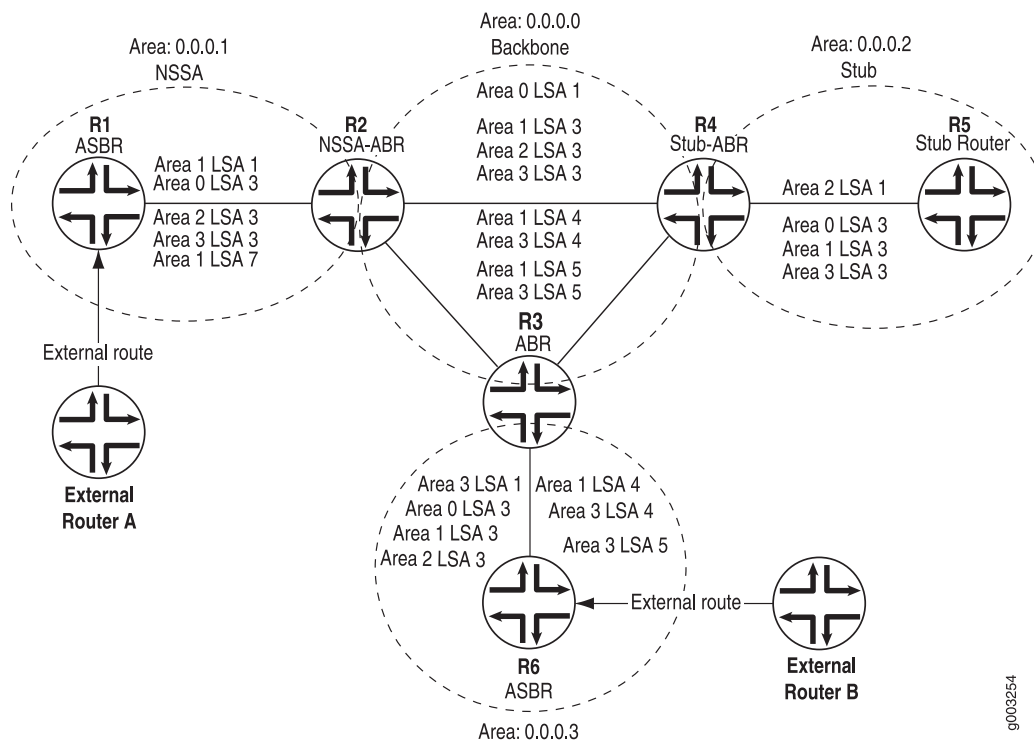
Table 31 on page 131 lists and describes the fields in the `show ospf neighbor` command.

**Table 31: Output Fields for the `show ospf neighbor` Command**

| Field     | Description                                                                                                                                                                                                                                       |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Address   | Address of the neighbor.                                                                                                                                                                                                                          |
| Interface | Interface through which the neighbor is reachable.                                                                                                                                                                                                |
| State     | State of the neighbor. It can be Attempt, Down, Exchange, ExStart, Full, Init, Loading, or 2 Way.                                                                                                                                                 |
| ID        | Router ID of the neighbor.                                                                                                                                                                                                                        |
| Pri       | Priority of the neighbor to become the designated router. Only used on broadcast networks during designated router elections. By default, set to 128, indicating the highest priority and the most likely router to be elected designated router. |
| Dead      | Number of seconds until the neighbor becomes unreachable.                                                                                                                                                                                         |

## Examine the OSPF Link-State Database

**Purpose** You can determine if the correct types of LSAs are sent and received throughout the OSPF network by examining the entire OSPF link-state database. Figure 13 on page 132 illustrates the flooding scope of LSAs generated and flooded in the example OSPF network.

**Figure 13: LSA Flooding Scopes**

This network should have the following distribution of LSAs:

- Backbone area 0.0.0.0 should have Type 1, Type 3, Type 4, and Type 5 LSAs.
- NSSA area 0.0.0.1 should have Type 1, Type 3, and Type 7 LSAs.
- Stub area 0.0.0.2 should have Type 1 and Type 3 LSAs.
- Area 0.0.0.3 should have Type 1, Type 3, Type 4, and Type 5 LSAs.

Because all routers in this network have SONET interfaces configured for Point-to-Point (PPP) encapsulation, all OSPF adjacencies are point-to-point, which results in Type 2 network LSAs not appearing in this network. Type 2 network LSAs are only advertised by a designated router, which is only present on broadcast or non-broadcast multiaccess (NBMA) networks.

**Action** To determine if the correct LSAs appear in the different areas of the OSPF AS, enter the following CLI operational mode command:

```
user@host> show ospf database
```

**Sample Output**

```
user@R2> show ospf database
OSPF link state database, area 0.0.0.0
Type      ID          Adv Rtr      Seq          Age      Opt  Cksum  Len
Router    *10.0.0.2   10.0.0.2     0x80000049   1555    0x2   0xd72a  84
Router    10.0.0.3   10.0.0.3     0x80000038   1395    0x2   0xef0e  84
Router    10.0.0.4   10.0.0.4     0x80000041    914    0x2   0x46a9  84
Summary   *10.0.0.1   10.0.0.2     0x80000047   1855    0x2   0xf509  28
Summary   10.0.0.5   10.0.0.4     0x8000003c   2114    0x2   0xd72c  28
Summary   10.0.0.6   10.0.0.3     0x80000033   1995    0x2   0xe527  28
```

```

Summary *10.1.12.0      10.0.0.2      0x80000047    786  0x2  0x5d98  28
Summary 10.1.36.0       10.0.0.3      0x80000035   2426  0x2  0x727c  28
Summary 10.1.45.0       10.0.0.4      0x8000003d   1021  0x2  0xf8e3  28
ASBRSum *10.0.0.1       10.0.0.2      0x80000046    355  0x2  0xe915  28
ASBRSum 10.0.0.6       10.0.0.3      0x80000032   1526  0x2  0xd933  28

```

OSPF link state database, area 0.0.0.1

| Type           | ID         | Adv Rtr  | Seq        | Age  | Opt | Cksum  | Len |
|----------------|------------|----------|------------|------|-----|--------|-----|
| <b>Router</b>  | 10.0.0.1   | 10.0.0.1 | 0x80000058 | 858  | 0x0 | 0x5c26 | 60  |
| Router         | *10.0.0.2  | 10.0.0.2 | 0x80000048 | 1986 | 0x0 | 0xecbd | 48  |
| <b>Summary</b> | *10.0.0.2  | 10.0.0.2 | 0x80000039 | 1686 | 0x0 | 0x1cf2 | 28  |
| Summary        | *10.0.0.3  | 10.0.0.2 | 0x80000038 | 2286 | 0x0 | 0x1eef | 28  |
| Summary        | *10.0.0.4  | 10.0.0.2 | 0x80000038 | 955  | 0x0 | 0x14f8 | 28  |
| Summary        | *10.0.0.5  | 10.0.0.2 | 0x80000038 | 186  | 0x0 | 0x14f6 | 28  |
| Summary        | *10.0.0.6  | 10.0.0.2 | 0x80000038 | 2155 | 0x0 | 0xaff  | 28  |
| Summary        | *10.1.23.0 | 10.0.0.2 | 0x80000046 | 655  | 0x0 | 0x4e9  | 28  |
| Summary        | *10.1.24.0 | 10.0.0.2 | 0x80000046 | 486  | 0x0 | 0xf8f3 | 28  |
| Summary        | *10.1.34.0 | 10.0.0.2 | 0x80000039 | 1255 | 0x0 | 0xae40 | 28  |
| Summary        | *10.1.36.0 | 10.0.0.2 | 0x80000039 | 55   | 0x0 | 0x9854 | 28  |
| Summary        | *10.1.45.0 | 10.0.0.2 | 0x80000039 | 1086 | 0x0 | 0x35ae | 28  |
| <b>NSSA</b>    | *0.0.0.0   | 10.0.0.2 | 0x80000044 | 2455 | 0x0 | 0xd821 | 36  |
| NSSA           | 10.0.0.100 | 10.0.0.1 | 0x80000051 | 2916 | 0x8 | 0x797c | 36  |

OSPF AS SCOPE link state database

| Type          | ID          | Adv Rtr  | Seq        | Age  | Opt | Cksum  | Len |
|---------------|-------------|----------|------------|------|-----|--------|-----|
| <b>Extern</b> | *10.0.0.100 | 10.0.0.2 | 0x8000005e | 1386 | 0x2 | 0xcf20 | 36  |
| Extern        | 10.0.0.101  | 10.0.0.6 | 0x8000002b | 333  | 0x2 | 0x9791 | 36  |

user@ R3 > show ospf database

OSPF link state database, area 0.0.0.0

| Type           | ID         | Adv Rtr  | Seq        | Age  | Opt | Cksum  | Len |
|----------------|------------|----------|------------|------|-----|--------|-----|
| <b>Router</b>  | 10.0.0.2   | 10.0.0.2 | 0x80000049 | 1668 | 0x2 | 0xd72a | 84  |
| Router         | *10.0.0.3  | 10.0.0.3 | 0x80000038 | 1506 | 0x2 | 0xef0e | 84  |
| Router         | 10.0.0.4   | 10.0.0.4 | 0x80000041 | 1027 | 0x2 | 0x46a9 | 84  |
| <b>Summary</b> | 10.0.0.1   | 10.0.0.2 | 0x80000047 | 1968 | 0x2 | 0xf509 | 28  |
| Summary        | 10.0.0.5   | 10.0.0.4 | 0x8000003c | 2227 | 0x2 | 0xd72c | 28  |
| Summary        | *10.0.0.6  | 10.0.0.3 | 0x80000033 | 2106 | 0x2 | 0xe527 | 28  |
| Summary        | 10.1.12.0  | 10.0.0.2 | 0x80000047 | 900  | 0x2 | 0x5d98 | 28  |
| Summary        | *10.1.36.0 | 10.0.0.3 | 0x80000036 | 6    | 0x2 | 0x707d | 28  |
| Summary        | 10.1.45.0  | 10.0.0.4 | 0x8000003d | 1134 | 0x2 | 0xf8e3 | 28  |
| <b>ASBRSum</b> | 10.0.0.1   | 10.0.0.2 | 0x80000046 | 468  | 0x2 | 0xe915 | 28  |
| ASBRSum        | *10.0.0.6  | 10.0.0.3 | 0x80000032 | 1638 | 0x2 | 0xd933 | 28  |

OSPF link state database, area 0.0.0.3

| Type           | ID         | Adv Rtr  | Seq        | Age  | Opt | Cksum   | Len |
|----------------|------------|----------|------------|------|-----|---------|-----|
| <b>Router</b>  | *10.0.0.3  | 10.0.0.3 | 0x80000036 | 2406 | 0x2 | 0x3452  | 48  |
| Router         | 10.0.0.6   | 10.0.0.6 | 0x8000002f | 445  | 0x2 | 0x1850  | 60  |
| <b>Summary</b> | *10.0.0.1  | 10.0.0.3 | 0x80000036 | 906  | 0x2 | 0x1cf1  | 28  |
| Summary        | *10.0.0.2  | 10.0.0.3 | 0x80000036 | 738  | 0x2 | 0x806   | 28  |
| Summary        | *10.0.0.3  | 10.0.0.3 | 0x80000033 | 1806 | 0x2 | 0xf917  | 28  |
| Summary        | *10.0.0.4  | 10.0.0.3 | 0x80000033 | 1038 | 0x2 | 0xf915  | 28  |
| Summary        | *10.0.0.5  | 10.0.0.3 | 0x80000033 | 306  | 0x2 | 0xf913  | 28  |
| Summary        | *10.1.12.0 | 10.0.0.3 | 0x80000036 | 606  | 0x2 | 0x8381  | 28  |
| Summary        | *10.1.23.0 | 10.0.0.3 | 0x80000036 | 438  | 0x2 | 0xffffa | 28  |
| Summary        | *10.1.24.0 | 10.0.0.3 | 0x80000036 | 1338 | 0x2 | 0xfef9  | 28  |
| Summary        | *10.1.34.0 | 10.0.0.3 | 0x80000036 | 138  | 0x2 | 0x8669  | 28  |
| Summary        | *10.1.45.0 | 10.0.0.3 | 0x80000033 | 1206 | 0x2 | 0x1dc9  | 28  |
| <b>ASBRSum</b> | *10.0.0.1  | 10.0.0.3 | 0x80000035 | 2238 | 0x2 | 0x10fd  | 28  |
| ASBRSum        | *10.0.0.2  | 10.0.0.3 | 0x80000035 | 1938 | 0x2 | 0xfb12  | 28  |

OSPF AS SCOPE link state database

| Type          | ID         | Adv Rtr  | Seq        | Age  | Opt | Cksum  | Len |
|---------------|------------|----------|------------|------|-----|--------|-----|
| <b>Extern</b> | 10.0.0.100 | 10.0.0.2 | 0x8000005e | 1500 | 0x2 | 0xcf20 | 36  |
| Extern        | 10.0.0.101 | 10.0.0.6 | 0x8000002b | 445  | 0x2 | 0x9791 | 36  |

```

user@ R4 > show ospf database
      OSPF link state database, area 0.0.0.0
  Type      ID          Adv Rtr      Seq      Age  Opt  Cksum  Len
Router    10.0.0.2      10.0.0.2    0x80000049 1711 0x2  0xd72a 84
Router      10.0.0.3      10.0.0.3    0x80000038 1550 0x2  0xef0e 84
Router  *10.0.0.4      10.0.0.4    0x80000041 1068 0x2  0x46a9 84
Summary   10.0.0.1      10.0.0.2    0x80000047 2011 0x2  0xf509 28
Summary *10.0.0.5      10.0.0.4    0x8000003c 2268 0x2  0xd72c 28
Summary   10.0.0.6      10.0.0.3    0x80000033 2150 0x2  0xe527 28
Summary   10.1.12.0      10.0.0.2    0x80000047 942 0x2  0x5d98 28
Summary   10.1.36.0      10.0.0.3    0x80000036 50 0x2  0x707d 28
Summary *10.1.45.0      10.0.0.4    0x8000003d 1175 0x2  0xf8e3 28
ASBRSum   10.0.0.1      10.0.0.2    0x80000046 511 0x2  0xe915 28
ASBRSum    10.0.0.6      10.0.0.3    0x80000032 1681 0x2  0xd933 28
      OSPF link state database, area 0.0.0.2
  Type      ID          Adv Rtr      Seq      Age  Opt  Cksum  Len
Router    *10.0.0.4      10.0.0.4    0x8000003f 875 0x0  0x5913 48
Router      10.0.0.5      10.0.0.5    0x8000002e 1263 0x0  0x5a03 60
Summary   *0.0.0.0      10.0.0.4    0x80000019 768 0x0  0x4be3 28
Summary *10.0.0.1      10.0.0.4    0x80000040 575 0x0  0x20e4 28
Summary *10.0.0.2      10.0.0.4    0x80000040 468 0x0  0xcf8 28
Summary *10.0.0.3      10.0.0.4    0x8000003f 275 0x0  0x401 28
Summary *10.0.0.4      10.0.0.4    0x8000003d 168 0x0  0xf313 28
Summary *10.0.0.6      10.0.0.4    0x8000003d 2075 0x0  0xf30f 28
Summary *10.1.12.0      10.0.0.4    0x8000003f 1968 0x0  0x8973 28
Summary *10.1.23.0      10.0.0.4    0x8000003f 1775 0x0  0x10e1 28
Summary *10.1.24.0      10.0.0.4    0x8000003d 1668 0x0  0xfef4 28
Summary *10.1.34.0      10.0.0.4    0x8000003d 1475 0x0  0x9059 28
Summary *10.1.36.0      10.0.0.4    0x8000003d 1368 0x0  0x8462 28
      OSPF AS SCOPE link state database
  Type      ID          Adv Rtr      Seq      Age  Opt  Cksum  Len
Extern    10.0.0.100      10.0.0.2    0x8000005e 1542 0x2  0xcf20 36
Extern      10.0.0.101      10.0.0.6    0x8000002b 488 0x2  0x9791 36

```

**Meaning** The sample output shows that all the ABRs have the correct distribution of LSAs. Area 0.0.0.0 for all routers has Type 1 router, Type 3 summary, and Type 4 ASBR summary LSAs. Each ABR has an OSPF AS scope link-state database that includes Type 5 external LSAs.

Note that Type 2 network LSAs are not found in this topology because both broadcast or NMBA network types are not present.

NSSA area 0.0.0.1, in the output for R2, has Type 1 router, Type 3 summary, and Type 7 NSSA LSAs. Stub area 0.0.0.2, in the output for R4, has Type 1 router and Type 3 summary LSAs. Non-backbone area 0.0.0.3, in the output for R3, has Type 1 router, Type 3 summary, Type 4 ASBR, and Type 5 external LSAs.

All areas have a Type 1 router LSA because the Type 1 LSA is generated for each router that has interfaces in that area. Because this LSA has an area flooding scope, it remains within its own particular area and is not seen in other areas. For example, in the link-state database for area 0.0.0.2, there are two router LSAs: one for R4 and one for R5.

The ABR for that area places the routing information contained within the Type 1 LSA into a Type 3 summary or Type 4 ASBR summary LSA and forwards it across the area boundary. Whether the area receives a Type 3 or Type 4 summary LSA depends on whether the area is a stub area. Type 3 summary LSAs appear in all

areas, but Type 4 LSAs only appear in non-stub areas as indicated in the link-state databases for areas 0.0.0.1, 0.0.0.2, and 0.0.0.3.

Each ABR router has a Type 5 AS external LSA used to advertise any networks external to the OSPF AS. This LSA is flooded by the ABRs to each non-stub router in the entire AS. For example, within area 0.0.0.0, Type 5 LSAs exist for areas 0.0.0.1 and 0.0.0.3. Both of these areas are connected to routers (external router A and external router B) from other ASs, which results in the injection of external routes into the OSPF AS. However, there are no Type 5 LSAs in stub areas 0.0.0.1 and 0.0.0.2.

A Type 7 NSSA external LSA appears in NSSA area 0.0.0.1 and is used within the NSSA to advertise an external router. This LSA is flooded to each router in the NSSA and is not sent to other adjacent areas. For example, only area 0.0.0.1 has a Type 7 LSA. Because a Type 7 LSA does not traverse area boundaries, the ABR in the NSSA (R2) translates the Type 7 LSA into a Type 5 LSA that is forwarded to all areas (with the exception of stub areas).

The sample output shows that each router has two databases, indicating that it is an ABR between the backbone and a non-backbone, stub, or NSSA area. All of the addresses preceded by an asterisk (\*) are LSAs that originated with the router from which the output was taken.

## Examine OSPF Routes

**Purpose** You can determine if the LSAs that appear in the link-state database of a router are correct by examining the route to the destination. In this step, three routes are examined. The first example shows the route from R5 to external router A, the second shows the route from R6 to external router A, and the third shows the route from R4 to R6.

**Action** To examine a route in an OSPF AS, enter one or all of the following CLI commands:

```
user@host> show route destination-prefix
user@host> show ospf database
```

**Sample Output 1** The following sample output shows the path from R5 to external router A:

```
user@R5> show route 10.0.0.100
inet.0: 23 destinations, 25 routes (23 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
0.0.0.0/0          * [OSPF/10] 01:58:42, metric 11
                   > via so-0/0/2.0

user@R5> show ospf database
OSPF link state database, area 0.0.0.2
```

| Type    | ID        | Adv Rtr  | Seq        | Age  | Opt | Cksum  | Len |
|---------|-----------|----------|------------|------|-----|--------|-----|
| Router  | 10.0.0.4  | 10.0.0.4 | 0x8000002b | 140  | 0x0 | 0x81fe | 48  |
| Router  | *10.0.0.5 | 10.0.0.5 | 0x8000001f | 526  | 0x0 | 0x78f3 | 60  |
| Summary | 0.0.0.0   | 10.0.0.4 | 0x80000005 | 32   | 0x0 | 0x73cf | 28  |
| Summary | 10.0.0.1  | 10.0.0.4 | 0x8000002b | 2132 | 0x0 | 0x4acf | 28  |
| Summary | 10.0.0.2  | 10.0.0.4 | 0x8000002b | 1940 | 0x0 | 0x36e3 | 28  |
| Summary | 10.0.0.3  | 10.0.0.4 | 0x8000002a | 1832 | 0x0 | 0x2eeb | 28  |
| Summary | 10.0.0.4  | 10.0.0.4 | 0x80000028 | 1640 | 0x0 | 0x1efd | 28  |
| Summary | 10.0.0.6  | 10.0.0.4 | 0x80000029 | 1340 | 0x0 | 0x1cfa | 28  |
| Summary | 10.1.12.0 | 10.0.0.4 | 0x8000002b | 1232 | 0x0 | 0xb15f | 28  |
| Summary | 10.1.23.0 | 10.0.0.4 | 0x8000002b | 1040 | 0x0 | 0x38cd | 28  |

```

Summary 10.1.24.0      10.0.0.4      0x80000029    932  0x0  0x27e0  28
Summary 10.1.34.0      10.0.0.4      0x80000029    740  0x0  0xb845  28
Summary 10.1.36.0      10.0.0.4      0x80000029    632  0x0  0xac4e  28

```

**Sample Output 2** The following sample output shows the route from R6 to external router A:

**Sample Output**

```

user@R6> show route 10.0.0.100
inet.0: 29 destinations, 31 routes (29 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.0.0.100/32      * [OSPF/150] 16:52:11, metric 0, tag 0
                   > via so-0/0/3.0

user@R6> show ospf database
      OSPF link state database, area 0.0.0.3

```

| Type     | ID        | Adv Rtr  | Seq        | Age  | Opt | Cksum  | Len |
|----------|-----------|----------|------------|------|-----|--------|-----|
| Router   | 10.0.0.3  | 10.0.0.3 | 0x8000001d | 502  | 0x2 | 0x6639 | 48  |
| Router   | *10.0.0.6 | 10.0.0.6 | 0x80000019 | 807  | 0x2 | 0x443a | 60  |
| Summary  | 10.0.0.1  | 10.0.0.3 | 0x8000001c | 1570 | 0x2 | 0x50d7 | 28  |
| Summary  | 10.0.0.2  | 10.0.0.3 | 0x8000001c | 1402 | 0x2 | 0x3ceb | 28  |
| Summary  | 10.0.0.3  | 10.0.0.3 | 0x80000019 | 2470 | 0x2 | 0x2efc | 28  |
| Summary  | 10.0.0.4  | 10.0.0.3 | 0x80000019 | 1702 | 0x2 | 0x2efa | 28  |
| Summary  | 10.0.0.5  | 10.0.0.3 | 0x80000019 | 970  | 0x2 | 0x2ef8 | 28  |
| Summary  | 10.1.12.0 | 10.0.0.3 | 0x8000001c | 1270 | 0x2 | 0xb767 | 28  |
| Summary  | 10.1.23.0 | 10.0.0.3 | 0x8000001c | 1102 | 0x2 | 0x34e0 | 28  |
| Summary  | 10.1.24.0 | 10.0.0.3 | 0x8000001c | 2002 | 0x2 | 0x33df | 28  |
| Summary  | 10.1.34.0 | 10.0.0.3 | 0x8000001c | 802  | 0x2 | 0xba4f | 28  |
| Summary  | 10.1.45.0 | 10.0.0.3 | 0x80000019 | 1870 | 0x2 | 0x51af | 28  |
| ASBR Sum | 10.0.0.1  | 10.0.0.3 | 0x8000001c | 370  | 0x2 | 0x42e4 | 28  |
| ASBR Sum | 10.0.0.2  | 10.0.0.3 | 0x8000001c | 70   | 0x2 | 0x2ef8 | 28  |

```

      OSPF AS SCOPE link state database

```

| Type          | ID                | Adv Rtr         | Seq               | Age        | Opt        | Cksum        | Len       |
|---------------|-------------------|-----------------|-------------------|------------|------------|--------------|-----------|
| <b>Extern</b> | <b>10.0.0.100</b> | <b>10.0.0.2</b> | <b>0x80000042</b> | <b>384</b> | <b>0x2</b> | <b>0x804</b> | <b>36</b> |
| Extern        | *10.0.0.101       | 10.0.0.6        | 0x80000015        | 807        | 0x2        | 0xc37b       | 36        |
| Extern        | 10.1.13.0         | 10.0.0.2        | 0x80000041        | 234        | 0x2        | 0x481e       | 36        |
| Extern        | 10.1.15.0         | 10.0.0.2        | 0x80000041        | 233        | 0x2        | 0x3232       | 36        |
| Extern        | 100.168.64.0      | 10.0.0.2        | 0x80000041        | 82         | 0x2        | 0xe0f7       | 36        |

**Sample Output 3** The following sample output shows the route from R4 to R6:

**Sample Output**

```

user@R4> show route 10.0.0.6
inet.0: 27 destinations, 31 routes (27 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.0.0.6/32      * [OSPF/10] 17:02:28, metric 2
                   > via so-0/0/0.0

user@R4> show ospf database
      OSPF link state database, area 0.0.0.0

```

| Type           | ID              | Adv Rtr         | Seq               | Age        | Opt        | Cksum         | Len       |
|----------------|-----------------|-----------------|-------------------|------------|------------|---------------|-----------|
| Router         | 10.0.0.2        | 10.0.0.2        | 0x8000002f        | 632        | 0x2        | 0xc10         | 84        |
| Router         | 10.0.0.3        | 10.0.0.3        | 0x8000001e        | 2271       | 0x2        | 0x24f3        | 84        |
| Router         | *10.0.0.4       | 10.0.0.4        | 0x80000022        | 1582       | 0x2        | 0x848a        | 84        |
| Summary        | 10.0.0.1        | 10.0.0.2        | 0x8000002d        | 789        | 0x2        | 0x2aee        | 28        |
| Summary        | *10.0.0.5       | 10.0.0.4        | 0x8000001e        | 982        | 0x2        | 0x140e        | 28        |
| <b>Summary</b> | <b>10.0.0.6</b> | <b>10.0.0.3</b> | <b>0x8000001a</b> | <b>302</b> | <b>0x2</b> | <b>0x180e</b> | <b>28</b> |
| Summary        | 10.1.12.0       | 10.0.0.2        | 0x8000002c        | 1847       | 0x2        | 0x937d        | 28        |
| Summary        | 10.1.36.0       | 10.0.0.3        | 0x8000001c        | 771        | 0x2        | 0xa463        | 28        |
| Summary        | *10.1.45.0      | 10.0.0.4        | 0x8000001f        | 1789       | 0x2        | 0x35c5        | 28        |
| ASBR Sum       | 10.0.0.1        | 10.0.0.2        | 0x8000002b        | 1533       | 0x2        | 0x20f9        | 28        |
| ASBR Sum       | 10.0.0.6        | 10.0.0.3        | 0x80000018        | 2402       | 0x2        | 0xe19         | 28        |

```

      OSPF link state database, area 0.0.0.2

```

| Type           | ID               | Adv Rtr         | Seq               | Age        | Opt        | Cksum         | Len       |
|----------------|------------------|-----------------|-------------------|------------|------------|---------------|-----------|
| Router         | *10.0.0.4        | 10.0.0.4        | 0x80000020        | 1282       | 0x0        | 0x97f3        | 48        |
| Router         | 10.0.0.5         | 10.0.0.5        | 0x80000018        | 1685       | 0x0        | 0x86ec        | 60        |
| Summary        | *10.0.0.1        | 10.0.0.4        | 0x80000021        | 1189       | 0x0        | 0x5ec5        | 28        |
| Summary        | *10.0.0.2        | 10.0.0.4        | 0x80000021        | 889        | 0x0        | 0x4ad9        | 28        |
| Summary        | *10.0.0.3        | 10.0.0.4        | 0x80000020        | 682        | 0x0        | 0x42e1        | 28        |
| Summary        | *10.0.0.4        | 10.0.0.4        | 0x8000001e        | 1489       | 0x0        | 0x32f3        | 28        |
| <b>Summary</b> | <b>*10.0.0.6</b> | <b>10.0.0.4</b> | <b>0x8000001f</b> | <b>589</b> | <b>0x0</b> | <b>0x30f0</b> | <b>28</b> |
| Summary        | *10.1.12.0       | 10.0.0.4        | 0x80000021        | 382        | 0x0        | 0xc555        | 28        |
| Summary        | *10.1.23.0       | 10.0.0.4        | 0x80000021        | 289        | 0x0        | 0x4cc3        | 28        |
| Summary        | *10.1.24.0       | 10.0.0.4        | 0x80000020        | 82         | 0x0        | 0x39d7        | 28        |
| Summary        | *10.1.34.0       | 10.0.0.4        | 0x8000001f        | 2089       | 0x0        | 0xcc3b        | 28        |
| Summary        | *10.1.36.0       | 10.0.0.4        | 0x8000001f        | 1882       | 0x0        | 0xc044        | 28        |

OSPF AS SCOPE link state database

| Type   | ID           | Adv Rtr  | Seq        | Age | Opt | Cksum  | Len |
|--------|--------------|----------|------------|-----|-----|--------|-----|
| Extern | 10.0.0.100   | 10.0.0.2 | 0x80000042 | 484 | 0x2 | 0x804  | 36  |
| Extern | 10.0.0.101   | 10.0.0.6 | 0x80000015 | 910 | 0x2 | 0xc37b | 36  |
| Extern | 10.1.13.0    | 10.0.0.2 | 0x80000041 | 333 | 0x2 | 0x481e | 36  |
| Extern | 10.1.15.0    | 10.0.0.2 | 0x80000041 | 332 | 0x2 | 0x3232 | 36  |
| Extern | 100.168.64.0 | 10.0.0.2 | 0x80000041 | 182 | 0x2 | 0xe0f7 | 36  |

**Meaning** Sample output 1 shows an OSPF default route (0.0.0.0/0) with a preference value of 10. In the area 0.0.0.2 link-state database, a Type 3 summary LSA advertises the default route.

Sample output 2 shows an OSPF route with a preference value of 150. In the AS scope link-state database, an external Type 5 LSA indicates that the route from R6 to external router A is through R2, the advertising router. By default, routes resulting from OSPF external LSAs are installed with a preference value of 150.

Sample output 3 shows an OSPF route with a preference value of 10. In the area 0.0.0.0 link-state database, a summary Type 3 LSA indicates that the route from R4 to R6 is through R3, the advertising router.

The LSAs placed into the link-state database are used by the router to run the Dijkstra algorithm (also called the shortest path first algorithm). This computation uses the link-state database as a source, resulting in a loop-free topology using the best metric from the local router to all nodes in the OSPF network.

## Examine the Forwarding Table

**Purpose** You can display the set of routes installed in the forwarding table to verify that the routing protocol process (rpd) has relayed the correct information into the forwarding table. This is especially important when there are network problems, such as connectivity. In this procedure, you verify that the routes displayed in Step 2 appear in the forwarding table for router R5.

**Action** To examine the forwarding table for a router, enter the following CLI command:

```
user@host> show route forwarding-table destination destination-prefix
```

**Sample Output**

```
user@R5> show route forwarding-table destination 10.0.0.3
Routing table: inet
Internet:
Destination          Type RtRef Next hop          Type Index NhRef Netif
10.0.0.3/32          user   0 10.1.15.0          ucst 285   7 so-0/0/1.0
user@R5> show route forwarding-table destination 10.0.0.3
```

```

Routing table: inet
Internet:
Destination          Type RtRef Next hop          Type Index NhRef Netif
10.0.0.3/32          user    0 10.1.56.0          ucst  281    9 so-0/0/0.0

```

**Meaning** The sample output shows the selected next hop between routers R5 and R3 sent from the `inet` routing table and installed into the forwarding table. The first instance shows the route through R1 and the second instance shows the route through R6. In both instances, the preferred route displayed in Step 2 is installed in the forwarding table.

In general, the sample output includes the destination address and destination type, the next-hop address and next-hop type, the number of references to the next hop, an index number into an internal next-hop database, and the interface used to reach the next hop.

## Examine Link-State Advertisements in Detail

You can obtain important information about the routers in your network by examining LSAs in detail.

To examine OSPF LSAs, follow these steps:

1. Examine a Type 1 Router LSA on page 138
2. Examine a Type 3 Summary LSA on page 139
3. Examine a Type 4 ASBR Summary LSA on page 140
4. Examine a Type 5 AS External LSA on page 141
5. Examine Type 7 NSSA External LSA on page 141

### Examine a Type 1 Router LSA

**Purpose** To examine a Type 1 router LSA, enter the following CLI operational mode command:

**Action** `user@host> show ospf database router extensive`

**Sample Output**

```

user@R1> show ospf database router extensive
  OSPF link state database, area 0.0.0.1
  Type      ID          Adv Rtr          Seq          Age  Opt  Cksum  Len
Router *10.0.0.1          10.0.0.1          0x8000005a    1180  0x0  0x5828  60
  bits 0x2 , link count 3
  id 10.0.0.1, data 255.255.255.255, Type Stub (3)
  TOS count 0, TOS 0 metric 0
  id 10.0.0.2, data 10.1.12.1, Type PointToPoint (1)
  TOS count 0, TOS 0 metric 1
  id 10.1.12.0, data 255.255.255.252, Type Stub (3)
  TOS count 0, TOS 0 metric 1
  Gen timer 00:30:19
  Aging timer 00:40:19
  Installed 00:19:40 ago, expires in 00:40:20, sent 00:19:38 ago
  Ours
Router 10.0.0.2          10.0.0.2          0x8000004b    679  0x0  0xe6c0  48
  bits 0x3, link count 2
  id 10.0.0.1, data 10.1.12.2, Type PointToPoint (1)
  TOS count 0, TOS 0 metric 1

```



```

id 10.1.12.0, data 255.255.255.252, Type Stub (3)
TOS count 0, TOS 0 metric 1
Aging timer 00:48:40
Installed 00:11:16 ago, expires in 00:48:41, sent 3w0d 23:33:12 ago

```

**Meaning** The sample output shows the details of two router LSAs: the first for R1 (\*10.0.0.1) and the second for R2 (10.0.0.2). The asterisk (\*) indicates that the LSA was generated by R1. You can also determine ownership of the LSA by the last line of the output in this case, *ours*.

Each time the LSA is updated, the sequence (*seq*) field increments, indicating that the router has the most recent version of the LSA. Values range from 0x80000001 to 0x7FFFFFFF. If the sequence field is not incrementing, there may be problems with the connection.

The *bits* field is set to 0x2 in the first LSA and 0x3 in the second LSA. When the *bits* field is set to 0x2, the originating router (R1) is an ASBR. When the *bits* field is set to 0x3, the originating router (R2) is both ABR and ASBR.

R1 has three links connected to area 0.0.0.1 shown by the link count field that is set to a value of 3. The *Type* field shows that R1 has a single point-to-point link to R2 and two links advertised as stub networks.

Each OSPF router generates a single Type 1 LSA to describe the status and cost (metric) of all links on the router. This LSA is flooded to each router in the OSPF area. It is defined as having an area scope, so it is not flooded across an area boundary.

### Examine a Type 3 Summary LSA

**Purpose** To examine a Type 3 summary LSA, enter the following CLI operational mode command:

**Action** user@host> **show ospf database netsummary extensive**

**Sample Output**

```

user@R2> show ospf database netsummary extensive
      OSPF link state database, area 0.0.0.0
      Type      ID              Adv Rtr          Seq           Age  Opt  Cksum  Len
Summary *10.0.0.1          10.0.0.2        0x80000043      529  0x2  0xfd05  28

      mask 255.255.255.255
      TOS 0x0, metric 1
      Gen timer 00:34:13
      Aging timer 00:51:10
      Installed 00:08:49 ago, expires in 00:51:11, sent 00:08:47 ago
      Ours ,
[...Output truncated...]
      OSPF link state database, area 0.0.0.1
[...Output truncated...]
Summary *10.0.0.5          10.0.0.2        0x80000047      2198  0x0  0xf506  28

      mask 255.255.255.255
      TOS 0x0, metric 2
      Gen timer 00:07:19
      Aging timer 00:23:22
      Installed 00:36:38 ago, expires in 00:23:22, sent 00:36:36 ago
      Ours,

```

**Meaning** The sample output shows that R2 is an ABR because it contains two databases: one for the backbone area 0.0.0.0 and one for area 0.0.0.1. Within the backbone area, the summary LSA \*10.0.0.1 is generated from R2 as indicated by the asterisk (\*) next to the link-state ID field, and ours in the last line of the LSA. The cost to transmit data out of the interface is 1, as indicated by the metric field.

Within area 0.0.0.1, the summary LSA \*10.0.0.5 is generated by R2 and has a metric of 2, which is the cost to R5 from R2. Before calculating the SPF algorithm, the local router (R2) must add an additional metric of 1 to the existing metric of 1. The additional metric of 1 must be added because there is another router between R2 and R5 (R4).

Each time the LSA is updated, the sequence (seq) field increments, indicating that the router has the most recent version of the LSA. Values range from 0x80000001 to 0x7FFFFFFF. If the sequence field is not incrementing, there may be problems with the connection.

## Examine a Type 4 ASBR Summary LSA

**Purpose** To examine a Type 4 ASBR summary LSA, enter the following CLI operational mode command:

**Action** user@host> **show ospf database asbrsummary extensive**

**Sample Output**

```
user@R3> show ospf database asbrsummary extensive
  OSPF link state database, area 0.0.0.0
[...Output truncated...]
ASBRSum *10.0.0.6          10.0.0.3          0x80000042  1023  0x2  0xb943  28
  mask 0.0.0.0
  TOS 0x0, metric 1
  Gen timer 00:27:57
  Aging timer 00:42:57
  Installed 00:17:03 ago, expires in 00:42:57, sent 00:17:01 ago
  Ours,
[...Output truncated...]
```

**Meaning** The sample output shows that an LSA within the backbone area, \*10.0.0.6, is generated by ASBR R3, as indicated by the asterisk (\*) next to the link-state ID field and ours in the last line of the LSA.

Each time the LSA is updated, the sequence (seq) field increments, indicating that the router has the most recent version of the LSA. Values range from 0x80000001 to 0x7FFFFFFF. If the sequence field is not incrementing, there may be problems with the connection.

Because the router ID of all the ASBR summary LSAs is a full 32-bit value, the network mask is not needed and is set to a value of 0.0.0.0. The metric for the LSA within the backbone area is set to 1, which is the cost to the advertising router (R3) from the originating router (R6). The metric is calculated before the SPF algorithm is calculated.

In general, each ABR that must transmit information about an ASBR from one OSPF area into another generates a Type 4 LSA. This LSA is flooded to each router in the

OSPF area. A Type 4 LSA is defined as having an area scope so that another ABR does not reflood it across the area boundary.

### Examine a Type 5 AS External LSA

**Purpose** To examine a Type 5 AS external LSA, enter the following CLI operational mode command:

**Action** user@host> **show ospf database extern extensive**

**Sample Output**

```
user@R2> show ospf database extern extensive
      OSPF AS SCOPE link state database
      Type      ID          Adv Rtr          Seq          Age  Opt  Cksum  Len
Extern *10.0.0.100      10.0.0.2      0x80000047    1377  0x2  0xfd09  36
mask 255.255.255.255
Type 2, TOS 0x0, metric 0, fwd addr 10.0.0.1, tag 0.0.0.0
Gen timer 00:21:02
Aging timer 00:37:02
Installed 00:22:57 ago, expires in 00:37:03, sent 00:22:55 ago
Ours,
[...Output truncated...]
```

**Meaning** The sample output shows one Type 5 external LSA, \*10.0.0.100. The status of the router represented by this LSA is indicated by the **fwd addr** field, which shows that it does not belong to any particular OSPF area. The forwarding address provides the address toward which packets should be sent to reach the external router (10.0.0.1). R1 is the ASBR with the connection to external router A.

The **mask** field represents the subnet mask associated with the advertised router. It is used with the link-state ID field (10.0.0.100), which encapsulates the network address in a Type 5 LSA. This LSA has a metric value of 0, the default value, indicating that this is a Type 2 external metric. Thus, any local router should use the default metric (0) when performing an SPF algorithm.

Each time the LSA is updated, the sequence (**seq**) field increments, indicating that the router has the most recent version of the LSA. Values range from 0x80000001 to 0x7FFFFFFF. If the sequence field is not incrementing, there may be problems with the connection.

In general, each ASBR generates a Type 5 LSA to advertise any routers external to the OSPF AS. This LSA is flooded to each non-stub router in the entire AS.

### Examine Type 7 NSSA External LSA

**Purpose** To examine a Type 7 NSSA external LSA, enter the following CLI operational mode command:

**Action** user@host> **show ospf database nssa extensive**

**Sample Output**

```
user@R1> show ospf database nssa extensive
      OSPF link state database, area 0.0.0.1
      Type      ID          Adv Rtr          Seq          Age  Opt  Cksum  Len
[...Output truncated...]
NSSA *10.0.0.100      10.0.0.1      0x8000003b    843  0x8  0xa566  36
```

```

mask 255.255.255.255
  Type 2, TOS 0x0, metric 0, fwd addr 10.0.0.1, tag 0.0.0.0
Gen timer 00:35:56
Aging timer 00:45:56
Installed 00:14:03 ago, expires in 00:45:57, sent 00:14:01 ago
Ours

```

**Meaning** The sample output shows that the LSA belongs to a single NSSA, 0.0.0.1, and was generated by R1. This router has a metric value of 0, which is the default, and is listed as a Type 2 external metric. Any local router must use the default metric as the total cost for the route when performing an SPF calculation. The default metric of the route must be added to the cost to reach the advertising ASBR. This value then represents the total cost for the route.

In general, each ASBR within the NSSA generates a Type 7 LSA to advertise any routers external to the OSPF AS. This LSA is flooded to each router within the NSSA (R2). Because the LSA has only an area flooding scope, it is not sent into other adjacent areas. For each Type 7 LSA received, the ABR (R2) translates the information into a Type 5 LSA and sends the information into the backbone. The other backbone routers do not know that the original information came from an NSSA. The Type 5 LSA is then flooded to each non-stub router in the entire AS.

## Chapter 13

# Verify the BGP Protocol and Peers

This chapter describes how to check whether the Border Gateway Protocol (BGP) is configured correctly on a Juniper Networks router in your network, the internal Border Gateway Protocol (IBGP) and exterior Border Gateway Protocol (EBGP) sessions are properly established, the external routes are advertised and received correctly, and the BGP path selection process is working properly.

- Checklist for Verifying the BGP Protocol and Peers on page 143
- Verify the BGP Protocol on page 144
- Verify BGP Peers on page 151
- Examine BGP Routes and Route Selection on page 157
- Examine Routes in the Forwarding Table on page 163

## Checklist for Verifying the BGP Protocol and Peers

**Purpose** Table 32 on page 143 provides links and commands for verifying whether the Border Gateway Protocol (BGP) is configured correctly on a Juniper Networks router in your network, the internal Border Gateway Protocol (IBGP) and exterior Border Gateway Protocol (EBGP) sessions are properly established, the external routes are advertised and received correctly, and the BGP path selection process is working properly.

**Table 32: Checklist for Verifying the BGP Protocol and Peers**

| Tasks                                                                        | Command or Action                                           |
|------------------------------------------------------------------------------|-------------------------------------------------------------|
| <b>“Verify the BGP Protocol” on page 144</b>                                 |                                                             |
| 1. Verify BGP on an Internal Router on page 146                              | show configuration                                          |
| 2. Verify BGP on a Border Router on page 148                                 | show configuration                                          |
| <b>“Verify BGP Peers” on page 151</b>                                        |                                                             |
| 1. Check That BGP Sessions Are Up on page 153                                | show bgp summary                                            |
| 2. Verify That a Neighbor is Advertising a Particular Route on page 156      | show route advertising-protocol bgp <i>neighbor-address</i> |
| 3. Verify That a Particular BGP Route Is Received on Your Router on page 156 | show route receive-protocol bgp <i>neighbor-address</i>     |
| <b>“Examine BGP Routes and Route Selection” on page 157</b>                  |                                                             |

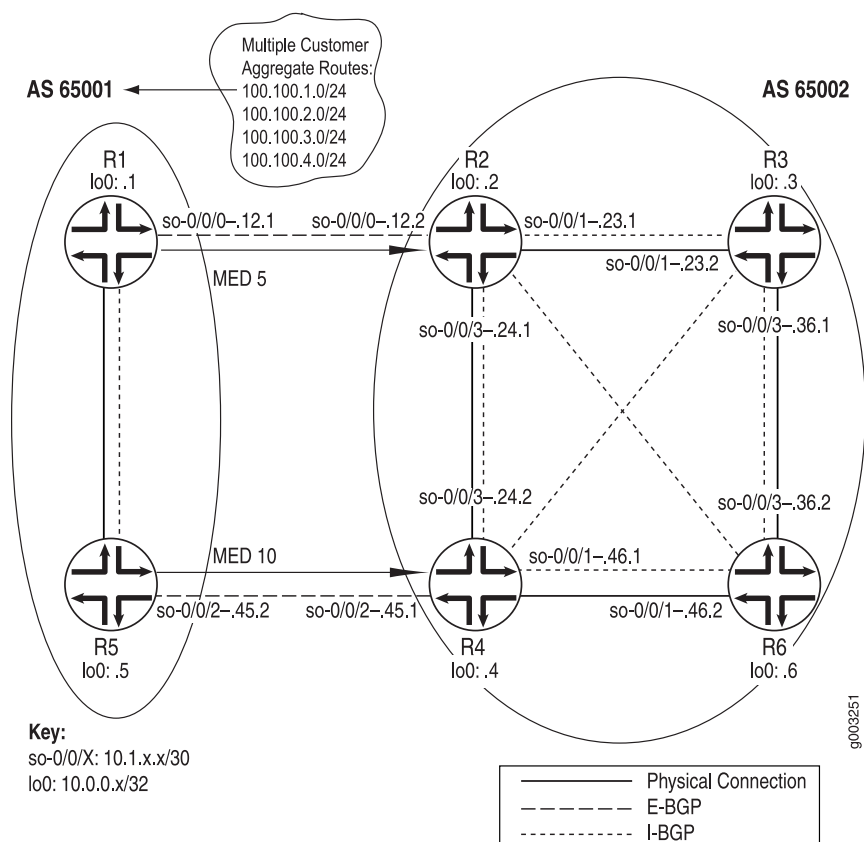
**Table 32: Checklist for Verifying the BGP Protocol and Peers** *(continued)*

| Tasks                                                                  | Command or Action                                           |
|------------------------------------------------------------------------|-------------------------------------------------------------|
| 1. Examine the Local Preference Selection on page 159                  | <code>show route destination-prefix &lt; detail &gt;</code> |
| 2. Examine the Multiple Exit Discriminator Route Selection on page 160 | <code>show route destination-prefix &lt; detail &gt;</code> |
| 3. Examine the EBGP over IBGP Selection on page 161                    | <code>show route destination-prefix &lt; detail &gt;</code> |
| 4. Examine the IGP Cost Selection on page 162                          | <code>show route destination-prefix &lt; detail &gt;</code> |
| <b>“Examine Routes in the Forwarding Table” on page 163</b>            | <code>show route forwarding-table</code>                    |

## Verify the BGP Protocol

**Purpose** For BGP to run on a router in your network, you must define the local autonomous system (AS) number, configure at least one group, and include information about at least one peer in the group. If the peer is an EBGP peer, include the peer’s AS number. For all peers, include either the peer’s interface IP address or loopback (lo0) IP address. When configuring BGP on an interface, you must also include the **family inet** statement at the `[edit interfaces interface-name unit logical-unit-number]` hierarchy level.

Figure 14 on page 145 illustrates the example configurations used in this topic.

**Figure 14: BGP Configuration Topology**

The network in Figure 14 on page 145 consists of two directly connected ASs. IP addresses included in the network diagram are as follows:

- 10.1.12.1—AS 650001 external IP address on R1
- 10.1.45.2—AS 650001 external IP address on R5
- 10.0.0.1—Internal loopback (lo0) IP address for R1
- 10.0.0.5—Internal loopback (lo0) IP address for R5
- 10.1.12.2—AS 65002 external IP address on R2
- 10.1.45.1—AS 65002 external IP address on R5
- 10.0.0.2—Internal loopback (lo0) address for R2
- 10.0.0.3—Internal loopback (lo0) address for R3
- 10.0.0.4—Internal loopback (lo0) address for R4
- 10.0.0.6—Internal loopback (lo0) address for R6

All routers within each AS maintain an IBGP session between each router in that AS. R1 and R5 have an IBGP session through their loopback (lo0) interfaces: 10.0.0.1 and 10.0.05. R2, R3, R4, and R6 maintain IBGP sessions between each other through their loopback (lo0) interfaces: 10.0.0.2, 10.0.0.3, 10.0.0.4, and 10.0.0.6.

The two routers in AS 65001 each contain one EBGP link to AS 65002 (R2 and R4) over which they announce aggregated prefixes: 100.100/16. Routers at the edge of a network that communicate directly with routers in other networks are called border routers. Border routers use EBGP to exchange routing information between networks.

Adjacent BGP routers are referred to as neighbors or peers. Peers can be internal or external to the AS. Internal and external peers are configured slightly differently. In general, internal peers communicate using the loopback (lo0) interface, and external peers communicate through the shared interface. See Figure 14 on page 145 for the loopback (lo0) and interface information.

To verify the BGP configuration of a router in your network, follow these steps:

1. Verify BGP on an Internal Router on page 146
2. Verify BGP on a Border Router on page 148

### Verify BGP on an Internal Router

**Purpose** To verify the BGP configuration of an internal router.

**Action** To verify the BGP configuration of an internal router, enter the following JUNOS command-line interface (CLI) command:

```
user@host> show configuration
```

**Sample Output**

```
user@R3> show configuration
[...Output truncated...]
interfaces {
  so-0/0/1 {
    unit 0 {
      family inet {
        address 10.1.23.2/30;
      }
      family iso;
    }
  }
  so-0/0/3 {
    unit 0 {
      family inet {
        address 10.1.36.1/30;
      }
      family iso;
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.0.0.3/32;
      }
      family iso {
        address 49.0002.1000.0000.0003.00;
      }
    }
  }
}
routing-options {
  [...Output truncated...]
  router-id 10.0.0.3;
}
```



```

    autonomous-system 65002;
}
protocols {
    bgp {
        group internal {
            type internal;
            local-address 10.0.0.3;
            neighbor 10.0.0.2;
            neighbor 10.0.0.4;
            neighbor 10.0.0.6;
        }
    }
    isis {
        level 1 disable;
        interface all {
            level 2 metric 10;
        }
        interface lo0.0;
    }
}

user@R6> show configuration |
[Output truncated...]
interfaces {
    so-0/0/1 {
        unit 0 {
            family inet {
                address 10.1.46.2/30;
            }
            family iso;
        }
    }
    so-0/0/3 {
        unit 0 {
            family inet {
                address 10.1.36.2/30;
            }
            family iso;
        }
    }
    lo0 {
        unit 0 {
            family inet {
                address 10.0.0.6/32;
            }
            family iso {
                address 49.0003.1000.0000.0006.00;
            }
        }
    }
}
routing-options {
    [Output truncated...]
    router-id 10.0.0.6;
    autonomous-system 65002;
}
protocols {
    bgp {
        group internal {
            type internal;
            local-address 10.0.0.6;

```

```

        neighbor 10.0.0.2;
        neighbor 10.0.0.3;
        neighbor 10.0.0.4;
    }
}
isis {
    level 1 disable;
    interface all {
        level 2 metric 10;
    }
    interface lo0.0;
}
}

```

**Meaning** The following sample output is for a BGP configuration on R3 in the network shown in Figure 14 on page 145:

The sample output shows a basic BGP configuration on routers R3 and R6. The local AS (65002) and one group (internal) are configured on both routers. R3 has three internal peers—10.0.0.2, 10.0.0.4, and 10.0.0.6—included at the [protocols bgp group group] hierarchy level. R6 also has three internal peers: 10.0.0.2, 10.0.0.3, and 10.0.0.4. The underlying IGP protocol is Intermediate System-to-Intermediate System (IS-IS), and relevant interfaces are configured to run IS-IS.

Note that in this configuration the router ID is manually configured to avoid any duplicate router ID problems.

## Verify BGP on a Border Router

**Purpose** To verify the BGP configuration of a border router.

**Action** To verify the BGP configuration of a border router, enter the following JUNOS CLI operational mode command:

```
user@host> show configuration
```

**Sample Output** The following sample output is for a BGP configuration on two border routers from AS 65002 (R2 and R4) shown in Figure 14 on page 145:

```

user@R2> show configuration
[...Output truncated...]
interfaces {
    so-0/0/0 {
        unit 0 {
            family inet {
                address 10.1.12.2/30;
            }
            family iso;
        }
    }
    so-0/0/1 {
        unit 0 {
            family inet {
                address 10.1.23.1/30;
            }
            family iso;
        }
    }
}

```

```

so-0/0/3 {
    unit 0 {
        family inet {
            address 10.1.24.1/30;
        }
        family iso;
    }
}
lo0 {
    unit 0 {
        family inet {
            address 10.0.0.2/32;
        }
        family iso {
            address 49.0002.1000.0000.0002.00;
        }
    }
}
}
routing-options {
[...Output truncated...]
    router-id 10.0.0.2;
    autonomous-system 65002;
}
protocols {
    bgp {
        group internal {
            type internal;
            export next-hop-self;
            neighbor 10.0.0.3;
            neighbor 10.0.0.4;
            neighbor 10.0.0.6;
        }
        group toR1 {
            type external;
            import import-toR1;
            peer-as 65001;
            neighbor 10.1.12.1;
        }
    }
    isis {
        level 1 disable;
        interface all {
            level 2 metric 10;
        }
        interface lo0.0;
    }
}
policy-options {
    policy-statement next-hop-self {
        term change-next-hop {
            from neighbor 10.1.12.1;
            then {
                next-hop self;
            }
        }
    }
    policy-statement import-toR1 {
        term 1 {
            from {
                route-filter 100.100.1.0/24 exact;
            }
        }
    }
}

```

```

    }
    then {
        local-preference 200;
    }
}

}

user@R4> show configuration
[...Output truncated...]
interfaces {
    so-0/0/1 {
        unit 0 {
            family inet {
                address 10.1.46.1/30;
            }
            family iso;
        }
    }
    so-0/0/2 {
        unit 0 {
            family inet {
                address 10.1.45.1/30;
            }
            family iso;
        }
    }
    so-0/0/3 {
        unit 0 {
            family inet {
                address 10.1.24.2/30;
            }
            family iso;
        }
    }
    lo0 {
        unit 0 {
            family inet {
                address 10.0.0.4/32;
            }
            family iso {
                address 49.0001.1000.0000.0004.00;
            }
        }
    }
}
routing-options {
    [...Output truncated...]
    router-id 10.0.0.4;
    autonomous-system 65002;
}
protocols {
    bgp {
        group internal {
            type internal;
            local-address 10.0.0.4;
            export next-hop-self;
            neighbor 10.0.0.2;
            neighbor 10.0.0.3;
            neighbor 10.0.0.6;
        }
        group toR5 {

```

```

        type external;
        peer-as 65001;
        neighbor 10.1.45.2;
    }
}
isis {
    level 1 disable;
    interface all {
        level 2 metric 10;
    }
    interface lo0.0;
}
policy-options {
    policy-statement next-hop-self {
        term change-next-hop {
            from neighbor 10.1.45.2;
            then {
                next-hop self;
            }
        }
    }
}

```

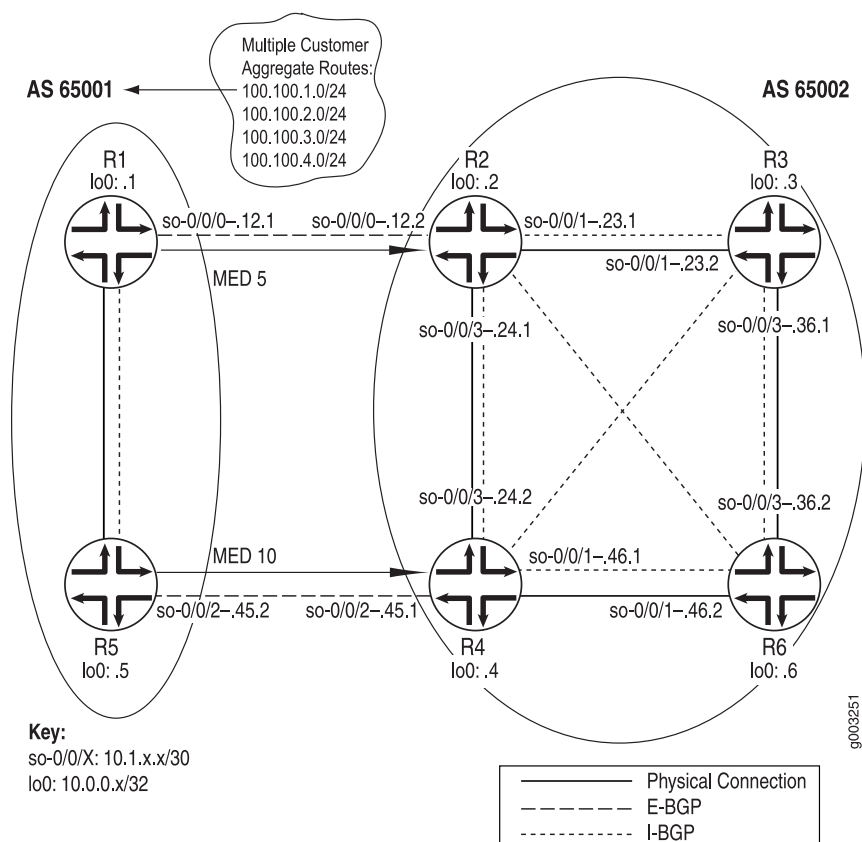
**Meaning** The sample output shows a basic BGP configuration on border routers R2 and R4. Both routers have the AS (65002) included at the [routing-options] hierarchy level. Each router has two groups included at the [protocols bgp group group] hierarchy level. External peers are included in the external group, either toR1 or toR5, depending on the router. Internal peers are included in the internal group. The underlying IGP protocol is IS-IS on both routers, and relevant interfaces are configured to run IS-IS.

Note that in the configuration on both routers, the router ID is manually configured to avoid duplicate router ID problems, and the **next-hop-self** statement is included to avoid any BGP next-hop reachability problems.

## Verify BGP Peers

**Purpose** Assuming that all the routers are correctly configured for BGP, you can verify if IBGP and EBGP sessions are properly established, external routes are advertised and received correctly, and the BGP path selection process is working properly.

Figure 15 on page 152 illustrates an example BGP network topology used in this topic.

**Figure 15: BGP Network Topology**

The network consists of two directly connected ASs consisting of external and internal peers. The external peers are directly connected through a shared interface and are running EBGP. The internal peers are connected through their loopback (lo0) interfaces through IBGP. AS 65001 is running OSPF and AS 65002 is running IS-IS as its underlying IGP. IBGP routers do not have to be directly connected, the underlying IGP allows neighbors to reach one another.

The two routers in AS 65001 each contain one EBGP link to AS 65002 (R2 and R4) over which they announce aggregated prefixes: 100.100.1.0, 100.100.2.0, 100.100.3.0, and 100.100.4.0. Also, R1 and R5 are injecting multiple exit discriminator (MED) values of 5 and 10, respectively, for some routes.

The internal routers in both ASs are using a full mesh IBGP topology. A full mesh is required because the networks are not using confederations or route reflectors, so any routes learned through IBGP are not distributed to other internal neighbors. For example, when R3 learns a route from R2, R3 does not distribute that route to R6 because the route is learned through IBGP, so R6 must have a direct BGP connection to R2 to learn the route.

In a full mesh topology, only the border router receiving external BGP information distributes that information to other routers within its AS. The receiving router does not redistribute that information to other IBGP routers in its own AS.

From the point of view of AS 65002, the following sessions should be up:

- The four routers in AS 65002 should have IBGP sessions established with each other.
- R2 should have an EBGP session established with R1.
- R4 should have an EBGP session established with R5.

To verify BGP peers, follow these steps:

1. Check That BGP Sessions Are Up on page 153
2. Verify That a Neighbor is Advertising a Particular Route on page 156
3. Verify That a Particular BGP Route Is Received on Your Router on page 156

### Check That BGP Sessions Are Up

**Purpose** To check that all IBGP and EBGP sessions are properly established.

**Action** To check that all IBGP and EBGP sessions are properly established, enter the following JUNOS CLI operational mode command:

```
user@host> show bgp summary
```

The following sample output from R2 shows four peers that are *not* established:

**Sample Output**

```
user@R2> show bgp summary
Groups: 2 Peers: 4 Down peers: 1
Table Tot Paths Act Paths Suppressed History Damp State Pending
inet.0 6 4 0 0 0 0
Peer AS InPkt OutPkt OutQ Flaps Last Up/Dwn
State|#Active/Received/Damped...
10.0.0.3 65002 86 90 0 2 42:54 0/0/0
0/0/0
10.0.0.4 65002 90 91 0 1 42:54 0/2/0
0/0/0
10.0.0.6 65002 87 90 0 3 3 Active
10.1.12.1 65001 89 89 0 1 42:54 4/4/0
0/0/0
```

The following sample output shows that all peers are established:

**Sample Output**

```
user@R2> show bgp summary
Groups: 2 Peers: 4 Down peers: 0
Table Tot Paths Act Paths Suppressed History Damp State Pending
inet.0 6 4 0 0 0 0
Peer AS InPkt OutPkt OutQ Flaps Last Up/Dwn
State|#Active/Received/Damped..
10.0.0.3 65002 54440 54457 0 1 2w4d21h 0/0/0
0/0/0
10.0.0.4 65002 51505 51507 0 0 2w3d21h 0/2/0
0/0/0
10.0.0.6 65002 14066 14070 0 1 4d 21:15:14 0/0/0
0/0/0
10.1.12.1 65001 88580 88587 0 0 4w2d18h 4/4/0
0/0/0

user@R3> show bgp summary
```

```

Groups: 1 Peers: 3 Down peers: 0
Table      Tot Paths  Act Paths Suppressed  History Damp State  Pending
inet.0      6          4          0          0      0      0      0
Peer      AS      InPkt    OutPkt    OutQ    Flaps Last
Up/Dwn State|#Active/Received/Damped...
10.0.0.2    65002    54476    54460      0      1      7:17 4/4/0
           0/0/0
10.0.0.4    65002    51527    51511      0      0      2w3d21h 0/2/0
           0/0/0
10.0.0.6    65002    54459    54459      0      0      2w4d21h 0/0/0
           0/0/0

```

```
user@R4> show bgp summary
```

```

Groups: 2 Peers: 4 Down peers: 0
Table      Tot Paths  Act Paths Suppressed  History Damp State  Pending
inet.0      8          4          0          0      0      0      0
Peer      AS      InPkt    OutPkt    OutQ    Flaps Last Up/Dwn
State|#Active/Received/Damped...
10.0.0.2    65002    51530    51532      0      1      8:59 2/4/0
           0/0/0
10.0.0.3    65002    51512    51531      0      0      2w3d21h 0/0/0
           0/0/0
10.0.0.6    65002    51515    51530      0      0      2w3d21h 0/0/0
           0/0/0
10.1.45.2   65001    51520    51530      0      0      2w3d21h 2/4/0
           0/0/0

```

```
user@R6> show bgp summary
```

```

Groups: 1 Peers: 3 Down peers: 0
Table      Tot Paths  Act Paths Suppressed  History Damp State  Pending
inet.0      6          4          0          0      0      0      0
Peer      AS      InPkt    OutPkt    OutQ    Flaps Last Up/Dwn
State|#Active/Received/Damped...
10.0.0.2    65002    88610    88587      0      2      10:30 2/4/0
           0/0/0
10.0.0.3    65002    54464    54468      0      1      2w4d22h 0/0/0
           0/0/0
10.0.0.4    65002    51532    51520      0      0      2w3d21h 2/2/0

```

**Meaning** Sample output 1 shows a peer that is not established, while sample output 2 shows that all IBGP and EBGP sessions shown in the network diagram in Figure 15 on page 152 are established.

Sample output 1 shows one peer (10.0.0.6) is not established, as indicated by the **Down Peers: 1** field. The **State|#Active/Received/Damped** column also displays **Active**, indicating that the peer is in the **Active** state and not yet established.

The **State|#Active/Received/Damped** column is a dual purpose field, as indicated by the pipe (|). When a peer is not established (as in our example), the field indicates the state of the peering session, such as active, connect, or idle. When the peer is in the **Established** state, the field displays the *number* of active, received, or damped routes received from the neighbor. For example, peer 10.0.0.6 is an example of the last column displaying the **Active** state, and peer 10.1.12.1 is an example of the last column showing the number of active, received, and damped routes (4/4/0). For more detailed information on the **show bgp summary** command, see the *JUNOS Routing Protocols and Policies Command Reference*.



If the BGP neighbor session is not established, use the **ping** and **show route** commands to verify network connectivity to the BGP neighbor. Also, use the **show log messages** command to look for any errors pertaining to the peer in question.

Sample output 2 shows that all IBGP and EBGP sessions shown in the network diagram in Figure 15 on page 152 are established, as indicated by the **Down Peers: 0** field and the last column that shows the number of routes.

Following is a description of the output for all established BGP peers, R2, R3, R4, and R6.

The route information for border router R2 shows the following:

- 0/0/0 for internal peers 10.0.0.3 and 10.0.0.6, indicating that no BGP routes are received or active in the routing table from those peers. No BGP routes are damped.
- 0/2/0 for internal peer 10.0.0.4, indicating that two received BGP routes are not active in the routing table. No BGP routes are damped.
- 4/4/0 for external peer 10.1.12.1, indicating that four received BGP routes are active in the routing table. No BGP routes are damped.

The route information for internal router R3 shows the following:

- 0/0/0 for internal peer 10.0.0.6, indicating that no BGP routes are received or active in the routing table from that peer. No BGP routes are damped.
- 0/2/0 for internal peer 10.0.0.4, indicating that two received BGP routes are not active in the routing table. No BGP routes are damped.
- 4/4/0 for internal peer 10.0.0.2, indicating that four received BGP routes are active in the routing table. No BGP routes are damped.

The route information for border router R4 shows the following:

- 0/0/0 for internal peers 10.0.0.3 and 10.0.0.6, indicating that no BGP routes are received or active in the routing table from those peers. No BGP routes are damped.
- 2/4/0 for internal peer 10.0.0.2 and external peer 10.1.45.1, indicating that two BGP routes are active in the routing table, but four are received. No BGP routes are damped.

The route information for internal router R6 shows the following:

- 0/0/0 for internal peer 10.0.0.3, indicating that no BGP routes are received or active in the routing table from that peer. No BGP routes are damped.
- 2/4/0 for internal peers 10.0.0.2, and 10.0.0.4, indicating that of the four received BGP routes, two are active in the routing table. No BGP routes are damped.

Other information in the sample output includes the following:

- Number of configured BGP groups: R2 has two groups configured (internal and toR1), and R4 also has two BGP groups configured (internal and toR5).
- Number of BGP peers to which the router is linked: R2 and R4 have four (one EBGP and three IBGP), and R3 and R6 have three IBGP. One peer is down (R6) in sample output 1.
- The name of the routing table storing the BGP routes, all routers are using inet.0.
- The total number of BGP paths, for example, R4 has a total of eight BGP paths from all of its peers.
- The number of active BGP routes, for example, R4 has a total of four active BGP routes from all of its peers.
- The second column of values (0/0/0) in the State|#Active/Received/Damped field indicates the number of multiprotocol BGP (MBGP) routes. All routers do not have any received, active, or damped MBGP routes.

### Verify That a Neighbor is Advertising a Particular Route

**Purpose** You can determine if a particular route that you have configured is being advertised by a neighbor.

**Action** To verify that a neighbor is advertising a particular route, enter the following JUNOS CLI operational mode command:

```
user@host> show route advertising-protocol bgp neighbor-address
```

**Sample Output**

```
user@R2> show route advertising-protocol bgp 10.0.0.4
inet.0: 20 destinations, 22 routes (20 active, 0 holddown, 0 hidden)
  Prefix                Nexthop          MED      Lclpref    AS path
* 100.100.1.0/24        Self             5         200        65001 I
* 100.100.2.0/24        Self             5         100        65001 I
* 100.100.3.0/24        Self             100       65001 I
* 100.100.4.0/24        Self             100       65001 I
```

**Meaning** The sample output shows the BGP routes advertised from R2 to its neighbor, 10.0.0.4 (R4). Out of 22 total routes in the inet.0 routing table, 20 are active destinations. No routes are hidden or in the hold-down state. Routes reside in the hold-down state prior to being declared active, and routes rejected by a routing policy can be placed into the hidden state. The information displayed reflects the routes that the routing table exported to the BGP routing protocol.

### Verify That a Particular BGP Route Is Received on Your Router

**Purpose** Display the routing information as it is received through a particular BGP neighbor and advertised by the local router to the neighbor.

**Action** To verify that a particular BGP route is received on your router, enter the following JUNOS CLI operational mode command:

```
user@host> show route receive-protocol bgp neighbor-address
```

**Sample Output**

```
user@R6> show route receive-protocol bgp 10.0.0.2
```

```

inet.0: 18 destinations, 20 routes (18 active, 0 holddown, 0 hidden)
  Prefix                Nexthop          MED      Lclpref   AS path
* 100.100.1.0/24        10.0.0.2         5        200       65001 I
* 100.100.2.0/24        10.0.0.2         5        100       65001 I
  100.100.3.0/24        10.0.0.2         100      65001 I
  100.100.4.0/24        10.0.0.2         100      65001 I
iso.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

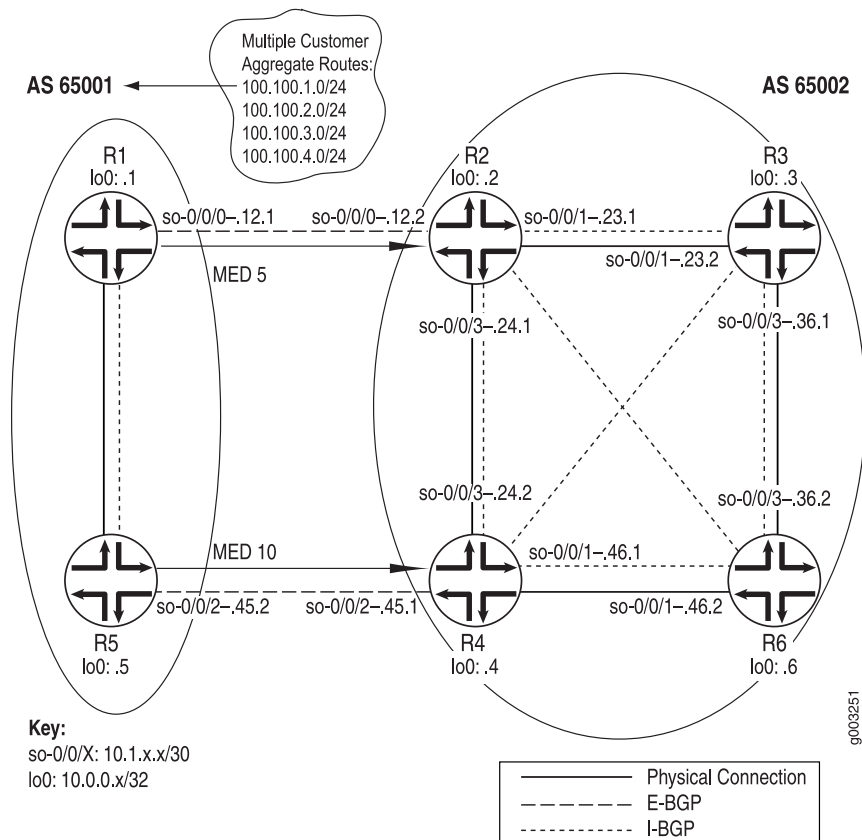
user@R6> show route receive-protocol bgp 10.0.0.4
inet.0: 18 destinations, 20 routes (18 active, 0 holddown, 0 hidden)
  Prefix                Nexthop          MED      Lclpref   AS path
* 100.100.3.0/24        10.0.0.4         100      65001 I
* 100.100.4.0/24        10.0.0.4         100      65001 I
iso.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)

```

**Meaning** The sample output shows four BGP routes from R2 and two from R4. Of the four routes from R2, only two are active in the routing table, as indicated by the asterisk (\*), while both routes received from R4 are active in the routing table. All BGP routes came through AS 65001.

## Examine BGP Routes and Route Selection

**Purpose** You can examine the BGP path selection process to determine the single, active path when BGP receives multiple routes to the same destination prefix.

**Figure 16: BGP Network Topology**

The network in Figure 16 on page 158 shows that R1 and R5 announce the same aggregate routes to R2 and R4, which results in R2 and R4 receiving two routes to the same destination prefix. The route selection process on R2 and R4 determines which of the two BGP routes received is active and advertised to the other internal routers (R3 and R6).

Before the router installs a BGP route, it must make sure that the BGP **next-hop** attribute is reachable. If the BGP next hop cannot be resolved, the route is not installed. When a BGP route is installed in the routing table, it must go through a path selection process if multiple routes exist to the same destination prefix. The BGP path selection process proceeds in the following order:

1. Route preference in the routing table is compared. For example, if an OSPF and a BGP route exist for a particular destination, the OSPF route is selected as the active route because the OSPF route has a default preference of 10, while the BGP route has a default preference of 170.
2. Routes are compared for local preference. The route with the highest local preference is preferred. For example, see “Examine the Local Preference Selection” on page 159.
3. The AS path attribute is evaluated. The shorter AS path is preferred.
4. The origin code is evaluated. The lowest origin code is preferred ( I (IGP) < E (EGP) < ? (Incomplete)).

5. The MED value is evaluated. By default, if any of the routes are advertised from the same neighboring AS, the lowest MED value is preferred. The absence of a MED value is interpreted as a MED of 0. For an example, see “Examine the Multiple Exit Discriminator Route Selection” on page 160.
6. The route is evaluated as to whether it is learned through EBGp or IBGP. EBGp learned routes are preferred to IBGP learned routes. For an example, see “Examine the EBGp over IBGP Selection” on page 161
7. If the route is learned from IBGP, the route with the lowest IGP cost is preferred. For an example, see “Examine the IGP Cost Selection” on page 162. The physical next hop to the IBGP peer is installed according to the following three rules:
  - a. After BGP examines the `inet.0` and `inet.3` routing tables, the physical next hop of the route with the lowest preference is used.
  - b. If the preference values in the `inet.0` and the `inet.3` routing tables are a tie, the physical next hop of the route in the `inet.3` routing table is used.
  - c. When a preference tie exists in the same routing table, the physical next hop of the route with more paths is installed.
8. The route reflection cluster list attribute is evaluated. The shortest length cluster list is preferred. Routes without a cluster list are considered to have a cluster list length of 0.
9. The router ID is evaluated. The route from the peer with the lowest router ID is preferred (usually the loopback address).
10. The peer address value is examined. The peer with the lowest peer IP address is preferred.

To determine the single, active path when BGP receives multiple routes to the same destination prefix, enter the following JUNOS CLI operational mode command:

```
user@host> show route destination-prefix < detail >
```

The following steps illustrate the inactive reason displayed when BGP receives multiple routes to the same destination prefix and one route is selected as the single, active path:

1. Examine the Local Preference Selection on page 159
2. Examine the Multiple Exit Discriminator Route Selection on page 160
3. Examine the EBGp over IBGP Selection on page 161
4. Examine the IGP Cost Selection on page 162

## **Examine the Local Preference Selection**

**Purpose** To examine a route to determine if local preference is the selection criteria for the single, active path.

**Action** To examine a route to determine if local preference is the selection criteria for the single, active path, enter the following JUNOS CLI operational mode command:

```
user@host> show route destination-prefix < detail >
```

```

Sample Output user@R4> show route 100.100.1.0 detail
inet.0: 20 destinations, 24 routes (20 active, 0 holddown, 0 hidden)
100.100.1.0/24 (2 entries, 1 announced)
    *BGP      Preference: 170/-201
        Source: 10.0.0.2
        Next hop: 10.1.24.1 via so-0/0/3.0, selected
        Protocol next hop: 10.0.0.2 Indirect next hop: 8644000 277
        State: <Active Int Ext>
        Local AS: 65002 Peer AS: 65002
        Age: 2:22:34      Metric: 5      Metric2: 10
        Task: BGP_65002.10.0.0.2+179
        Announcement bits (3): 0-KRT 3-BGP.0.0.0.0+179 4-Resolve inet.0

        AS path: 65001 I
        Localpref: 200
        Router ID: 10.0.0.2
    BGP      Preference: 170/-101
        Source: 10.1.45.2
        Next hop: 10.1.45.2 via so-0/0/2.0, selected
        State: <Ext>
        Inactive reason: Local Preference
        Local AS: 65002 Peer AS: 65001
        Age: 2w0d 1:28:31      Metric: 10
        Task: BGP_65001.10.1.45.2+179
        AS path: 65001 I
        Localpref: 100
        Router ID: 10.0.0.5

```

**Meaning** The sample output shows that R4 received two instances of the 100.100.1.0 route: one from 10.0.0.2 (R2) and one from 10.1.45.2 (R5). R4 selected the path from R2 as its active path, as indicated by the asterisk (\*). The selection is based on the local preference value contained in the **Localpref** field. The path with the *highest* local preference is preferred. In the example, the path with the higher local preference value is the path from R2, 200.

The reason that the route from R5 is not selected is in the **Inactive reason** field, in this case, **Local Preference**.

Note that the two paths are from the same neighboring network: AS 65001.

## Examine the Multiple Exit Discriminator Route Selection

**Purpose** To examine a route to determine if the MED is the selection criteria for the single, active path.

**Action** To examine a route to determine if the MED is the selection criteria for the single, active path, enter the following JUNOS CLI operational mode command:

```
user@host> show route destination-prefix < detail >
```

```

Sample Output user@R4> show route 100.100.2.0 detail
inet.0: 20 destinations, 24 routes (20 active, 0 holddown, 0 hidden)
100.100.2.0/24 (2 entries, 1 announced)
    *BGP      Preference: 170/-101
        Source: 10.0.0.2
        Next hop: 10.1.24.1 via so-0/0/3.0, selected
        Protocol next hop: 10.0.0.2 Indirect next hop: 8644000 277
        State: <Active Int Ext>

```

```

Local AS: 65002 Peer AS: 65002
Age: 2:32:01      Metric: 5      Metric2: 10
Task: BGP_65002.10.0.0.2+179
Announcement bits (3): 0-KRT 3-BGP.0.0.0.0+179 4-Resolve inet.0

  AS path: 65001 I
  Localpref: 100
  Router ID: 10.0.0.2
BGP Preference: 170/-101
  Source: 10.1.45.2
  Next hop: 10.1.45.2 via so-0/0/2.0, selected
  State: <NotBest Ext>
  Inactive reason: Not Best in its group
  Local AS: 65002 Peer AS: 65001
  Age: 2w0d 1:37:58      Metric: 10
  Task: BGP_65001.10.1.45.2+179
  AS path: 65001 I
  Localpref: 100
  Router ID: 10.0.0.5

```

**Meaning** The sample output shows that R4 received two instances of the 100.100.2.0 route: one from 10.0.0.2 (R2), and one from 10.1.45.2 (R5). R4 selected the path from R2 as its active route, as indicated by the asterisk (\*). The selection is based on the MED value contained in the **Metric** field. The path with the lowest MED value is preferred. In the example, the path with the lowest MED value (5) is the path from R2. Note that the two paths are from the same neighboring network: AS 65001.

The reason that the inactive path is not selected is displayed in the **Inactive reason** field, in this case, **Not Best in its group**. The wording is used because the JUNOS software uses the process of deterministic MED selection, by default.

## Examine the EBGP over IBGP Selection

**Purpose** To examine a route to determine if EBGP is selected over IBGP as the selection criteria for the single, active path.

**Action** To examine a route to determine if EBGP is selected over IBGP as the selection criteria for the single, active path, enter the following JUNOS CLI operational mode command:

```
user@host> show route destination-prefix < detail >
```

```

Sample Output user@R4> show route 100.100.3.0 detail
inet.0: 20 destinations, 24 routes (20 active, 0 holddown, 0 hidden)
100.100.3.0/24 (2 entries, 1 announced)
  *BGP      Preference: 170/-101
    Source: 10.1.45.2
    Next hop: 10.1.45.2 via so-0/0/2.0, selected
    State: <Active Ext>
    Local AS: 65002 Peer AS: 65001
    Age: 5d 0:31:25
    Task: BGP_65001.10.1.45.2+179
    Announcement bits (3): 0-KRT 3-BGP.0.0.0.0+179 4-Resolve inet.0

    AS path: 65001 I
    Localpref: 100
    Router ID: 10.0.0.5
BGP Preference: 170/-101
  Source: 10.0.0.2

```

```

Next hop: 10.1.24.1 via so-0/0/3.0, selected
Protocol next hop: 10.0.0.2 Indirect next hop: 8644000 277
State: <NotBest Int Ext>
  Inactive reason: Interior > Exterior > Exterior via Interior
Local AS: 65002 Peer AS: 65002
Age: 2:48:18 Metric2: 10
Task: BGP_65002.10.0.0.2+179
AS path: 65001 I
Localpref: 100
Router ID: 10.0.0.2

```

**Meaning** The sample output shows that R4 received two instances of the 100.100.3.0 route: one from 10.1.45.2 (R5) and one from 10.0.0.2 (R2). R4 selected the path from R5 as its active path, as indicated by the asterisk (\*). The selection is based on a preference for routes learned from an EBGp peer over routes learned from an IBGP. R5 is an EBGp peer.

You can determine if a path is received from an EBGp or IBGP peer by examining the **Local As** and **Peer As** fields. For example, the route from R5 shows the local AS is 65002 and the peer AS is 65001, indicating that the route is received from an EBGp peer. The route from R2 shows that both the local and peer AS is 65002, indicating that it is received from an IBGP peer.

The reason that the inactive path is not selected is displayed in the **Inactive reason** field, in this case, **Interior > Exterior > Exterior via Interior**. The wording of this reason shows the order of preferences applied when the same route is received from two routers. The route received from a strictly internal source (IGP) is preferred first, the route received from an external source (EBGP) is preferred next, and any route which comes from an external source and is received internally (IBGP) is preferred last.

## Examine the IGP Cost Selection

**Purpose** To examine a route to determine if EBGp is selected over IBGP as the selection criteria for the single, active path.

**Action** To examine a route to determine if EBGp is selected over IBGP as the selection criteria for the single, active path, enter the following JUNOS CLI operational mode command:

```
user@host> show route destination-prefix < detail >
```

**Sample Output**

```

user@R6> show route 100.100.4.0 detail
inet.0: 18 destinations, 20 routes (18 active, 0 holddown, 0 hidden)
100.100.4.0/24 (2 entries, 1 announced)
  *BGP Preference: 170/-101
    Source: 10.0.0.4
    Next hop: 10.1.46.1 via so-0/0/1.0, selected
    Protocol next hop: 10.0.0.4 Indirect next hop: 864c000 276
    State: <Active Int Ext>
    Local AS: 65002 Peer AS: 65002
    Age: 2:16:11 Metric2: 10
    Task: BGP_65002.10.0.0.4+4120
    Announcement bits (2): 0-KRT 4-Resolve inet.0
    AS path: 65001 I
    Localpref: 100
    Router ID: 10.0.0.4
  BGP Preference: 170/-101
    Source: 10.0.0.2

```



```

Next hop: 10.1.46.1 via so-0/0/1.0, selected
Next hop: 10.1.36.1 via so-0/0/3.0
Protocol next hop: 10.0.0.2 Indirect next hop: 864c0b0 278
State: <NotBest Int Ext>
Inactive reason: IGP metric
Local AS: 65002 Peer AS: 65002
Age: 2:16:03 Metric2: 20
Task: BGP_65002.10.0.0.2+179
AS path: 65001 I
Localpref: 100
Router ID: 10.0.0.2

```

**Meaning** The sample output shows that R6 received two instances of the 100.100.4.0 route: one from 10.0.0.4 (R4) and one from 10.0.0.2 (R2). R6 selected the path from R4 as its active route, as indicated by the asterisk (\*). The selection is based on the IGP metric, displayed in the Metric2 field. The route with the lowest IGP metric is preferred. In the example, the path with the lowest IGP metric value is the path from R4, with an IGP metric value of 10, while the path from R2 has an IGP metric of 20. Note that the two paths are from the same neighboring network: AS 65001.

The reason that the inactive path was not selected is displayed in the Inactive reason field, in this case, IGP metric.

## Examine Routes in the Forwarding Table

**Purpose** When you run into problems, such as connectivity problems, you may need to examine routes in the forwarding table to verify that the routing protocol process has relayed the correct information into the forwarding table.

**Action** To display the set of routes installed in the forwarding table, enter the following JUNOS CLI operational mode command:

```
user@host> show route forwarding-table
```

### Sample Output

```

user@R2> show route forwarding-table
Routing table: inet
Internet:

```

| Destination  | Type | RtRef | Next hop  | Type   | Index | NhRef | Netif      |
|--------------|------|-------|-----------|--------|-------|-------|------------|
| default      | perm | 0     |           | reject | 10    | 1     |            |
| 10.0.0.2/32  | intf | 0     | 10.0.0.2  | local  | 256   | 1     |            |
| 10.0.0.3/32  | user | 1     | 10.1.23.0 | ucst   | 282   | 4     | so-0/0/1.0 |
| 10.0.0.4/32  | user | 1     | 10.1.24.0 | ucst   | 290   | 7     | so-0/0/3.0 |
| 10.0.0.6/32  | user | 1     | 10.1.24.0 | ucst   | 290   | 7     | so-0/0/3.0 |
| 10.1.12.0/30 | intf | 1     | ff.3.0.21 | ucst   | 278   | 6     | so-0/0/0.0 |
| 10.1.12.0/32 | dest | 0     | 10.1.12.0 | recv   | 280   | 1     | so-0/0/0.0 |
| 10.1.12.2/32 | intf | 0     | 10.1.12.2 | local  | 277   | 1     |            |
| 10.1.12.3/32 | dest | 0     | 10.1.12.3 | bcst   | 279   | 1     | so-0/0/0.0 |
| 10.1.23.0/30 | intf | 0     | ff.3.0.21 | ucst   | 282   | 4     | so-0/0/1.0 |
| 10.1.23.0/32 | dest | 0     | 10.1.23.0 | recv   | 284   | 1     | so-0/0/1.0 |
| 10.1.23.1/32 | intf | 0     | 10.1.23.1 | local  | 281   | 1     |            |
| 10.1.23.3/32 | dest | 0     | 10.1.23.3 | bcst   | 283   | 1     | so-0/0/1.0 |
| 10.1.24.0/30 | intf | 0     | ff.3.0.21 | ucst   | 290   | 7     | so-0/0/3.0 |
| 10.1.24.0/32 | dest | 0     | 10.1.24.0 | recv   | 292   | 1     | so-0/0/3.0 |
| 10.1.24.1/32 | intf | 0     | 10.1.24.1 | local  | 289   | 1     |            |
| 10.1.24.3/32 | dest | 0     | 10.1.24.3 | bcst   | 291   | 1     | so-0/0/3.0 |
| 10.1.36.0/30 | user | 0     | 10.1.23.0 | ucst   | 282   | 4     | so-0/0/1.0 |
| 10.1.46.0/30 | user | 0     | 10.1.24.0 | ucst   | 290   | 7     | so-0/0/3.0 |

```

100.100.1.0/24    user    0 10.1.12.0      ucst   278    6 so-0/0/0.0
100.100.2.0/24    user    0 10.1.12.0      ucst   278    6 so-0/0/0.0
100.100.3.0/24    user    0 10.1.12.0      ucst   278    6 so-0/0/0.0
100.100.4.0/24    user    0 10.1.12.0      ucst   278    6 so-0/0/0.0
[...Output truncated...]

```

**Meaning** The sample output shows the network-layer prefixes and their next hops installed in the forwarding table. The output includes the same next-hop information as in the `show route detail` command (the next-hop address and interface name). Additional information includes the destination type, the next-hop type, the number of references to this next hop, and an index into an internal next-hop database. (The internal database contains additional information used by the Packet Forwarding Engine to ensure proper encapsulation of packets sent out an interface. This database is not accessible to the user.)

For detailed information about the meanings of the various flags and types fields, see the *JUNOS Routing Protocols and Policies Command Reference*.

## Chapter 14

# Verify the Routing Engine CPU Memory

This chapter describes how to verify the Routing Engine CPU memory on your Juniper Networks router.

- Checklist for Verifying the Routing Engine CPU Memory on page 165
- Check the Routing CPU Memory Usage on page 165

### Checklist for Verifying the Routing Engine CPU Memory

**Purpose** Table 33 on page 165 provides links and commands for verifying the routing engine CPU memory.

**Table 33: Checklist for Verifying the Routing Engine CPU Memory**

| Tasks                                                            | Command or Action                                           |
|------------------------------------------------------------------|-------------------------------------------------------------|
| <b>“Check the Routing CPU Memory Usage” on page 165</b>          |                                                             |
| 1. Check Overall CPU and Memory Usage on page 166                | show system process extensive                               |
| 2. Check Routing Protocol Process (rpd) Memory Usage on page 168 | show route summary<br>show task memory detail               |
| 3. Display Tasks on page 170                                     | show task<br>show task memory<br>show task <i>task-name</i> |

### Check the Routing CPU Memory Usage

**Purpose** Software processes on the router can consume a considerable amount of CPU and memory. The routing protocol process (rpd) can consume enormous amounts of memory to store information needed for the operation of routing and related protocols, such as Border Gateway Protocol (BGP), Open Shortest Path First (OSPF), Intermediate System-to-Intermediate System (ISIS), Resource Reservation Protocol (RSVP), Label Distribution Protocol (LDP), and Multiprotocol Label Switching (MPLS).

To verify the traffic passing through the router and check memory utilization, follow these steps:

1. Check Overall CPU and Memory Usage on page 166
2. Check Routing Protocol Process (rpd) Memory Usage on page 168
3. Display Tasks on page 170

## Check Overall CPU and Memory Usage

**Purpose** You can display exhaustive system process information about software processes that are running on the router 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.

**Action** To check overall CPU and memory usage, enter the following JUNOS command-line interface (CLI) command:

```
user@host> show system processes extensive
```

### Sample Output

```
user@R1> show system processes extensive
last pid: 5251; load averages: 0.00, 0.00, 0.00 up 4+20:22:16 10:44:41
58 processes: 1 running, 57 sleeping
Mem: 57M Active, 54M Inact, 17M Wired, 184K Cache, 35M Buf, 118M Free
Swap: 512M Total, 512M Free

  PID USERNAME PRI NICE  SIZE  RES STATE   TIME  WCPU   CPU COMMAND
  4480 root      2  0  3728K 1908K select 231:17 2.34% 2.34% chassisd
  4500 root      2  0  1896K  952K select   0:36 0.00% 0.00% fud
  4505 root      2  0  1380K  736K select   0:35 0.00% 0.00% irsd
  4481 root      2  0  1864K  872K select   0:32 0.00% 0.00% alarmd
  4488 root      2  0  8464K 4600K kqread  0:28 0.00% 0.00% rpd
  4501 root      2 -15 1560K  968K select   0:21 0.00% 0.00% ppm
  4510 root      2  0  1372K  812K select   0:13 0.00% 0.00% bfdd
   5 root     18  0    0K    0K syncer   0:09 0.00% 0.00% syncer
  4485 root      2  0  3056K 1776K select   0:07 0.00% 0.00% snmpd
  4499 root      2  0  3688K 1676K select   0:05 0.00% 0.00% kmd
  4486 root      2  0  3760K 1748K select   0:05 0.00% 0.00% mib2d
  4493 root      2  0  1872K  928K select   0:03 0.00% 0.00% pfed
  4507 root      2  0  1984K 1052K select   0:02 0.00% 0.00% fsad
  4518 root      2  0  3780K 2400K select   0:02 0.00% 0.00% dcd
   8 root     -18  0    0K    0K psleep   0:02 0.00% 0.00% vmuncachedaemo
   4 root     -18  0    0K    0K psleep   0:02 0.00% 0.00% bufdaemon
  4690 root      2  0    0K    0K peer_s   0:01 0.00% 0.00% peer proxy
  4504 root      2  0  1836K  968K select   0:01 0.00% 0.00% dfwd
  4477 root      2  0   992K  320K select   0:01 0.00% 0.00% watchdog
  4354 root      2  0  1116K  604K select   0:01 0.00% 0.00% syslogd
  4492 root     10  0  1004K  400K nanslp   0:01 0.00% 0.00% tnp.snmpd
  4446 root     10  0  1108K  616K nanslp   0:01 0.00% 0.00% cron
  4484 root      2  0 15716K 7468K select   0:01 0.00% 0.00% mgd
  4494 root      2 15 2936K 2036K select   0:01 0.00% 0.00% sampled
  5245 remote    2  0  8340K 3472K select   0:01 0.00% 0.00% cli
   2 root     -18  0    0K    0K psleep   0:00 0.00% 0.00% pagedaemon
  4512 root      2  0  2840K 1400K select   0:00 0.00% 0.00% l2tpd
   1 root     10  0   852K  580K wait    0:00 0.00% 0.00% init
  5244 root      2  0  1376K  784K select   0:00 0.00% 0.00% telnetd
  4509 root     10  0  1060K  528K nanslp   0:00 0.00% 0.00% eccd
  4508 root      2  0  2264K 1108K select   0:00 0.00% 0.00% spd
  2339 root     10  0   514M 17260K mfsidl   0:00 0.00% 0.00% newfs
```

```

4497 root      2   0 2432K 1152K select 0:00 0.00% 0.00% cosd
4490 root      2 -15 2356K 1020K select 0:00 0.00% 0.00% apsd
4496 root      2   0 2428K 1108K select 0:00 0.00% 0.00% rmopd
4491 root      2   0 2436K 1104K select 0:00 0.00% 0.00% vrrpd
4487 root      2   0 15756K 7648K sbwait 0:00 0.00% 0.00% mgd
5246 root      2   0 15776K 8336K select 0:00 0.00% 0.00% mgd
   0 root     -18   0   0K   0K sched 0:00 0.00% 0.00% swapper
5251 root    30   0 21732K  840K RUN   0:00 0.00% 0.00% top
4511 root      2   0 1964K  908K select 0:00 0.00% 0.00% pgmd
4502 root      2   0 1960K  956K select 0:00 0.00% 0.00% lmpd
4495 root      2   0 1884K  876K select 0:00 0.00% 0.00% ilmid
4482 root      2   0 1772K  776K select 0:00 0.00% 0.00% craftd
4503 root     10   0 1040K  492K nanslp 0:00 0.00% 0.00% smartd
   6 root     28   0   0K   0K sleep 0:00 0.00% 0.00% netdaemon
4498 root      2   0 1736K  932K select 0:00 0.00% 0.00% nasd
4506 root      2   0 1348K  672K select 0:00 0.00% 0.00% rtspd
4489 root      2   0 1160K  668K select 0:00 0.00% 0.00% inetd
4478 root      2   0 1108K  608K select 0:00 0.00% 0.00% tnetd
4483 root      2   0 1296K  540K select 0:00 0.00% 0.00% ntpd
4514 root      3   0 1080K  540K ttyin  0:00 0.00% 0.00% getty
4331 root      2   0  416K  232K select 0:00 0.00% 0.00% pccardd
   7 root      2   0   0K   0K pfeacc 0:00 0.00% 0.00% if_pfe_listen
  11 root      2   0   0K   0K picacc 0:00 0.00% 0.00% if_pic_listen
   3 root     18   0   0K   0K psleep 0:00 0.00% 0.00% vmdaemon
   9 root      2   0   0K   0K scs_ho 0:00 0.00% 0.00% scs_housekeepi
  10 root      2   0   0K   0K cb-pol 0:00 0.00% 0.00% cb_poll

```

**Meaning** The sample output shows the amount of virtual memory used by the Routing Engine and software processes. For example, 118 MB of physical memory is free and 512 MB of the swap file is free, indicating that the router is not short of memory. The **processes** field shows that most of the 58 processes are in the **sleeping** state, with 1 in the **running** state. The process or command that is running is the **top** command.

The **commands** column lists the processes that are currently running. For example, the chassis process (chassisd) has a process identifier (PID) of 4480, with a current priority (PRI) of 2. A lower priority number indicates a higher priority.

The processes are listed according to level of activity, with the most active process at the top of the output. For example, the chassis (chassisd) process is consuming the largest amount of CPU resource at 2.34 percent.

The memory field (**Mem**) shows the virtual memory managed by the Routing Engine and used by processes. The value in the memory field is in KB and MB, and is broken down as follows:

- **Active**—Memory that is allocated and actually in use by programs.
- **Inact**—Memory that is either allocated but not recently used or memory that was freed by programs. Inactive memory is still mapped in the address space of one or more processes and, therefore, counts toward the resident set size of those processes.
- **Wired**—Memory that is not eligible to be swapped, and is usually used for Routing Engine memory structures 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**—The size of the memory buffer used to hold data recently called from 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.

When the system is under memory pressure, the pageout process reuses memory from the free, cache, inactive and, if necessary, active pages.

The **Swap** field shows the total swap space available and how much is unused. In the example, the output shows 512 MB of total swap space and 512 MB of free swap space.

Finally, the memory usage of each process is listed. 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. In the sample output, the chassis (chassisd) process has 3728 KB of virtual address space and 1908 KB of physical memory.

For additional information about the `show system processes extensive` command, see “Stop and Start JUNOS Software” on page 33.

## Check Routing Protocol Process (rpd) Memory Usage

**Purpose** When you notice a lot of memory usage, you can obtain detailed information about the memory utilization of routing tasks to get an idea of what is going on. The routing process (rpd) is the main task that uses Routing Engine memory.

**Action** To check routing process memory usage, enter the following JUNOS CLI operational mode commands:

```
user@host> show route summary
user@host> show task memory detail
```

**Sample Output**

```
user@host> show route summary
Autonomous system number: 209
Router ID: 205.175.0.170
inet.0: 179783 destinations, 898393 routes (179771 active, 146 holddown, 157
hidden)
    Direct:    17 routes,    17 active
    Local:    18 routes,    18 active
    BGP: 896632 routes, 178010 active
    Static:   32 routes,    31 active
    IS-IS:   1694 routes,   1694 active
inet.2: 8766 destinations, 22700 routes (8766 active, 124 holddown, 73 hidden)
    Direct:    17 routes,    17 active
    Local:    18 routes,    18 active
    BGP: 20939 routes, 7006 active
    Static:   32 routes,    31 active
    IS-IS:   1694 routes,   1694 active
inet.3: 1614 destinations, 1719 routes (1614 active, 0 holddown, 0 hidden)
    IS-IS:   1613 routes,   1551 active
    RSVP:    45 routes,    45 active
    LDP:     61 routes,    18 active
iso.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
    Direct:    1 routes,    1 active
mpls.0: 371 destinations, 371 routes (371 active, 0 holddown, 0 hidden)
```

```

MPLS:      3 routes,      3 active
RSVP:     303 routes,    303 active
LDP:       65 routes,     65 active

```

```
user@R1> show task memory detail
```

```

----- Overall Memory Report -----
Size TP      Allocs  Mallocs  AllocBytes  MaxAllocs  MaxBytes  FreeBytes
12      8140   186959   2341188    200824     2409888   54972
16      4061    182      67888     4586       73376    5840
16 T      -       -         -         393571     6297136   -
20     688588  51    13772780   713704     14274080  423956
[...Output truncated...]
8192 P      91      -       745472     195        1597440   -
12288 P      -       -         -          1         12288     -
block      5       -       137200     14         137732    6160
pool       50      -        896       100        1792     3200
alloc      -       8       383744     10         397365    9472
-----
389169664 578341705 72977920
----- Allocator Memory Report -----
Name      Size Alloc DTP      Alloc      Alloc MaxAlloc  MaxAlloc
              Size      Blocks      Bytes  Blocks      Bytes
patricia_root_struct  8  12      7741    92892    8130    97560
sockaddr_un.i802      8  12        2        24        2        24
sockaddr_un.tag       8  12       371    4452     995    11940
if_addr_entry         8  12        -         -         1        12
gw_entry_list         8  12         1        12         1        12
isis_proto_list       8  12        25       300         30       360
struct krt_scb       12  16         4         64         6         96
ldp_rt_data          12  16        61       976        133      2128
config_list          12  16      2353    37648     2353    37648
TED NodeInfo         12  16       845    13520         907    14512
  isis_area_addr      12  16       544    8704         612    9792
isis_nh_list         12  16       237     3792         922    14752
isis_tsi             12  16        17       272         19       304
bgp_use_block        12  16        -         -         112      1792
isis_route_walk_cont  12  16 T        -         -          1        16
bgpg_rtinfo_entry     12  16 T        -         -     393571  6297136
task_floating_socket  16  20         1        20          1        20
[...Output truncated...]
rt_parse_memory      4092 4096 TP        -         -          1      4096
noblock_buffer_blk   4092 4096 TP         5    20480         811  3321856
bgp_buffer           4100 8192 P         91   745472         100  819200
bgp_outbuf           4104 8192 P         -         -          94  770048
ldp_buffer           4108 8192 P         -         -           7   57344
RPD SNMP             8268 12288 P         -         -           1  12288
LDP config           various      1        896          1       896
-----
349037508 543172620
----- Malloc Usage Report -----
Name      Allocs      Bytes  MaxAllocs  MaxBytes  FuncCalls
MGMT.local      1        12         1        12          1
RSVP             -         -         1     2048    156084
BGP_Group_Tweak-RTClie  2        24         2        24          2
[...Output truncated...]
LDP             2        24         2        24          2
KRT Request     -         -         1        16    446888
BGP_Group_Packet-Design  2        24         2        24          38
[...Output truncated...]
MPLS           22272  1221656    22274  1221784    228522
BGP.0.0.0.0+179  186419  2237028   192292  2307504  282141191

```

```

IS-IS I/O./var/run/ppmd      1      66536      43      103916  695536231
IS-IS                        2407     361372     5887     446076  889294754
BGP RT Background           3      66556      3      66556      3
SNMP Subagent./var/run/     -        24        1      9144     3677022
KRT                          2      205616      3      207900     10
ASPaths                     13901    1581544    18023    2067605  293868769
RT                           27        556       28        580     2815
Scheduler                   194      2604      199      2684     41382
--Anonymous--              4294944918 4293764616 4294967294 4294967292 45560848

--System--                  38565   35474324    38684   35487048   235115763
-----
                                40015436      41923181
Dynamically allocated memory: 485789696      Maximum: 541736960
Program data+BSS memory:     2101248      Maximum: 2101248
Page data overhead:          3039232      Maximum: 3039232
Page directory size:          512000      Maximum: 512000
-----
Total bytes in use: 491442176 (70% of available memory)

```

**Meaning** The sample output shows summary statistics about the entries in the routing table (`show route summary` command) and the memory usage breakdown (`show task memory detail` command) for the routing process (rpd). The two commands provide a comprehensive picture of the memory utilization of the routing protocol process.

The `show route summary` command shows the number of routes in the various routing tables. In the sample output, the routing tables represented are `inet.0`, `inet.2`, `inet.3`, `iso.0`, and `mpls.0`. Within each routing table, all of the active, hold-down, and hidden destinations and routes are summarized for all the protocols from which routes are learned. Routes are in the **hold-down** state prior to being declared inactive, and **hidden** routes are not used because of routing policy. Routes in the **hold-down** and **hidden** states are still using memory because they appear in the routing table.

In addition, routes are summarized in the following categories: those directly connected to the network (**Direct**), local routes (**Local**), and routes learned from configured routing protocols, such as BGP and IS-IS.

The `show task memory detail` command lists the data structures within the tasks run by the routing protocol process (rpd). Tasks are enabled depending on the router's configuration. For example, `isis_area_addr` is a data structure resulting from the IS-IS configuration. The `AllocBytes` field indicates the highest amount of memory used by the data structure. For example, the `isis_area_addr` data structure has 544 blocks of allocated memory, each block is allocated a value of 16 bytes, resulting in allocated bytes of 8704. The maximum allocated blocks and bytes are high-water marks for a data structure. For more information on displaying task-related information, see "Display Tasks" on page 170.

The **Total bytes in use** field shows the total amount of memory used by the routing protocol process (rpd).

## Display Tasks

**Purpose** You can display information about tasks to further your investigation of a memory problem on the router.



**Action** To display a list of tasks that are enabled on the router, enter the following JUNOS CLI operational mode commands:

```
user@host> show task
user@host> show task memory
user@host> show task task-name
```

**Sample Output**

```
user@R1> show task
Pri Task Name                                Pro  Port So Flags
10 LMP Client                                17 <>
10 IF
15 INET6
15 INET
15 ISO
15 Memory
20 RPD Unix Domain Server./var/run/rpd_serv.local 21 <>
20 RPD Unix Domain Server./var/run/rpd_serv.local 20 <>
20 RPD Unix Domain Server./var/run/rpd_serv.local 19 <>
20 RPD Unix Domain Server./var/run/rpd_server_communication 16 <Accept>
20 RPD Server.0.0.0.0+666                    666 15 <Accept>
20 Aggregate
20 RT
30 ICMP                                      1
30 Router-Advertisement
30 ICMPv6                                    58 9 <>
39 OSPFv2 I/O./var/run/ppmd_control          12 <>
40 l2vpn global task
40 BGP RT Background                        <LowPrio>
40 BGP.::+179                              179 23 <Accept LowPrio>
40 BGP.0.0.0.0+179                          179 22 <Accept LowPrio>
40 BFD I/O./var/run/bfdd_control             11 <>
40 OSPF                                      89
50 BGP_65001.10.0.0.5+3531                  3531 18 <LowPrio>
50 BGP_65002.10.1.12.2+1224                 1224 25 <LowPrio>
50 BGP_Group_internal                        <LowPrio>
50 BGP_Group_toR2                           <LowPrio>
50 TED
50 ASPaths
51 Resolve inet.0                          <LowPrio>
60 KStat                                    13 <>
60 KRT Request                              7 <>
60 KRT Ifstate                             255 6 <>
60 KRT                                      255 5 <>
60 Redirect
70 MGMT.local                              24 <>
70 MGMT_Listen./var/run/rpd_mgmt             14 <Accept>
70 SNMP Subagent./var/run/snmpd_stream       10 <>
80 IF Delete

user@R1> show task memory
Memory                                Size (kB)  %Available  When
Currently In Use:                     3490      1%          now
Maximum Ever Used:                     3535      1%          04/02/04 11:54:46
Available:                             220623    100%        now

user@R1> show task io
Task Name                                Reads  Writes  Rcvd  Sent  Dropped
LMP Client                              1      1      0     0     0
IF                                       0      0      0     0     0
INET6                                   0      0      0     0     0
INET                                    0      0      0     0     0
ISO                                     0      0      0     0     0
```

|                                |       |   |    |   |   |
|--------------------------------|-------|---|----|---|---|
| Memory                         | 0     | 0 | 0  | 0 | 0 |
| RPD Unix Domain Server./var/ru | 1     | 0 | 0  | 0 | 0 |
| RPD Unix Domain Server./var/ru | 1     | 0 | 0  | 0 | 0 |
| RPD Unix Domain Server./var/ru | 0     | 0 | 0  | 0 | 0 |
| RPD Unix Domain Server./var/ru | 3     | 0 | 0  | 0 | 0 |
| RPD Server.0.0.0.0+666         | 0     | 0 | 0  | 0 | 0 |
| Aggregate                      | 0     | 0 | 0  | 0 | 0 |
| RT                             | 0     | 0 | 0  | 0 | 0 |
| ICMP                           | 0     | 0 | 0  | 0 | 0 |
| Router-Advertisement           | 0     | 0 | 0  | 0 | 0 |
| ICMPv6                         | 0     | 0 | 0  | 0 | 0 |
| OSPFv2 I/O./var/run/ppmd_contr | 31167 | 1 | 0  | 0 | 0 |
| 12vpn global task              | 0     | 0 | 0  | 0 | 0 |
| BGP RT Background              | 0     | 0 | 0  | 0 | 0 |
| BGP.::+179                     | 0     | 0 | 0  | 0 | 0 |
| BGP.0.0.0.0+179                | 8     | 0 | 0  | 0 | 0 |
| BFD I/O./var/run/bfdd_control  | 30731 | 1 | 0  | 0 | 0 |
| OSPF                           | 0     | 0 | 0  | 0 | 0 |
| BGP_65001.10.0.0.5+3531        | 20486 | 0 | 0  | 0 | 0 |
| BGP_65002.10.1.12.2+1224       | 20489 | 6 | 0  | 0 | 0 |
| BGP_Group_internal             | 0     | 0 | 0  | 0 | 0 |
| BGP_Group_toR2                 | 0     | 0 | 0  | 0 | 0 |
| TED                            | 0     | 0 | 0  | 0 | 0 |
| ASPaths                        | 0     | 0 | 0  | 0 | 0 |
| Resolve inet.0                 | 0     | 0 | 0  | 0 | 0 |
| KStat                          | 0     | 0 | 0  | 0 | 0 |
| KRT Request                    | 0     | 0 | 57 | 0 | 0 |
| KRT Ifstate                    | 18    | 0 | 16 | 0 | 0 |
| KRT                            | 0     | 0 | 2  | 0 | 0 |
| Redirect                       | 0     | 0 | 0  | 0 | 0 |
| MGMT.local                     | 0     | 0 | 0  | 0 | 0 |
| MGMT_Listen./var/run/rpd_mgmt  | 23    | 0 | 0  | 0 | 0 |
| SNMP Subagent./var/run/snmpd_s | 23    | 0 | 0  | 0 | 0 |
| IF Delete                      | 0     | 0 | 0  | 0 | 0 |

**Meaning** The sample output shows a list of routing, routing protocol, and interface tasks that are currently running on the router (**show task**), a summary of memory utilization (**show task memory**), and the memory utilization of a particular task (**show task io**). Tasks can be baseline tasks performed regardless of the router configuration, and other tasks that depend on the router configuration. For example, the **BGP\_Group\_internal** task is the result of the configuration of BGP on the router, while the **INET6** task is a base task associated with the routing process (rpd).

Each task in the **show task** command output has a priority and a task name. For example, the current priority is 10 for **LMP Client** and 80 for **IF Delete**. A lower number indicates a higher priority.

Some tasks have flags attached to them. For example, the **BGP.0.0.0.0+179** task has two flags, **Accept** and **LowPrio**. The **Accept** flag indicates that the task is waiting for incoming connections, and the **LowPrio** flag indicates that the task will be dispatched to read its socket after other, higher priority tasks. Two additional flags are **Connect**, which indicates that a task is waiting for a connection to complete, and **Delete**, which indicates that a task has been deleted and is being cleaned up.

The **show task io** command shows the statistics gathered for each IO operation. The counters show the following:

- **Reads**—This counter increments when a datagram arrives on a connected socket of the task and the task's read callback is called.
- **Writes**—This counter increments when a connected socket of a task becomes writable and the task's callback is called.
- **Rcvd**—This counter increments when the task calls the Routing Engine to read a datagram from a socket which may or may not be connected.
- **Sent**—This counter increments when a task attempts to read or write a datagram on an existing or nonexisting socket.
- **Drops**—This counter increments when a task attempts to read or write a datagram through the Routing Engine on a prebuilt socket, but the request fails for any reason.



Chapter 15

Verify Traffic and Packets Through the Router

- This chapter describes how to verify traffic and packets entering and passing through your Juniper Networks router.
- Checklist for Verifying Traffic and Packets through the Router on page 175
  - Monitor Traffic through the Router on page 176
  - Verify Packets on page 178

Checklist for Verifying Traffic and Packets through the Router

**Purpose** Table 34 on page 175 provides links and commands for verifying traffic and packets through the router.

Table 34: Checklist for Verifying Traffic and Packets through the Router

| Tasks                                                                                       | Command or Action                               |
|---------------------------------------------------------------------------------------------|-------------------------------------------------|
| <b>“Monitor Traffic through the Router” on page 176</b>                                     |                                                 |
| 1. Display Real-Time Statistics about All Interfaces on the Router on page 176              | monitor interface traffic                       |
| 2. Display Real-Time Statistics about an Interface on page 176                              | monitor interface <i>interface-name</i>         |
| <b>“Verify Packets” on page 178</b>                                                         |                                                 |
| 1. Monitor Packets Sent from and Received by the Routing Engine on page 178                 | monitor traffic interface <i>interface-name</i> |
| 2. Display Key IP Header Information on page 179                                            | show firewall log                               |
| 3. Show Packet Count When a Firewall Filter Is Configured with the Count Option on page 180 | show firewall filter <i>filter-name</i>         |
| 4. Display Traffic from the Point of View of the Packet Forwarding Engine on page 181       | show pfe statistics traffic                     |

## Monitor Traffic through the Router

**Purpose** To continue your diagnosis of a problem, display real-time statistics about the traffic passing through physical interfaces on the router.

To display real-time statistics about physical interfaces, follow these steps:

1. Display Real-Time Statistics about All Interfaces on the Router on page 176
2. Display Real-Time Statistics about an Interface on page 176

### Display Real-Time Statistics about All Interfaces on the Router

**Purpose** To display real-time statistics about traffic passing through all interfaces on the router.

**Action** To display real-time statistics about traffic passing through all interfaces on the router, use the following JUNOS command-line interface (CLI) operational mode command:

```
user@host> monitor interface traffic
```

**Sample Output**

```
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
```

**Meaning** The sample output displays traffic data for active interfaces and the amount that each field has changed since the command started or since the counters were cleared by using the **C** key. In this example, the **monitor interface** command has been running for 15 seconds since the command was issued or since the counters last returned to zero.

### Display Real-Time Statistics about an Interface

**Purpose** To display real-time statistics about traffic passing through an interface on the router.

**Action** To display traffic passing through an interface on the router, use the following JUNOS CLI operational mode command:

```
user@host> monitor interface interface-name
```

**Sample Output**

```
user@R1> monitor interface so-0/0/1
Next='n', Quit='q' or ESC, Freeze='f', Thaw='t', Clear='c', Interface='i'
R1
Interface: so-0/0/1, Enabled, Link is Up
Encapsulation: PPP, Keepalives, Speed: OC3 Traffic statistics:
  Input bytes:                5856541 (88 bps)
  Output bytes:               6271468 (96 bps)
  Input packets:              157629 (0 pps)
  Output packets:             157024 (0 pps)
Encapsulation statistics:
  Input keepalives:           42353
  Output keepalives:          42320
LCP state: Opened
Error statistics:
  Input errors:                0
  Input drops:                 0
  Input framing errors:        0
  Input runs:                  0
  Input giants:                0
  Policed discards:            0
  L3 incompletes:              0
  L2 channel errors:           0
  L2 mismatch timeouts:        0
  Carrier transitions:         1
  Output errors:               0
  Output drops:                0
  Aged packets:                0
Active alarms : None
Active defects: None
SONET error counts/seconds:
  LOS count                    1
  LOF count                     1
  SEF count                     1
  ES-S                          77
  SES-S                         77
SONET statistics:
  BIP-B1                        0
  BIP-B2                        0
  REI-L                         0
  BIP-B3                        0
  REI-P                         0
Received SONET overhead:  F1      : 0x00  J0      : 0xZ
```

**Meaning** The sample output shows the input and output packets for a particular SONET interface (so-0/0/1). The information can include common interface failures, such as SONET/SDH and T3 alarms, loopbacks detected, and increases in framing errors. For more information, see “Track Error Conditions” on page 251.

To control the output of the command while it is running, use the keys shown in Table 35 on page 178.

**Table 35: Monitor Interface Output Control Keys**

| Action                                                                                                                                                                                                                       | Key |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Display information about the next interface. The <b>monitor interface</b> command scrolls through the physical or logical interfaces in the same order that they are displayed by the <b>show interfaces terse</b> command. | N   |
| Display information about a different interface. The command prompts you for the name of a specific interface.                                                                                                               | I   |
| Freeze the display, halting the display of updated statistics.                                                                                                                                                               | F   |
| Thaw the display, resuming the display of updated statistics.                                                                                                                                                                | T   |
| Clear (zero) the current delta counters since <b>monitor interface</b> was started. It does not clear the accumulative counter.                                                                                              | C   |
| Stop the <b>monitor interface</b> command.                                                                                                                                                                                   | Q   |

See the *JUNOS System Basics and Services Command Reference* for details on using match conditions with the **monitor traffic** command.

## Verify Packets

**Purpose** You can check the flow of packets to and from the router to further your investigation of issues on the router.

To verify packets, follow these steps:

1. Monitor Packets Sent from and Received by the Routing Engine on page 178
2. Display Key IP Header Information on page 179
3. Show Packet Count When a Firewall Filter Is Configured with the Count Option on page 180
4. Display Traffic from the Point of View of the Packet Forwarding Engine on page 181

### Monitor Packets Sent from and Received by the Routing Engine

**Purpose** To print packet headers transmitted through network interfaces sent from or received by the Routing Engine.

**Action** To print packet headers transmitted through network interfaces sent from or received by the Routing Engine, enter the following JUNOS CLI operational mode command:

```
user@host> monitor traffic interface interface-name
```

**Sample Output**

```
user@R1> monitor traffic interface so-0/0/1
verbose output suppressed, use <detail> or <extensive> for full protocol decode
Listening on so-0/0/1, capture size 96 bytes
11:23:01.666720 In IP 10.1.15.2 > OSPF-ALL.MCAST.NET: OSPFv2 Hello length: 48
11:23:01.666884 Out IP 10.1.15.1 > OSPF-ALL.MCAST.NET: OSPFv2 Hello length: 48
11:23:01.681330 Out IP 10.0.0.1.bgp > 10.0.0.5.3813: P 3821434885:3821434904(19)
```



```

ack 165811073 win 16417 <nop,nop,timestamp 42120056 42108995>: BGP, length: 19
11:23:01.682041 In IP 10.0.0.5.3813 > 10.0.0.1.bgp: P 1:20(19) ack 19 win 16398
<nop,nop,timestamp 42111985 42120056>: BGP, length: 19
11:23:01.781132 Out IP 10.0.0.1.bgp > 10.0.0.5.3813: . ack 20 win 16398
<nop,nop,timestamp 42120066 42111985>
11:23:03.996629 In LCP echo request (type 0x09 id 0x67 len 0x0008)
11:23:03.996645 Out LCP echo reply (type 0x0a id 0x67 len 0x0008)
11:23:04.801130 Out LCP echo request (type 0x09 id 0x6d len 0x0008)
11:23:04.801694 In LCP echo reply (type 0x0a id 0x6d len 0x0008)
^C
11 packets received by filter
0 packets dropped by kernel

```

**Meaning** The sample output shows the actual packets entering and leaving the Routing Engine, not the transit packets passing through the router. You can use this information to diagnose issues such as Point-to-Point Protocol negotiation, Border Gateway Protocol negotiation, and Open Shortest Path First hellos.

The **monitor traffic** command is similar to the UNIX **tcpdump** command. For more information about the **monitor traffic** command, see the *JUNOS System Basics and Services Command Reference*.



**CAUTION:** Use the **monitor traffic** command to diagnose problems on your router. Do not to leave this command on because it consumes Routing Engine resources.

## Display Key IP Header Information

**Purpose** To display key IP header information when you have a firewall configured with a log action.

**Action** To display key IP header information if you have a firewall configured with a log action, enter the following JUNOS CLI operational mode command:

```
user@host> show firewall log
```

**Sample Output**

```

user@R1> show firewall log
Time      Filter      A Interface      Pro Source address  Destination address
16:08:04 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:24373
16:08:03 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:29531
16:08:02 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:27265
16:08:01 pfe          A so-1/1/0.0     OSP 123.168.10.65 212.0.0.5:48
16:08:01 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:43943
16:08:00 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:58572
16:07:59 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:56307
16:07:58 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:60185
16:07:57 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:1600
16:07:56 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:6502
16:07:55 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:17548
16:07:54 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:5298
16:07:53 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:24536
16:07:52 sample-test A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:24373
16:07:52 sample-test A local          ICM 123.168.10.66 123.168.10.65:22325
16:07:52 pfe          A so-1/1/0.0     ICM 123.168.10.65 123.168.10.66:27900
16:07:51 pfe          A so-1/1/0.0     OSP 123.168.10.65 212.0.0.5:48

```

```
16:07:51 sample-test A so-1/1/0.0      ICM 123.168.10.65  123.168.10.66:29531
16:07:51 sample-test A local          ICM 123.168.10.66   123.168.10.65:27483
```

**Meaning** The sample output shows key IP header information about firewall filters on the router. The source and destination addresses of packets provide important information when you investigate problems on the router.

The **Filter** field contains information about how a packet traveled through the router before it was handled by either the Routing Engine or the Packet Forwarding Engine.

- If the filter name appears in the **Filter** field, the Routing Engine handled the packet. For example, **sample-test** is a firewall filter configured at the **[edit firewall]** hierarchy level.
- If the word **pfe** appears in the **Filter** field, the Packet Forwarding Engine handled the packet. The Packet Forwarding Engine receives information about the name of the firewall filter.

All packets were accepted (A). Other actions are discard (D) and reject (R).

The **Interface** column shows that all packets came through **so-1/1/0.0**, and **icm** or **osp** are the represented protocols. Other possible protocol names are: **egp**, **gre**, **ipip**, **pim**, **resp**, **tcp**, or **udp**.

## Show Packet Count When a Firewall Filter Is Configured with the Count Option

**Purpose** To show the packet count when a firewall filter is configured with the **count** option.

**Action** To show the packet count when a firewall filter is configured with the **count** option, enter the following JUNOS CLI operational mode command:

```
user@host> show firewall filter filter-name
```

The following sample output shows the **icmp** filter incrementing:

**Sample Output**

```
user@R1> show firewall filter icmp
Filter: icmp
Counters:
Name                                     Bytes      Packets
count-icmp                             252         3
```

**Sample Output** The following sample output shows a configuration of the **count** option:

```
[edit]
user@R1# show firewall filter icmp
term a {
    from {
        protocol icmp;
    }
    then count count-icmp;
}
term b {
    then accept;
}
```

**Meaning** The sample output shows that the packet matched a criteria in the icmp filter and the filter had a count action applied to it.

## **Display Traffic from the Point of View of the Packet Forwarding Engine**

**Purpose** To display traffic from the point of view of the Packet Forwarding Engine.

**Action** To display traffic from the point of view of the Packet Forwarding Engine, enter the following JUNOS CLI operational mode command:

```
user@host> show pfe statistics traffic
```

The following sample output was taken before packets were sent:

```
Sample Output user@R2> show pfe statistics traffic
PFE Traffic statistics:
    635392 packets input  (0 packets/sec)
    829862 packets output (0 packets/sec)
PFE Local Traffic statistics:
    579278 local packets input
    773747 local packets output
        0 software input high drops
        0 software input medium drops
        0 software input low drops
        1 software output drops
        0 hardware input drops
PFE Local Protocol statistics:
    0 hdlc keepalives
    0 atm oam
    0 fr lmi
    254613 ppp lcp/ncp
    0 ospf hello
    0 rsvp hello
    107203 isis iih
PFE Hardware Discard statistics:
    0 timeout
    0 truncated key
    0 bits to test
    0 data error
    0 stack underflow
    0 stack overflow
    0 normal discard
    0 extended discard
    0 invalid iif
    0 info cell drops
    0 fabric drops
```

The following sample output was taken after 100 packets were sent to router R2:

```
Sample Output user@R2> show pfe statistics traffic
PFE Traffic statistics:
    635595 packets input  (2 packets/sec)
    829990 packets output (2 packets/sec)
PFE Local Traffic statistics:
    579373 local packets input
    773869 local packets output
        0 software input high drops
        0 software input medium drops
        0 software input low drops
```

```

1 software output drops
0 hardware input drops
PFE Local Protocol statistics:
0 hdlc keepalives
0 atm oam
0 fr lmi
254655 ppp lcp/ncp
0 ospf hello
0 rsvp hello
107220 isis iih
PFE Hardware Discard statistics:
0 timeout
0 truncated key
0 bits to test
0 data error
0 stack underflow
0 stack overflow
100 normal discard
0 extended discard
0 invalid iif
0 info cell drops
0 fabric drops

```

**Meaning** The sample output shows the number and rate of packets entering and leaving the Packet Forwarding Engine. For example, the 100 packets sent to R2 were discarded due to a route that had a discard next hop configured, as shown in the **PFE Hardware Discard statistics** field. All counters increased as a result of the 100 packets.

Chapter 16

Use the ping and traceroute Commands

This chapter describes how to use the `ping` command to check the availability of various routers in a network topology, and how to use the `traceroute` command to check the path that packets travel between routers.

- Checklist for Using the ping and traceroute Commands on page 183
- Check the Accessibility of Two Routers on the Edge on page 183
- Examples of Unsuccessful ping and traceroute Commands on page 186

Checklist for Using the ping and traceroute Commands

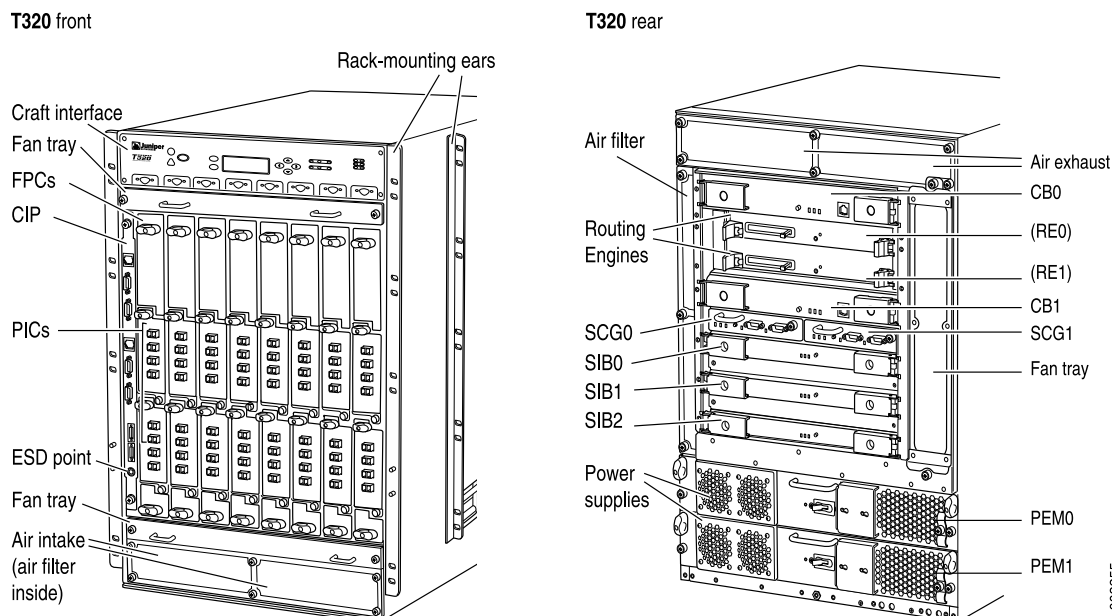
**Purpose** Table 36 on page 183 provides commands for using the `ping` command to check the availability of various routers in a network topology, and how to use the `traceroute` command to check the path that packets travel between routers.

Table 36: Checklist for Using the ping and traceroute Commands

| Tasks                                                                      | Command or Action                                                                               |
|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| <b>“Check the Accessibility of Two Routers on the Edge” on page 183</b>    |                                                                                                 |
| “Use Loopback Addresses” on page 184                                       | <code>ping remote-host count requests</code><br><code>traceroute remote-host</code>             |
| “Use Interface Addresses” on page 185                                      | <code>ping interface-address count requests</code><br><code>traceroute interface-address</code> |
| <b>“Examples of Unsuccessful ping and traceroute Commands” on page 186</b> |                                                                                                 |

Check the Accessibility of Two Routers on the Edge

**Purpose** This topic provides examples of how to use the `ping` command to check the reachability of various routers in a network topology, and how to use the `traceroute` command to check the path that packets travel between routers. The topology shown in Figure 17 on page 184 illustrates these commands.

**Figure 17: Topology for ping and traceroute Command Examples**

The network in Figure 17 on page 184 consists of two autonomous systems (ASs). AS 65001 includes two routers, and AS 65002 includes three routers. The border router (R1) in AS 65001 announces aggregated prefixes 100.100/24 to the AS 65002 network.

To check the reachability of routers and the path to the routers, follow these steps:

1. Use Loopback Addresses on page 184
2. Use Interface Addresses on page 185

## Use Loopback Addresses

**Purpose** You can ping one router from another router by specifying the other router's loopback address as the IP address in the **ping** and **traceroute** commands. In this step, R6 and R5 both ping and traceroute each other.

**Action** To ping and traceroute between R5 and R6, enter the following JUNOS command-line interface (CLI) operational mode commands:

```
user@host> ping remote-host count requests
user@host> traceroute remote-host
```

The following sample output is from R6 to R5, as shown in the network topology in Figure 17 on page 184:

**Sample Output**

```
user@R6> ping 10.0.0.5 count 3
PING 10.0.0.6 (10.0.0.6): 56 data bytes
64 bytes from 10.0.0.6: icmp_seq=0 ttl=255 time=0.298 ms
64 bytes from 10.0.0.6: icmp_seq=1 ttl=255 time=0.237 ms
64 bytes from 10.0.0.6: icmp_seq=2 ttl=255 time=0.273 ms
--- 10.0.0.6 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
```

```
round-trip min/avg/max/stddev = 0.237/0.269/0.298/0.025 ms
```

```
user@R6> traceroute 10.0.0.5
traceroute to 10.0.0.5 (10.0.0.5), 30 hops max, 40 byte packets
 1  10.1.26.1 (10.1.26.1)  0.626 ms  0.530 ms  0.489 ms
 2  10.1.12.1 (10.1.12.1)  0.546 ms  0.534 ms  0.507 ms
 3  10.0.0.5 (10.0.0.5)  0.749 ms  0.694 ms  0.686 ms
```

```
user@R5> ping 10.0.0.6 count 3
PING 10.0.0.6 (10.0.0.6): 56 data bytes
64 bytes from 10.0.0.6: icmp_seq=0 ttl=253 time=0.875 ms
64 bytes from 10.0.0.6: icmp_seq=1 ttl=253 time=0.815 ms
64 bytes from 10.0.0.6: icmp_seq=2 ttl=253 time=0.819 ms
--- 10.0.0.6 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.815/0.836/0.875/0.027 ms
```

```
user@R5> traceroute 10.0.0.6
traceroute to 10.0.0.6 (10.0.0.6), 30 hops max, 40 byte packets
 1  10.1.15.1 (10.1.15.1)  0.635 ms  39.951 ms  0.526 ms
 2  10.1.12.2 (10.1.12.2)  0.555 ms  0.535 ms  0.515 ms
 3  10.0.0.6 (10.0.0.6)  0.769 ms  0.720 ms  0.674 ms
```

**Meaning** The sample output shows a successful ping and traceroute between the R6 and R5 loopback (lo0) addresses. The ping is successful because the loopback addresses of both routers are advertised to their directly connected neighbors.

The output for the `traceroute` command shows the path from R6 to R5, which is through R2.



**NOTE:** A ping command might lose packets due to rate limiting of Internet Message Control Protocol (ICMP) packets on the specified host.

---

## Use Interface Addresses

**Purpose** You can ping interfaces on remote routers.

**Action** To ping and traceroute between R5 and R6, enter the following JUNOS CLI operational mode commands:

```
user@host> ping interface-address count requests
user@host> traceroute interface-address
```

**Sample Output**

```
user@R6> ping 10.1.15.2 count 3
PING 10.1.15.2 (10.1.15.2): 56 data bytes
64 bytes from 10.1.15.2: icmp_seq=0 ttl=253 time=2.738 ms
64 bytes from 10.1.15.2: icmp_seq=1 ttl=253 time=0.858 ms
64 bytes from 10.1.15.2: icmp_seq=2 ttl=253 time=0.849 ms
--- 10.1.15.2 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.849/1.482/2.738/0.888 ms
```

```
user@R6> traceroute 10.1.15.2
traceroute to 10.1.15.2 (10.1.15.2), 30 hops max, 40 byte packets
 1  10.1.26.1 (10.1.26.1)  0.617 ms  0.534 ms  0.500 ms
```

```

2 10.1.12.1 (10.1.12.1) 3.500 ms 0.543 ms 0.508 ms
3 10.1.15.2 (10.1.15.2) 0.699 ms 0.700 ms 0.672 ms

```

```

user@R5> ping 10.1.36.2 count 3
PING 10.1.36.2 (10.1.36.2): 56 data bytes
64 bytes from 10.1.36.2: icmp_seq=0 ttl=253 time=0.890 ms
64 bytes from 10.1.36.2: icmp_seq=1 ttl=253 time=0.857 ms
64 bytes from 10.1.36.2: icmp_seq=2 ttl=253 time=3.264 ms
--- 10.1.36.2 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.857/1.670/3.264/1.127 ms

```

```

user@R5> traceroute 10.1.36.2
traceroute to 10.1.36.2 (10.1.36.2), 30 hops max, 40 byte packets
 1 10.1.15.1 (10.1.15.1) 0.636 ms 7.979 ms 0.497 ms
 2 10.1.12.2 (10.1.12.2) 0.544 ms 0.547 ms 0.512 ms
 3 10.1.36.2 (10.1.36.2) 0.729 ms 0.696 ms 0.672 ms

```

**Meaning** The sample output shows a successful ping and traceroute between the interfaces on R6 and R5. The ping is successful because the interface addresses of both routers are advertised to their directly connected neighbors.

The output for the `traceroute` command shows the path from R6 to R5, which is through R2.



**NOTE:** A ping command might lose packets due to rate limiting of ICMP packets on the specified host.

## Examples of Unsuccessful ping and traceroute Commands

**Purpose** When the ping or traceroute commands are unsuccessful, it is useful to understand the output.

**Action** To ping and traceroute between R5 and R6, enter the following JUNOS CLI operational mode commands:

```

user@host> ping interface-address count requests
user@host> traceroute interface-address

```

### Sample Output 1

```

user@R6> ping 10.1.15.2 count 3
PING 10.1.15.2 (10.1.15.2): 56 data bytes
36 bytes from 10.1.26.1: Time to live exceeded
Vr HL TOS Len ID Flg off TTL Pro cks Src Dst
 4 5 00 0054 3648 0 0000 01 01 465c 10.1.26.2 10.1.15.2
36 bytes from 10.1.26.1: Time to live exceeded
Vr HL TOS Len ID Flg off TTL Pro cks Src Dst
 4 5 00 0054 364b 0 0000 01 01 4659 10.1.26.2 10.1.15.2
36 bytes from 10.1.26.1: Time to live exceeded
Vr HL TOS Len ID Flg off TTL Pro cks Src Dst
 4 5 00 0054 364f 0 0000 01 01 4655 10.1.26.2 10.1.15.2
^C
--- 10.1.15.2 ping statistics ---
3 packets transmitted, 0 packets received, 100% packet loss

user@R6> ping 10.0.0.5 count 3

```



```

PING 10.0.0.5 (10.0.0.5): 56 data bytes
ping: sendto: No route to host
ping: sendto: No route to host
ping: sendto: No route to host
^C
--- 10.0.0.5 ping statistics ---
3 packets transmitted, 0 packets received, 100% packet loss

user@R6> ping 10.1.15.2
PING 10.1.15.2 (10.1.15.2): 56 data bytes
^C
--- 10.1.15.2 ping statistics ---
4 packets transmitted, 0 packets received, 100% packet loss

```

**Sample Output 2**

```

user@R6> traceroute 10.1.15.2
traceroute to 10.1.15.2 (10.1.15.2), 30 hops max, 40 byte packets
 1  10.1.26.1 (10.1.26.1)  0.626 ms  0.526 ms  0.494 ms
 2  10.1.26.2 (10.1.26.2)  0.521 ms  0.529 ms  0.509 ms
 3  10.1.26.1 (10.1.26.1)  0.516 ms  0.536 ms  0.523 ms
 4  10.1.26.2 (10.1.26.2)  0.528 ms  0.547 ms  0.524 ms
 5  10.1.26.1 (10.1.26.1)  0.532 ms  0.549 ms  0.535 ms
 6  10.1.26.2 (10.1.26.2)  0.547 ms  0.566 ms  0.543 ms
 7  10.1.26.1 (10.1.26.1)  0.551 ms  0.569 ms  0.538 ms
 8  10.1.26.2 (10.1.26.2)  0.557 ms  0.580 ms  0.567 ms
 9  10.1.26.1 (10.1.26.1)  0.570 ms  0.598 ms  0.570 ms

user@R6> traceroute 10.1.15.2
traceroute to 10.1.15.2 (10.1.15.2), 30 hops max, 40 byte packets
 1  10.1.36.1 (10.1.36.1)  0.651 ms  7.834 ms  0.506 ms
 2  10.1.23.1 (10.1.23.1)  0.536 ms  0.538 ms  0.504 ms
 3  * * *
 4  * * *
 5  *^C

```

**Meaning** Sample output 1 shows three instances of the **ping** command not succeeding. In the first instance, the packets exceed the time-to-live value, which is decremented to 1, indicating that packets are being rejected possibly because of a loop. In the second instance, the local router does not know the route to the host. In the third instance, there is no route to the IP address, which might be due to packets being lost on a remote router.

Sample output 2 shows two instances of the **traceroute** command not succeeding. In the first instance, there is a loop between shared interfaces on **R6** and **R2**, as indicated by the **10.1.26.1** and **10.1.26.2** appearing repeatedly. In the second instance, the path goes through **R3** (**10.1.36.1**) to **R2** (**10.1.23.1**) when it times out, as indicated by the asterisk (\*). The timeout might be due to the absence of a route to the remote interface.



## Chapter 17

# Use MIBs

This chapter describes how to determine which Management Information Bases (MIBs) are supported by a Juniper Networks release, and how to query enterprise-specific and standard MIBs to retrieve management information for the various hardware and software components of a Juniper Networks router.

- Checklist for Using MIBs on page 189
- Determine Which MIBs Are Supported by a Juniper Release on page 190
- Run Snmpwalk from an NMS System to a Juniper Router on page 190
- Use SNMP Trace Operations to Monitor a Router on page 192
- Monitor Memory Usage on a Router on page 194
- Monitor CPU Utilization on page 200
- Retrieve Version Information about Router Software Components on page 204

### Checklist for Using MIBs

**Purpose** Table 37 on page 189 provides links commands for using standard MIBs to retrieve management information for the various hardware and software components of a Juniper Networks router.

**Table 37: Checklist for Using MIBs**

| Tasks                                                                        | Command or Action                                                                                                     |
|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| <b>“Determine Which MIBs Are Supported by a Juniper Release” on page 190</b> | <a href="http://www.juniper.net/techpubs/software/index.html">http://www.juniper.net/techpubs/software/index.html</a> |
| <b>“Run Snmpwalk from an NMS System to a Juniper Router” on page 190</b>     | <code>snmpwalk [common arguments] hostname community object-id</code>                                                 |
| <b>“Use SNMP Trace Operations to Monitor a Router” on page 192</b>           |                                                                                                                       |
| 1. Configure Trace Operations for SNMP on page 192                           | <code>[edit]<br/>edit snmp<br/>set traceoptions flag pdu<br/>commit and-quit</code>                                   |
| 2. Query a MIB With SNMPGet on page 193                                      | <code>snmpget hostname community oid</code>                                                                           |
| 3. Display the Output for SNMP Trace Operations on page 194                  | <code>show log snmp</code>                                                                                            |
| <b>“Monitor Memory Usage on a Router” on page 194</b>                        |                                                                                                                       |

**Table 37: Checklist for Using MIBs** *(continued)*

| Tasks                                                                              | Command or Action                                                                       |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1. Check Memory Utilization on Chassis Components on page 195                      | snmpwalk [common arguments] hostname community object-id<br>show chassis routing-engine |
| 2. Check Memory Utilization per Process on page 197                                | snmpwalk [common arguments] hostname community object-id                                |
| <b>“Monitor CPU Utilization” on page 200</b>                                       |                                                                                         |
| 1. Check CPU Utilization on page 200                                               | snmpwalk [common arguments] hostname community object-id                                |
| 2. Check CPU Utilization per Process on page 201                                   | snmpwalk [common arguments] hostname community object-id                                |
| <b>“Retrieve Version Information about Router Software Components” on page 204</b> |                                                                                         |
|                                                                                    | snmpwalk [common arguments] hostname community object-id                                |

## Determine Which MIBs Are Supported by a Juniper Release

**Purpose** When you update the router software, you might also want to update the corresponding MIBs. Links to the MIBs related to a release are located in the *JUNOS Software Installation and Upgrade Guide*. This guide lists the Juniper-specific enterprise MIBs, and provides a link to Simple Network Management Protocol (SNMP) standards that list the standard MIBs supported by the JUNOS software.

In addition, a tar file that contains all the Juniper Networks enterprise-specific MIBs is included in the JUNOS software package for each release.

**Action** To determine MIBs supported by a Juniper release, follow these steps:

1. Enter the following URL into the address line of your browser:  
  
`http://www.juniper.net/techpubs/software/index.html`
2. Select the release you are interested in.
3. From JUNOS Configuration Guides, select Network Management.
4. From the table of contents, select JUNOS Networks Enterprise-Specific MIBs.
5. From the table of contents, select SNMP Overview.
6. From SNMP Overview, select SNMP Standards.

## Run Snmpwalk from an NMS System to a Juniper Router

**Purpose** Snmpwalk is an SNMP application that you can use to query a MIB for information about the functioning of a router in your network. Snmpwalk uses GetNext requests

to retrieve the specified information. Object identifiers (OIDs) are used to query the MIB. If the OID argument is not present, Snmpwalk searches MIB-2.

**Action** To run Snmpwalk for a specific OID, from a management station that has access to the router, and using a tool such as Snmpwalk, enter the following command:

```
user-nms# snmpwalk [common arguments] hostname community object-id
```

**Sample Output**

```
user-nms % snmpwalk -Os -M /volume/~mibs -m all tp1 public .1.3.6.1.2.1.4
ipForwarding.0 = forwarding(1)
ipDefaultTTL.0 = 64
ipInReceives.0 = Counter32: 9262713
ipInHdrErrors.0 = Counter32: 0
ipInAddrErrors.0 = Counter32: 0
ipForwDatagrams.0 = Counter32: 614171
ipInUnknownProtos.0 = Counter32: 0
ipInDiscards.0 = Counter32: 0
ipInDelivers.0 = Counter32: 8648408
ipOutRequests.0 = Counter32: 1226483
ipOutDiscards.0 = Counter32: 0
ipOutNoRoutes.0 = Counter32: 0
ipReasmTimeout.0 = 60
ipReasmReqds.0 = Counter32: 0
ipReasmOKs.0 = Counter32: 0
ipReasmFails.0 = Counter32: 0
ipFragOKs.0 = Counter32: 0
ipFragFails.0 = Counter32: 0
ipFragCreates.0 = Counter32: 0
ipAdEntAddr.10.0.0.1 = IPAddress: 10.0.0.1
ipAdEntAddr.10.1.12.1 = IPAddress: 10.1.12.1
ipAdEntAddr.10.1.15.1 = IPAddress: 10.1.15.1
ipAdEntAddr.10.168.70.143 = IPAddress: 10.168.70.143
[...Output truncated...]
```

**Meaning** The sample output shows that the user is on a network management station (user-nms %) that has access to the router, **tp1**. In the command, the following options are used:

- **Os**—Deletes all but the last symbolic part of the OID **sysUpTime.0**. For example, Timeticks: (14096763) 1 day, 15:09:27.63.
- **-M**—Compiles the MIB and gives a path or location to the MIBs.
- **-m**—Uses the files in the directory pointed to by the **-M** option.
- **all**—Uses all the files in the directory pointed to by the **-M** option.

In addition, the command includes the hostname **tp1**, the community string **public**, and the OID **.1.3.6.1.2.1.4**.

The OID in this example is from RFC 2096, *IP Forwarding Table MIB*, which displays multipath IP routes that have the same network number but different network masks.

Before you can retrieve SNMP information from a router, you must have the minimum SNMP configuration for that router. Following is the minimum SNMP configuration required:

```
[edit]
snmp {
  community public {
    authorization read-only;
  }
}
```

With this configuration, the system responds to SNMP Get, GetNext, and GetBulk commands that contain the community string **public**.

For more detailed information on configuring SNMP on a router, see the *JUNOS Network Management Configuration Guide*.

## Use SNMP Trace Operations to Monitor a Router

**Purpose** Tracing operations record more detailed messages about the operation of SNMP, such as the various types of routing protocol packets sent and received, and routing policy actions. In this topic, traceoptions are configured on a router, a MIB object is queried through a network management station, and the action of the query is verified with a log file on the router.



**NOTE:** Traceoptions, in general, requires extra router resources. It is recommended that you do not leave it on permanently.

To use SNMP traceoptions to monitor a router, follow these steps:

1. Configure Trace Operations for SNMP on page 192
2. Query a MIB With SNMPGet on page 193
3. Display the Output for SNMP Trace Operations on page 194

### Configure Trace Operations for SNMP

**Purpose** Define tracing for SNMP to access more granular information about the packets sent and received through SNMP.

**Action** To configure SNMP tracing operations, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```
[edit]
user@R1# edit snmp
```

2. Configure trace operations:

```
[edit snmp]
user@R1# set traceoptions flag pdu
```

3. Commit the configuration:

```

user@R1# commit and-quit
commit complete
Exiting configuration mode

```

**Sample Output**

```

user@R1> show configuration snmp
view all {
    oid .1 include;
}
view system {
    oid system;
}
community public {
    view all;
    authorization read-only;
}
community private {
    view system;
    authorization read-write;
}
traceoptions {
    flag pdu;
}

```

**Meaning** The sample output shows a configuration for SNMP that includes traceoptions. The pdu flag is configured, which results in the generation of SNMP request and response packets. The output for the tracing operation is placed into various log files in the /var/log directory.

Protocol-specific tracing operations override any equivalent operations that you specify in the global traceoptions statement. If there are no equivalent operations, they supplement the global tracing options. If you do not specify any protocol-specific tracing, the routing protocol inherits all the global tracing operations.

## Query a MIB With SNMPGet

**Purpose** Send an SNMP request to check that the SNMP configuration is correct.

**Action** To query a MIB with SNMPGet, enter the following command:

```

user@nms % snmpget hostname community oid

```

**Sample Output**

```

user-nms % snmpget tp1 public .1.3.6.1.2.1.1.1.0
system.sysDescr.0 = m7i internet router, kernel 6.0R1.5

user-nms % snmpget tp1 public sysDescr.0
system.sysDescr.0 = m7i internet router, kernel 6.0R1.5

```

**Meaning** The sample output shows a query from a network management station (nms) for the description of the system running on the router tp1. The OID is entered in numerical form in the command line, and a description (sysDescr.0) is obtained in the output. You can also use sysDescr.0 in the command line to obtain the same output.





From a management station that has access to the router and using a tool, such as Snmpwalk, follow these steps:

1. Check Memory Utilization on Chassis Components on page 195
2. Check Memory Utilization per Process on page 197

## Check Memory Utilization on Chassis Components

**Purpose** The enterprise-specific chassis MIB provides information about the router and its components. Within the chassis MIB, the `jnxMIBs` branch contains one main subbranch, `jnxBoxAnatomy`, which in turn contains a section, `jnxOperatingTable`. Within `jnxOperatingTable`, you can use the `jnxOperatingBuffer` object to monitor memory usage on your router. (See Figure 18 on page 195.)

**Figure 18: Chassis MIB Tree**

```

+--juniperMIB(2636)¶
|   +--jnxProducts(1)¶
|   +--jnxServices(2)¶
|   +--jnxMibs(3)¶
|       +--jnxBoxAnatomy(1)¶
|           +--jnxContainersTable(6) ¶
|           +--jnxContentsTable(8)¶
|           +--jnxLEDTable(10)¶
|           +--jnxFilledTable(12)¶
|           +--jnxOperatingTable(13)¶
|               +--jnxOperatingEntry(1)¶
|                   +-- jnxOperatingContentsIndex(1)¶
|                   +-- jnxOperatingL1Index(2)¶
|                   +-- jnxOperatingL2Index(3)¶
|                   +-- jnxOperatingL3Index(4)¶
|                   +-- jnxOperatingDescr(5)¶
|                   +-- jnxOperatingState(6)¶
|                   +-- jnxOperatingTemp(7)¶
|                   +-- jnxOperatingCPU(8)¶
|                   +-- jnxOperatingISR(9)¶
|                   +-- jnxOperatingDRAMSize(10)¶
|                   +-- jnxOperatingBuffer(11)¶
|                   +-- jnxOperatingHeap(12)¶
|                   +-- jnxOperatingUpTime(13)¶
|                   +-- jnxOperatingLastRestart(14)¶
|                   +-- jnxOperatingMemory(15)¶
|                   +-- jnxOperatingStateOrdered(16)¶
|           +--jnxRedundancyTable(14)¶
|           +--jnxFruTable(15)¶

```

After each object description is a value in parenthesis, such as (1). This value can be used to enter an OID for the specific object. For example, to gather information on memory utilization, you can type the object description (`jnxOperatingBuffer`) or the OID (`.1.3.6.1.4.1.2636.3.1.13.1.11`).

**Action** To check memory utilization using the Juniper Networks enterprise chassis MIB, from a management station that has access to the router, and using a tool such as Snmpwalk, enter the following commands:

```

user-bsd# snmpwalk [common arguments] hostname community object-id
user@host> show chassis routing-engine

```

```

Sample Output user-nms % snmpwalk -Os -M /volume/~mibs -m all tp1 public jnxOperatingBuffer
jnxOperatingBuffer.jnxOperatingBuffer.1.1.1.0 = Gauge32: 0
jnxOperatingBuffer.1.1.2.0 = Gauge32: 0
jnxOperatingBuffer.1.1.3.0 = Gauge32: 0
jnxOperatingBuffer.2.1.0.0 = Gauge32: 0
jnxOperatingBuffer.4.1.1.0 = Gauge32: 0
jnxOperatingBuffer.4.1.2.0 = Gauge32: 0
jnxOperatingBuffer.4.1.3.0 = Gauge32: 0
jnxOperatingBuffer.4.1.4.0 = Gauge32: 0
jnxOperatingBuffer.6.1.1.0 = Gauge32: 6
jnxOperatingBuffer.6.1.2.0 = Gauge32: 6
jnxOperatingBuffer.7.1.0.0 = Gauge32: 8
jnxOperatingBuffer.7.2.0.0 = Gauge32: 8
jnxOperatingBuffer.8.1.1.0 = Gauge32: 0
jnxOperatingBuffer.8.2.3.0 = Gauge32: 0
jnxOperatingBuffer.8.2.4.0 = Gauge32: 0
jnxOperatingBuffer.9.1.0.0 = Gauge32: 28
jnxOperatingBuffer.9.1.1.0 = Gauge32: 0

user-nms % snmpwalk -Os -M /volume/~mibs -m all tp1 public jnxOperatingDescr
jnxOperatingDescr.1.1.1.0 = midplane
jnxOperatingDescr.1.1.2.0 = midplane
jnxOperatingDescr.1.1.3.0 = midplane
jnxOperatingDescr.2.1.0.0 = Power Supply A
jnxOperatingDescr.4.1.1.0 = Left Tray front fan
jnxOperatingDescr.4.1.2.0 = Left Tray second fan
jnxOperatingDescr.4.1.3.0 = Left Tray third fan
jnxOperatingDescr.4.1.4.0 = Left Tray fourth fan
jnxOperatingDescr.6.1.1.0 = CFEB Internet Processor IIv1
jnxOperatingDescr.6.1.2.0 = CFEB Internet Processor IIv1
jnxOperatingDescr.7.1.0.0 = FPC @ 0/*/*
jnxOperatingDescr.7.2.0.0 = FPC @ 1/*/*
jnxOperatingDescr.8.1.1.0 = PIC: 4x OC-3 SONET, MM @ 0/0/*
jnxOperatingDescr.8.2.3.0 = PIC: 1x Tunnel @ 1/2/*
jnxOperatingDescr.8.2.4.0 = PIC: 1x G/E, 1000 BASE-SX @ 1/3/*
jnxOperatingDescr.9.1.0.0 = Routing Engine
jnxOperatingDescr.9.1.1.0 = Routing Engine PCMCIA Card

user@R1> show chassis routing-engine
Routing Engine status:
  Temperature                28 degrees C / 82 degrees F
  DRAM                       256 MB
  Memory utilization          28 percent
  CPU utilization:
    User                      0 percent
    Background                0 percent
    Kernel                    6 percent
    Interrupt                  0 percent
    Idle                       94 percent
  Model                       RE-5.0
  Serial ID                   1000431687
  Start time                   2003-11-20 11:42:04 PST
  Uptime                       63 days, 2 hours, 34 minutes, 4 seconds
  Load averages:              1 minute   5 minute   15 minute
                              0.01        0.02        0.01

```

**Meaning** The sample output shows the percentage of utilization for the FPC and Routing Engine. The first object, `jnxOperatingBuffer`, shows that the Routing Engine (9.1.0.0) has 28 percent memory utilization, the two CFEB processors are using 6 percent, and the FPCs have 8 percent memory utilization.

The second object, `jnxOperatingDescr`, provides a human readable description of the separate instances in the `jnxOperatingBuffer` object. For example, `1.1.0.0` represents the midplane, and `7.1.0.0` represents `FPC @ 0/*/*`.

The output for the `show chassis routing-engine` command shows similar information to that displayed in the output of the `jnxOperatingBuffer` object, with 28 percent memory utilization for the Routing Engine.

## Check Memory Utilization per Process

**Purpose** The standard System Application MIB (RFC 2287, *Definitions of System-Level Managed Objects for Applications*), describes a set of managed objects that are restricted to information that can be determined from the system itself. The object `sysAppElmtRunMemory` provides information about applications and associated elements that have run or are currently running on the host system. (See Figure 19 on page 197.)

**Figure 19: System Application MIB Tree**

```

+--System: Application MIB
|   +--sysAppObj
|   +--sysAppInstalled
|   +--sysAppRun
|   +--sysAppMap
|   +--sysAppNotifications
|   +--sysAppConformance
|       +--sysAppMIBCompliances
|       +--sysAppMIBGroups
|           +--sysAppRunGroup
|               +--sysAppRunStarted
|               +--sysAppRunCurrentState
|               +--sysAppPastRunStarted
|               +--sysAppPastRunExitState
|               +--sysAppPastRunTimeEnded
|               +--sysAppElmtRunInstallID
|               +--sysAppElmtRunTimeStarted
|               +--sysAppElmtRunState
|               +--sysAppElmtRunName
|               +--sysAppElmtRunParameters
|               +--sysAppElmtRunCPU
|               +--sysAppElmtRunMemory
|               +--sysAppElmtRunNumFiles
|               +--sysAppElmtRunUser
|   [...Output Truncated...]

```

**Action** To check memory utilization per process, from a management station that has access to the router, and using a tool such as `Snmpwalk`, enter the following command:

```
user-bsd# snmpwalk [common arguments] hostname community object-id
```

**Sample Output**

```

use-nms % snmpwalk -Os -M /volume/~mibs -m all tp1 public
sysAppElmtRunMemorysysAppElmtRunMemory.0.0.0 = Gauge32: 0 Kbytes
sysAppElmtRunMemory.0.0.2 = Gauge32: 0 Kbytes
sysAppElmtRunMemory.0.0.3 = Gauge32: 0 Kbytes
sysAppElmtRunMemory.0.0.4 = Gauge32: 0 Kbytes
sysAppElmtRunMemory.0.0.5 = Gauge32: 0 Kbytes
sysAppElmtRunMemory.0.0.6 = Gauge32: 0 Kbytes
sysAppElmtRunMemory.0.0.7 = Gauge32: 0 Kbytes

```

```

sysApp1ElmtRunMemory.0.0.8 = Gauge32: 0 Kbytes
sysApp1ElmtRunMemory.0.0.9 = Gauge32: 0 Kbytes
sysApp1ElmtRunMemory.0.0.10 = Gauge32: 0 Kbytes
sysApp1ElmtRunMemory.0.0.11 = Gauge32: 0 Kbytes
sysApp1ElmtRunMemory.0.0.12 = Gauge32: 0 Kbytes
sysApp1ElmtRunMemory.0.0.116 = Gauge32: 526164 Kbytes
sysApp1ElmtRunMemory.0.0.2023 = Gauge32: 416 Kbytes
sysApp1ElmtRunMemory.0.0.2131 = Gauge32: 1100 Kbytes
sysApp1ElmtRunMemory.0.0.2160 = Gauge32: 984 Kbytes
sysApp1ElmtRunMemory.0.0.2161 = Gauge32: 1100 Kbytes
sysApp1ElmtRunMemory.0.0.2174 = Gauge32: 996 Kbytes
sysApp1ElmtRunMemory.0.0.2324 = Gauge32: 0 Kbytes
sysApp1ElmtRunMemory.0.0.16781 = Gauge32: 1072 Kbytes
sysApp1ElmtRunMemory.0.0.18311 = Gauge32: 1284 Kbytes
sysApp1ElmtRunMemory.0.0.26827 = Gauge32: 1368 Kbytes
sysApp1ElmtRunMemory.3.1.1 = Gauge32: 4028 Kbytes
sysApp1ElmtRunMemory.3.2.2163 = Gauge32: 3196 Kbytes
sysApp1ElmtRunMemory.3.3.2185 = Gauge32: 1624 Kbytes
sysApp1ElmtRunMemory.3.4.2194 = Gauge32: 9768 Kbytes
sysApp1ElmtRunMemory.3.7.2168 = Gauge32: 2484 Kbytes
sysApp1ElmtRunMemory.3.9.2169 = Gauge32: 3004 Kbytes
sysApp1ElmtRunMemory.3.12.2172 = Gauge32: 2108 Kbytes
sysApp1ElmtRunMemory.3.13.2173 = Gauge32: 1888 Kbytes
sysApp1ElmtRunMemory.3.14.2164 = Gauge32: 1672 Kbytes
sysApp1ElmtRunMemory.3.15.2175 = Gauge32: 1644 Kbytes
sysApp1ElmtRunMemory.3.16.2165 = Gauge32: 1632 Kbytes
sysApp1ElmtRunMemory.3.17.2176 = Gauge32: 2716 Kbytes
sysApp1ElmtRunMemory.3.19.2177 = Gauge32: 1668 Kbytes
sysApp1ElmtRunMemory.3.20.2178 = Gauge32: 2160 Kbytes
sysApp1ElmtRunMemory.3.21.2179 = Gauge32: 2164 Kbytes
sysApp1ElmtRunMemory.3.23.2188 = Gauge32: 1688 Kbytes
sysApp1ElmtRunMemory.3.25.2186 = Gauge32: 1292 Kbytes
sysApp1ElmtRunMemory.3.26.2180 = Gauge32: 1676 Kbytes
sysApp1ElmtRunMemory.3.27.2181 = Gauge32: 2052 Kbytes
sysApp1ElmtRunMemory.3.30.2187 = Gauge32: 1236 Kbytes
sysApp1ElmtRunMemory.3.31.2184 = Gauge32: 1032 Kbytes
sysApp1ElmtRunMemory.3.34.2171 = Gauge32: 1156 Kbytes
sysApp1ElmtRunMemory.3.35.2047 = Gauge32: 1132 Kbytes
sysApp1ElmtRunMemory.3.36.2189 = Gauge32: 1836 Kbytes
sysApp1ElmtRunMemory.3.37.2191 = Gauge32: 1052 Kbytes
sysApp1ElmtRunMemory.5.5.7495 = Gauge32: 7628 Kbytes
sysApp1ElmtRunMemory.5.6.2167 = Gauge32: 11824 Kbytes
sysApp1ElmtRunMemory.5.6.26829 = Gauge32: 11880 Kbytes
sysApp1ElmtRunMemory.5.8.26828 = Gauge32: 7984 Kbytes
sysApp1ElmtRunMemory.5.28.2182 = Gauge32: 1468 Kbytes
sysApp1ElmtRunMemory.5.29.2183 = Gauge32: 1828 Kbytes

```

```

user-nms % snmpwalk -Os -M /volume/~mibs -m all tp1 public sysApp1ElmtRunName

```

```

sysApp1ElmtRunName.0.0.0 = (swapper)
sysApp1ElmtRunName.0.0.2 = (pagedaemon)
sysApp1ElmtRunName.0.0.3 = (vmdaemon)
sysApp1ElmtRunName.0.0.4 = (bufdaemon)
sysApp1ElmtRunName.0.0.5 = (syncer)
sysApp1ElmtRunName.0.0.6 = (netdaemon)
sysApp1ElmtRunName.0.0.7 = (if_pfe)
sysApp1ElmtRunName.0.0.8 = (if_pfe_listen)
sysApp1ElmtRunName.0.0.9 = (cb_poll)
sysApp1ElmtRunName.0.0.10 = (vmuncachedaemon)
sysApp1ElmtRunName.0.0.11 = (scs_housekeeping)
sysApp1ElmtRunName.0.0.12 = (if_pic_listen)
sysApp1ElmtRunName.0.0.116 = mfs

```

```

sysApp1ElmtRunName.0.0.2023 = pccardd
sysApp1ElmtRunName.0.0.2131 = cron
sysApp1ElmtRunName.0.0.2160 = /sbin/watchdog
sysApp1ElmtRunName.0.0.2161 = /usr/sbin/tnetd
sysApp1ElmtRunName.0.0.2174 = /usr/sbin/tnp.snmpd
sysApp1ElmtRunName.0.0.2324 = (peer proxy)
sysApp1ElmtRunName.0.0.16781 = /usr/libexec/getty
sysApp1ElmtRunName.0.0.18311 = /usr/sbin/xntpd
sysApp1ElmtRunName.0.0.26827 = telnetd
sysApp1ElmtRunName.3.1.1 = /sbin/preinit
sysApp1ElmtRunName.3.2.2163 = /usr/sbin/chassisd
sysApp1ElmtRunName.3.3.2185 = /usr/sbin/dfwd
sysApp1ElmtRunName.3.4.2194 = /sbin/dcd
sysApp1ElmtRunName.3.7.2168 = /usr/sbin/snmpd
sysApp1ElmtRunName.3.9.2169 = /usr/sbin/mib2d
sysApp1ElmtRunName.3.12.2172 = /usr/sbin/apsd
sysApp1ElmtRunName.3.13.2173 = /usr/sbin/vrrpd
sysApp1ElmtRunName.3.14.2164 = /usr/sbin/alarmd
sysApp1ElmtRunName.3.15.2175 = /usr/sbin/pfed
sysApp1ElmtRunName.3.16.2165 = /usr/sbin/craftd
sysApp1ElmtRunName.3.17.2176 = /usr/sbin/sampled
sysApp1ElmtRunName.3.19.2177 = /usr/sbin/ilmid
sysApp1ElmtRunName.3.20.2178 = /usr/sbin/rmopd
sysApp1ElmtRunName.3.21.2179 = /usr/sbin/cosd
sysApp1ElmtRunName.3.23.2188 = /usr/sbin/fsad
sysApp1ElmtRunName.3.25.2186 = /usr/sbin/irsd
sysApp1ElmtRunName.3.26.2180 = /usr/sbin/nasd
sysApp1ElmtRunName.3.27.2181 = /usr/sbin/fud
sysApp1ElmtRunName.3.30.2187 = /usr/sbin/rtspd
sysApp1ElmtRunName.3.31.2184 = /usr/sbin/smartd
sysApp1ElmtRunName.3.34.2171 = /usr/sbin/inetd
sysApp1ElmtRunName.3.35.2047 = syslogd
sysApp1ElmtRunName.3.36.2189 = /usr/sbin/spd
sysApp1ElmtRunName.3.37.2191 = /usr/sbin/eccd
sysApp1ElmtRunName.5.5.7495 = /usr/sbin/rpd
sysApp1ElmtRunName.5.6.2167 = /usr/sbin/mgd
sysApp1ElmtRunName.5.6.26829 = mgd: (mgd) (user)/dev/tty0
sysApp1ElmtRunName.5.8.26828 = -cli
sysApp1ElmtRunName.5.28.2182 = /usr/sbin/ppmd
sysApp1ElmtRunName.5.29.2183 = /usr/sbin/lmpd

```

**Meaning** The sample output shows the total amount of real system memory, measured in kilobytes, currently allocated to the processes retrieved by the `sysApp1ElmtRunMemory` object.

The `sysApp1ElmtRunMemory` object shows granular, per-process information about memory usage. For example, the `sampled` process (3.17.2176) is using 2716 kilobytes of memory.

The `sysApp1ElmtRunName` object provides a description of the separate instances displayed in the `sysApp1ElmtRunMemory` object. For example, the `sampled` process is represented by the OID 3.17.2176.

## Monitor CPU Utilization

**Purpose** You can monitor CPU utilization using the Juniper specific enterprise chassis MIB and the standard system application MIB (RFC 2287, *Definitions of System-Level Managed Objects for Applications*).

From a management station that has access to the router, and using a tool such as Snmpwalk, follow these steps:

1. Check CPU Utilization on page 200
2. Check CPU Utilization per Process on page 201

### Check CPU Utilization

**Purpose** The enterprise-specific chassis MIB provides information about the router and its components. Within the chassis MIB, the `jnxMIBs` branch contains one main subbranch, `jnxBoxAnatomy`, which in turn contains a section, `jnxOperatingTable`. Within `jnxOperatingTable`, and under the `jnxOperatingEntry`, you can use the `jnxOperatingCPU` object to monitor the CPU on your router. (See Figure 20 on page 200.)

**Figure 20: Chassis MIB Tree**

```

+---juniperMIB(2636)¶
|   +---jnxProducts(1)¶
|   +---jnxServices(2)¶
|   +---jnxMibs(3)¶
|       +---jnxBoxAnatomy(1)¶
|           +---jnxContainersTable(6) ¶
|           +---jnxContentsTable(8)¶
|           +---jnxLEDTable(10)¶
|           +---jnxFilledTable(12)¶
|           +---jnxOperatingTable(13)¶
|               +---jnxOperatingEntry(1)¶
|                   +--- jnxOperatingContentsIndex(1)¶
|                   +--- jnxOperatingL1Index(2)¶
|                   +--- jnxOperatingL2Index(3)¶
|                   +--- jnxOperatingL3Index(4)¶
|                   +--- jnxOperatingDescr(5)¶
|                   +--- jnxOperatingState(6)¶
|                   +--- jnxOperatingTemp(7)¶
|                   +--- jnxOperatingCPU(8)¶
|                   +--- jnxOperatingISR(9)¶
|                   +--- jnxOperatingDRAMSize(10)¶
|                   +--- jnxOperatingBuffer(11)¶
|                   +--- jnxOperatingHeap(12)¶
|                   +--- jnxOperatingUpTime(13)¶
|                   +--- jnxOperatingLastRestart(14)¶
|                   +--- jnxOperatingMemory(15)¶
|                   +--- jnxOperatingStateOrdered(16)¶
|           +---jnxRedundancyTable(14)¶
|           +---jnxFruTable(15)¶

```

After each object description is a value in parenthesis, such as (1). This value can be used to enter an OID for the specific object. For example, to gather information on the CPU, you can type the object description (`jnxOperatingCPU`) or the OID (`.1.3.6.1.4.1.2636.3.1.13.1.8`).

**Action** To check CPU utilization using the Juniper Networks enterprise chassis MIB, from a management station that has access to the router, and using a tool such as Snmpwalk, enter the following command:

```
user-bsd# snmpwalk [common arguments] hostname community object-id
```

**Sample Output**

```
user-nms % snmpwalk -Os -M /volume/~mibs -m all tp1 public jnxOperatingCPU
jnxOperatingCPU.1.1.1.0 = Gauge32: 0
jnxOperatingCPU.1.1.2.0 = Gauge32: 0
jnxOperatingCPU.1.1.3.0 = Gauge32: 0
jnxOperatingCPU.2.1.0.0 = Gauge32: 0
jnxOperatingCPU.4.1.1.0 = Gauge32: 0
jnxOperatingCPU.4.1.2.0 = Gauge32: 0
jnxOperatingCPU.4.1.3.0 = Gauge32: 0
jnxOperatingCPU.4.1.4.0 = Gauge32: 0
jnxOperatingCPU.6.1.1.0 = Gauge32: 224
jnxOperatingCPU.6.1.2.0 = Gauge32: 224
jnxOperatingCPU.7.1.0.0 = Gauge32: 2
jnxOperatingCPU.7.2.0.0 = Gauge32: 2
jnxOperatingCPU.8.1.1.0 = Gauge32: 0
jnxOperatingCPU.8.2.3.0 = Gauge32: 0
jnxOperatingCPU.8.2.4.0 = Gauge32: 0
jnxOperatingCPU.9.1.0.0 = Gauge32: 6
jnxOperatingCPU.9.1.1.0 = Gauge32: 0

user-nms % snmpwalk -Os -M /volume/~mibs -m all tp1 public jnxOperatingDesc
jnxOperatingDescr.1.1.1.0 = midplane
jnxOperatingDescr.1.1.2.0 = midplane
jnxOperatingDescr.1.1.3.0 = midplane
jnxOperatingDescr.2.1.0.0 = Power Supply A
jnxOperatingDescr.4.1.1.0 = Left Tray front fan
jnxOperatingDescr.4.1.2.0 = Left Tray second fan
jnxOperatingDescr.4.1.3.0 = Left Tray third fan
jnxOperatingDescr.4.1.4.0 = Left Tray fourth fan
jnxOperatingDescr.6.1.1.0 = CFEB Internet Processor IIv1
jnxOperatingDescr.6.1.2.0 = CFEB Internet Processor IIv1
jnxOperatingDescr.7.1.0.0 = FPC @ 0/*/*
jnxOperatingDescr.7.2.0.0 = FPC @ 1/*/*
jnxOperatingDescr.8.1.1.0 = PIC: 4x OC-3 SONET, MM @ 0/0/*
jnxOperatingDescr.8.2.3.0 = PIC: 1x Tunnel @ 1/2/*
jnxOperatingDescr.8.2.4.0 = PIC: 1x G/E, 1000 BASE-SX @ 1/3/*
jnxOperatingDescr.9.1.0.0 = Routing Engine
jnxOperatingDescr.9.1.1.0 = Routing Engine PCMCIA Card
```

**Meaning** The sample output shows the percentage CPU utilization on router, **tp1**. The Routing Engine (9.1.0.0) has 6 percent CPU utilization, the two CFEB Internet Processors IIv1 (6.1.1.0 and 6.1.2.0) have 22 percent each, and the FPCs (7.1.0.0 and 7.2.0.0) have 2 percent each. Components with a value of zero indicate that the information is either unavailable or inapplicable.

The output for the **jnxOperatingDesc** object provides a description of the separate instances in the **jnxOperatingCPU** object. For example, 9.1.0.0 represents the Routing Engine.

## Check CPU Utilization per Process

**Purpose** The standard system application MIB (RFC 2287, *Definitions of System-Level Managed Objects for Applications*), describes a set of managed objects that are restricted to

information that can be determined from the system itself. The object `sysAppElmtRunCPU` provides information about applications and associated elements that have run or are currently running on the host system. (See Figure 21 on page 202.)

**Figure 21: System Application MIB Tree**

```

+--System: Application MIB
|
|  +--sysApp1Obj
|  +--sysApp1Installed
|  +--sysApp1Run
|  +--sysApp1Map
|  +--sysApp1Notifications
|  +--sysApp1Conformance
|  |
|  |  +--sysApp1MIBCompliances
|  |  +--sysApp1MIBGroups
|  |  |
|  |  |  +--sysApp1RunGroup
|  |  |  |
|  |  |  |  +--sysApp1RunStarted
|  |  |  |  +--sysApp1RunCurrentState
|  |  |  |  +--sysApp1PastRunStarted
|  |  |  |  +--sysApp1PastRunExitState
|  |  |  |  +--sysApp1PastRunTimeEnded
|  |  |  |  +--sysApp1ElmtRunInstallID
|  |  |  |  +--sysApp1ElmtRunTimeStarted
|  |  |  |  +--sysApp1ElmtRunState
|  |  |  |  +--sysApp1ElmtRunName
|  |  |  |  +--sysApp1ElmtRunParameters
|  |  |  |  +--sysApp1ElmtRunCPU
|  |  |  |  +--sysApp1ElmtRunMemory
|  |  |  |  +--sysApp1ElmtRunNumFiles
|  |  |  |  +--sysApp1ElmtRunUser
|  |  |  |
|  |  |  |  [...Output Truncated...]

```

**Action** To check CPU utilization per process, from a management station that has access to the router, and using a tool such as `Snmpwalk`, enter the following command:

```
user-bsd# snmpwalk [common arguments] hostname community object-id
```

**Sample Output**

```

use-nms % snmpwalk -Os -M /volume/~mibs -m all tp1 public sysAppElmtRunCPU
sysAppElmtRunCPU.0.0.0 = Timeticks: (278) 0:00:02.78
sysAppElmtRunCPU.0.0.2 = Timeticks: (487) 0:00:04.87
sysAppElmtRunCPU.0.0.3 = Timeticks: (0) 0:00:00.00
sysAppElmtRunCPU.0.0.4 = Timeticks: (1742) 0:00:17.42
sysAppElmtRunCPU.0.0.5 = Timeticks: (13899) 0:02:18.99
sysAppElmtRunCPU.0.0.6 = Timeticks: (79) 0:00:00.79
sysAppElmtRunCPU.0.0.7 = Timeticks: (0) 0:00:00.00
sysAppElmtRunCPU.0.0.8 = Timeticks: (0) 0:00:00.00
sysAppElmtRunCPU.0.0.9 = Timeticks: (0) 0:00:00.00
sysAppElmtRunCPU.0.0.10 = Timeticks: (2229) 0:00:22.29
sysAppElmtRunCPU.0.0.11 = Timeticks: (0) 0:00:00.00
sysAppElmtRunCPU.0.0.12 = Timeticks: (0) 0:00:00.00
sysAppElmtRunCPU.0.0.116 = Timeticks: (25) 0:00:00.25
sysAppElmtRunCPU.0.0.2023 = Timeticks: (0) 0:00:00.00
sysAppElmtRunCPU.0.0.2131 = Timeticks: (1103) 0:00:11.03
sysAppElmtRunCPU.0.0.2160 = Timeticks: (1599) 0:00:15.99
sysAppElmtRunCPU.0.0.2161 = Timeticks: (4) 0:00:00.04
sysAppElmtRunCPU.0.0.2174 = Timeticks: (1168) 0:00:11.68
sysAppElmtRunCPU.0.0.2324 = Timeticks: (1738) 0:00:17.38
sysAppElmtRunCPU.0.0.16781 = Timeticks: (0) 0:00:00.00
sysAppElmtRunCPU.0.0.18311 = Timeticks: (0) 0:00:00.00

```



```

sysApp1ElmtRunCPU.0.0.26827 = Timeticks: (2) 0:00:00.02
sysApp1ElmtRunCPU.3.1.1 = Timeticks: (483) 0:00:04.83
sysApp1ElmtRunCPU.3.2.2163 = Timeticks: (33548776) 3 days, 21:11:27.76
sysApp1ElmtRunCPU.3.3.2185 = Timeticks: (1314) 0:00:13.14
sysApp1ElmtRunCPU.3.4.2194 = Timeticks: (5282) 0:00:52.82
sysApp1ElmtRunCPU.3.7.2168 = Timeticks: (20380) 0:03:23.80
sysApp1ElmtRunCPU.3.9.2169 = Timeticks: (6703) 0:01:07.03
sysApp1ElmtRunCPU.3.12.2172 = Timeticks: (337) 0:00:03.37
sysApp1ElmtRunCPU.3.13.2173 = Timeticks: (36) 0:00:00.36
sysApp1ElmtRunCPU.3.14.2164 = Timeticks: (39783) 0:06:37.83
sysApp1ElmtRunCPU.3.15.2175 = Timeticks: (4206) 0:00:42.06
sysApp1ElmtRunCPU.3.16.2165 = Timeticks: (18) 0:00:00.18
sysApp1ElmtRunCPU.3.17.2176 = Timeticks: (61) 0:00:00.61
sysApp1ElmtRunCPU.3.19.2177 = Timeticks: (25) 0:00:00.25
sysApp1ElmtRunCPU.3.20.2178 = Timeticks: (200) 0:00:02.00
sysApp1ElmtRunCPU.3.21.2179 = Timeticks: (38) 0:00:00.38
sysApp1ElmtRunCPU.3.23.2188 = Timeticks: (3175) 0:00:31.75
sysApp1ElmtRunCPU.3.25.2186 = Timeticks: (44774) 0:07:27.74
sysApp1ElmtRunCPU.3.26.2180 = Timeticks: (17) 0:00:00.17
sysApp1ElmtRunCPU.3.27.2181 = Timeticks: (48950) 0:08:09.50
sysApp1ElmtRunCPU.3.30.2187 = Timeticks: (11) 0:00:00.11
sysApp1ElmtRunCPU.3.31.2184 = Timeticks: (93) 0:00:00.93
sysApp1ElmtRunCPU.3.34.2171 = Timeticks: (80) 0:00:00.80
sysApp1ElmtRunCPU.3.35.2047 = Timeticks: (1585) 0:00:15.85
sysApp1ElmtRunCPU.3.36.2189 = Timeticks: (30) 0:00:00.30
sysApp1ElmtRunCPU.3.37.2191 = Timeticks: (326) 0:00:03.26
sysApp1ElmtRunCPU.5.5.7495 = Timeticks: (24721) 0:04:07.21
sysApp1ElmtRunCPU.5.6.2167 = Timeticks: (936) 0:00:09.36
sysApp1ElmtRunCPU.5.6.26829 = Timeticks: (1) 0:00:00.01
sysApp1ElmtRunCPU.5.8.26828 = Timeticks: (25) 0:00:00.25
sysApp1ElmtRunCPU.5.28.2182 = Timeticks: (29234) 0:04:52.34
sysApp1ElmtRunCPU.5.29.2183 = Timeticks: (21) 0:00:00.21

```

```

user-nms % snmpwalk -Os -M ~/mibs -m all tp1 public sysApp1ElmtRunName

```

```

sysApp1ElmtRunName.0.0.0 = (swapper)
sysApp1ElmtRunName.0.0.2 = (pagedaemon)
sysApp1ElmtRunName.0.0.3 = (vmdaemon)
sysApp1ElmtRunName.0.0.4 = (bufdaemon)
sysApp1ElmtRunName.0.0.5 = (syncer)
sysApp1ElmtRunName.0.0.6 = (netdaemon)
sysApp1ElmtRunName.0.0.7 = (if_pfe)
sysApp1ElmtRunName.0.0.8 = (if_pfe_listen)
sysApp1ElmtRunName.0.0.9 = (cb_poll)
sysApp1ElmtRunName.0.0.10 = (vmuncachedaemon)
sysApp1ElmtRunName.0.0.11 = (scs_housekeeping)
sysApp1ElmtRunName.0.0.12 = (if_pic_listen)
sysApp1ElmtRunName.0.0.116 = mfs
sysApp1ElmtRunName.0.0.2023 = pccardd
sysApp1ElmtRunName.0.0.2131 = cron
sysApp1ElmtRunName.0.0.2160 = /sbin/watchdog
sysApp1ElmtRunName.0.0.2161 = /usr/sbin/tnetd
sysApp1ElmtRunName.0.0.2174 = /usr/sbin/tnp.sntpd
sysApp1ElmtRunName.0.0.2324 = (peer proxy)
sysApp1ElmtRunName.0.0.16781 = /usr/libexec/getty
sysApp1ElmtRunName.0.0.18311 = /usr/sbin/xntpd
sysApp1ElmtRunName.0.0.26827 = telnetd
sysApp1ElmtRunName.3.1.1 = /sbin/preinit
sysApp1ElmtRunName.3.2.2163 = /usr/sbin/chassisd
sysApp1ElmtRunName.3.3.2185 = /usr/sbin/dfwd
sysApp1ElmtRunName.3.4.2194 = /sbin/dcd
sysApp1ElmtRunName.3.7.2168 = /usr/sbin/snmpd

```

```

sysApp1ElmtRunName.3.9.2169 = /usr/sbin/mib2d
sysApp1ElmtRunName.3.12.2172 = /usr/sbin/apsd
sysApp1ElmtRunName.3.13.2173 = /usr/sbin/vrrpd
sysApp1ElmtRunName.3.14.2164 = /usr/sbin/alarmd
sysApp1ElmtRunName.3.15.2175 = /usr/sbin/pfed
sysApp1ElmtRunName.3.16.2165 = /usr/sbin/craftd
sysApp1ElmtRunName.3.17.2176 = /usr/sbin/sampled
sysApp1ElmtRunName.3.19.2177 = /usr/sbin/ilmid
sysApp1ElmtRunName.3.20.2178 = /usr/sbin/rmopd
sysApp1ElmtRunName.3.21.2179 = /usr/sbin/cosd
sysApp1ElmtRunName.3.23.2188 = /usr/sbin/fsad
sysApp1ElmtRunName.3.25.2186 = /usr/sbin/irsd
sysApp1ElmtRunName.3.26.2180 = /usr/sbin/nasd
sysApp1ElmtRunName.3.27.2181 = /usr/sbin/fud
sysApp1ElmtRunName.3.30.2187 = /usr/sbin/rtsdp
sysApp1ElmtRunName.3.31.2184 = /usr/sbin/smartd
sysApp1ElmtRunName.3.34.2171 = /usr/sbin/inetd
sysApp1ElmtRunName.3.35.2047 = syslogd
sysApp1ElmtRunName.3.36.2189 = /usr/sbin/spd
sysApp1ElmtRunName.3.37.2191 = /usr/sbin/eccd
sysApp1ElmtRunName.5.5.7495 = /usr/sbin/rpd
sysApp1ElmtRunName.5.6.2167 = /usr/sbin/mgd
sysApp1ElmtRunName.5.6.26829 = mgd: (mgd) (user)/dev/tty0
sysApp1ElmtRunName.5.8.26828 = -cli
sysApp1ElmtRunName.5.28.2182 = /usr/sbin/ppmd
sysApp1ElmtRunName.5.29.2183 = /usr/sbin/lmpd

```

**Meaning** The sample output shows the number of centi-seconds of total system CPU resources consumed by a particular process. For example, the chassis process (chassisd, 3.2.2163) has consumed 3 days, or 33,548,776 centi-seconds of total system CPU resources.

The sysApp1ElmtRunName object retrieves the name of the OID. For example, sysApp1ElmtRunCPU.3.2.2163 represents the chassis process.

## Retrieve Version Information about Router Software Components

**Purpose** RFC 2790, *Host Resources MIB*, describes a set of managed objects that are useful for managing host systems, including routers.

**Action** To retrieve version information about software components on the router, from a management station that has access to the router and using a tool, such as Snmpwalk, enter the following command:

```
user-bsd# snmpwalk [common arguments] hostname community object-id
```

**Sample Output**

```

user-nms % snmpwalk -Os -M /volume/~mibs -m all tp1 public
.1.3.6.1.2.1.25.6.3hrSWInstalledIndex.2 = 2
hrSWInstalledIndex.3 = 3
hrSWInstalledIndex.4 = 4
hrSWInstalledIndex.5 = 5
hrSWInstalledIndex.6 = 6
hrSWInstalledIndex.9 = 9
hrSWInstalledName.2 = "JUNOS Base OS Software Suite [6.0R1.5]"
hrSWInstalledName.3 = "JUNOS Kernel Software Suite [6.0R1.5]"
hrSWInstalledName.4 = "JUNOS Packet Forwarding Engine Support (M7i/M10i) [6.0R1.5]"
hrSWInstalledName.5 = "JUNOS Routing Software Suite [6.0R1.5]"
hrSWInstalledName.6 = "JUNOS Online Documentation [6.0R1.5]"

```

```

hrSWInstalledName.9 = "JUNOS Support Tools Package [6.0-20031122-unocM2]"
hrSWInstalledID.2 = OID: zeroDotZero
hrSWInstalledID.3 = OID: zeroDotZero
hrSWInstalledID.4 = OID: zeroDotZero
hrSWInstalledID.5 = OID: zeroDotZero
hrSWInstalledID.6 = OID: zeroDotZero
hrSWInstalledID.9 = OID: zeroDotZero
hrSWInstalledType.2 = operatingSystem(2)
hrSWInstalledType.3 = operatingSystem(2)
hrSWInstalledType.4 = operatingSystem(2)
hrSWInstalledType.5 = operatingSystem(2)
hrSWInstalledType.6 = application(4)
hrSWInstalledType.9 = operatingSystem(2)
hrSWInstalledDate.2 = 2003-8-10,20:34:45.0,-7:0
hrSWInstalledDate.3 = 2003-8-10,20:35:21.0,-7:0
hrSWInstalledDate.4 = 2003-8-10,20:36:30.0,-7:0
hrSWInstalledDate.5 = 2003-8-10,20:36:47.0,-7:0
hrSWInstalledDate.6 = 2003-8-10,20:36:51.0,-7:0
hrSWInstalledDate.9 = 2003-11-22,4:8:47.0,-8:0a1

```

**Meaning** The sample output shows the version information for various software components on the router.



## **Part 4**

# **Gather System Management Information**

- Display Basic Chassis Information on page 209
- Display and Locate Files and Directories on page 213
- Check Time on a Router on page 221
- Check User Accounts and Permissions on page 227



## Chapter 18

# Display Basic Chassis Information

This chapter describes how to obtain basic system information, including a list of all Flexible PIC Concentrators (FPCs) and Physical Interface Cards (PICs) installed in the router chassis, the hardware version level, and the serial number.

- Checklist for Displaying Basic Chassis Information on page 209
- Display Basic Chassis Information on page 209

## Checklist for Displaying Basic Chassis Information

**Purpose** Table 38 on page 209 provides links and commands for displaying basic chassis information, including a list of all Flexible PIC Concentrators (FPCs) and Physical Interface Cards (PICs) installed in the router chassis, the hardware version level, and the serial number.

**Table 38: Checklist for Displaying Basic Chassis Information**

| Task                                            | Command or Action              |
|-------------------------------------------------|--------------------------------|
| “Display Basic Chassis Information” on page 209 | show chassis hardware <detail> |

## Display Basic Chassis Information

**Purpose** Before you return a router component to Juniper Networks, you must contact the Juniper Networks Technical Assistance Center (JTAC) with the serial number of the failed component and failure information. JTAC will then grant a Return Materials Authorization (RMA).

**Action** To display a list of the serial numbers of components installed in the router chassis, use the following JUNOS command-line interface (CLI) operational mode command:

```
user@host> show chassis hardware <detail>
```

**Sample Output**

```
user@host> show chassis hardware
Hardware inventory:
Item          Version  Part number  Serial number  Description
Chassis                               25708         M20
Backplane     REV 03   710-002334   BB9738
Power Supply A REV 06   740-001465   005234         AC
Power Supply B REV 06   740-001465   005237         AC
Display       REV 04   710-001519   BA4681
```

|                  |        |            |            |                       |
|------------------|--------|------------|------------|-----------------------|
| Routing Engine 0 | REV 06 | 740-003239 | 1000224893 | RE-2.0                |
| Routing Engine 1 | REV 06 | 740-003239 | 9000022146 | RE-2.0                |
| SSB slot 0       | REV 02 | 710-001951 | AZ8112     | Internet Processor II |
| SSB slot 1       | N/A    | N/A        | N/A        | backup                |
| FPC 0            | REV 03 | 710-003308 | BD8455     | E-FPC                 |
| PIC 0            | REV 08 | 750-002303 | AZ5310     | 4x F/E, 100 BASE-TX   |
| PIC 1            | REV 07 | 750-004745 | BC9368     | 2x CT3-NxDS0          |
| FPC 1            | REV 03 | 710-003308 | BB9032     | E-FPC                 |
| PIC 0            | REV 03 | 750-002914 | BC0131     | 2x OC-3 ATM, MM       |

```
user@host> show chassis hardware
```

```
Hardware inventory:
```

| Item           | Version | Part number | Serial number       | Description           |
|----------------|---------|-------------|---------------------|-----------------------|
| Chassis        |         |             | 00159               | <b>M40</b>            |
| Backplane      | REV 08  | 710-000073  | AA2125              |                       |
| Power Supply B | Rev A1  | 740-000235  | 000289              | DC                    |
| <b>Maxicab</b> | REV 08  | 710-000229  | <b>CA4516</b>       |                       |
| Minicab        | REV 04  | 710-001739  | CA4610              |                       |
| Display        | REV 07  | 710-000150  | AA5145              |                       |
| Routing Engine | REV 07  | 740-005022  | <b>P10865702236</b> | <b>RE-3.0</b>         |
| SCB            | REV 03  | 710-007684  | CA3900              | Internet Processor II |
| FPC 1          | REV 01  | 710-001292  | AL7435              |                       |
| PIC 0          | REV 03  | 750-000617  | AA3530              | 1x OC-48 SONET, SMIR  |
| FPC 2          | REV 09  | 710-000175  | AA4740              |                       |
| PIC 0          | REV 03  | 750-000617  | AA4557              | 1x OC-48 SONET, SMIR  |
| FPC 3          | REV 01  | 710-001292  | AB4775              |                       |
| PIC 0          | REV 03  | 750-000612  | AA1771              | 2x OC-3 ATM, MM       |
| PIC 1          | REV 03  | 750-002977  | AV3457              | 2x OC-3 ATM, MM       |
| FPC 5          | REV 01  | 710-001292  | AC5118              |                       |
| PIC 1          | REV 03  | 750-003628  | AS8882              | 1x G/E, 1000 BASE-LH  |

```
user@host> show chassis hardware detail
```

```
Hardware inventory:
```

| Item             | Version | Part number | Serial number           | Description           |
|------------------|---------|-------------|-------------------------|-----------------------|
| Chassis          |         |             | 25708                   | <b>M20</b>            |
| Backplane        | REV 03  | 710-002334  | BB9738                  |                       |
| Power Supply A   | REV 06  | 740-001465  | 005234                  | AC                    |
| Power Supply B   | REV 06  | 740-001465  | 005237                  | AC                    |
| Display          | REV 04  | 710-001519  | BA4681                  |                       |
| Routing Engine 0 | REV 06  | 740-003239  | <b>1000224893</b>       | <b>RE-2.0</b>         |
| Routing Engine 0 |         |             | <b>58000007348d9a01</b> | <b>RE-2.0</b>         |
| Routing Engine 1 | REV 06  | 740-003239  | 9000022146              | RE-2.0                |
| Routing Engine 1 |         |             | d800000734745701        | RE-2.0                |
| SSB slot 0       | REV 02  | 710-001951  | AZ8112                  | Internet Processor II |
| SSRAM bank 0     | REV 02  | 710-001385  | 242525                  | 2 Mbytes              |
| SSRAM bank 1     | REV 02  | 710-001385  | 242741                  | 2 Mbytes              |
| SSRAM bank 2     | REV 02  | 710-001385  | 242886                  | 2 Mbytes              |
| SSRAM bank 3     | REV 02  | 710-001385  | 242482                  | 2 Mbytes              |
| SSB slot 1       | N/A     | N/A         | N/A                     | backup                |
| FPC 0            | REV 03  | 710-003308  | BD8455                  | E-FPC                 |
| SSRAM            | REV 02  | 710-001385  | 241669                  | 2 Mbytes              |
| SDRAM bank 0     | REV 01  | 710-000099  | 0003409                 | 64 Mbytes             |
| SDRAM bank 1     | REV 01  | 710-000099  | 0003408                 | 64 Mbytes             |
| PIC 0            | REV 08  | 750-002303  | AZ5310                  | 4x F/E, 100 BASE-TX   |
| PIC 1            | REV 07  | 750-004745  | BC9368                  | 2x CT3-NxDS0          |
| FPC 1            | REV 03  | 710-003308  | BB9032                  | E-FPC                 |
| SSRAM            | REV 01  | 710-001385  | V00818                  | 2 Mbytes              |
| SDRAM bank 0     | REV 01  | 710-000099  | 0003803                 | 64 Mbytes             |
| SDRAM bank 1     | REV 01  | 710-000099  | 0003847                 | 64 Mbytes             |
| PIC 0            | REV 03  | 750-002914  | BC0131                  | 2x OC-3 ATM, MM       |



**Meaning** The sample output is for an M20 and an M40 router. It shows a list of all FPCs and PICs installed in the router chassis, including the hardware version level and serial number.

The **detail** option displays detailed information about hardware, including memory, hardware version level, serial number, and additional information about memory.

If the Routing Engine is identified by a 10- and 16-digit serial number, both numbers are displayed in the output for the **detail** option, and are especially important when processing an RMA for such a Routing Engine. In addition, when you request an RMA for the M40 router, include the **maxicab** serial number.

Table 39 on page 211 provides a description of all the output fields for the **show chassis hardware** command.

**Table 39: Output fields for the show chassis hardware command**

| Output field  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Item          | <p>(For M-series routers) Chassis component. Information is displayed about the backplane; power supplies; Routing Engine; maxicab (the connection between the Routing Engine and the backplane, for the M40 router only); System Control Board (SCB), System and Switch Board (SSB), Switching and Forwarding Module (SFM), or Forwarding Engine Board (FEB); Miscellaneous Control Subsystem (MCS) and PFE clock generator (PCG) (for the M160 router only); and each FPC and PIC.</p> <p>(For T-series platforms) Chassis component. Information is displayed about the backplane, power supplies, midplane, Control Board (CB), Connector Interface Panel (CIP), FPC, Front Panel Module (FPM) (craft interface), Power Entry Module (PEM), PIC, SONET Clock Generator (SCG), Small Form-factor Pluggable (SFP) modules, Switch Interface Board (SIB), and Switch Processor Mezzanine Board (SPMB).</p> |
| Version       | Revision level of the chassis component.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Part number   | Part number of the chassis component.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Serial number | Serial number of the chassis component. For all RMAs, the chassis serial number must be provided to JTAC. If the RMA is for the chassis itself, you must obtain the backplane or midplane serial number as well.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Description   | Brief description of the hardware item.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |



**NOTE:** When you request an RMA, you must also include output from the **show chassis environment** command, the **show version** command, and the troubleshooting output used to identify the failure.



## Chapter 19

# Display and Locate Files and Directories

This chapter describes how to display and locate files and directories on a router.

- Checklist for Displaying and Locating Files and Directories on a Router on page 213
- Copy a File on a Routing Engine on page 214
- Maintain a Single Configuration File for Both Routing Engines on page 216
- List Files and Directories on a Router on page 219
- Display File Contents on page 219
- Rename a File on a Router on page 220
- Delete a File on a Router on page 220

### Checklist for Displaying and Locating Files and Directories on a Router

**Purpose** Table 40 on page 213 provides links and commands for displaying and locating files and directories on a router.

**Table 40: Checklist for Displaying and Locating Files and Directories on a Router**

| Tasks                                                                              | Command or Action                                                     |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| <b>“Copy a File on a Routing Engine” on page 214</b>                               |                                                                       |
| 1. Copy a File from One Routing Engine to Another on page 214                      | <code>file copy source destination</code>                             |
| 2. Copy Files between the Local Router and a Remote System on page 215             | <code>file copy filename ftp://hostname/path/filename</code>          |
|                                                                                    | <code>file copy filename ftp://user:password@hostname/filename</code> |
|                                                                                    | <code>file copy filename ftp://user@hostname/filename</code>          |
|                                                                                    | <code>file copy filename scp://user@hostname/path/filename</code>     |
| <b>“Maintain a Single Configuration File for Both Routing Engines” on page 216</b> |                                                                       |

**Table 40: Checklist for Displaying and Locating Files and Directories on a Router**  
(continued)

| Tasks                                                       | Command or Action                                                                                                                                                                                                |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Configure the New Group on page 216                      | <pre>[edit groups] set group-name  [edit groups re0] set interfaces <i>interface name</i> unit <i>unit</i> family inet address address  [edit groups re0 system] set host-name <i>hostname</i> show commit</pre> |
| 2. Apply the New Group on page 218                          | <pre>[edit] set apply-groups <i>group-name</i> show commit</pre>                                                                                                                                                 |
| <b>“List Files and Directories on a Router” on page 219</b> | file list <i>filename</i> or <i>directory</i>                                                                                                                                                                    |
| <b>“Display File Contents” on page 219</b>                  | file show <i>filename</i>                                                                                                                                                                                        |
| <b>“Rename a File on a Router” on page 220</b>              | file rename <i>source destination</i>                                                                                                                                                                            |
| <b>“Delete a File on a Router” on page 220</b>              | file delete <i>filename</i>                                                                                                                                                                                      |

## Copy a File on a Routing Engine

**Purpose** When you configure one Routing Engine and another Routing Engine needs to have a similar configuration, or when you upgrade the JUNOS software version on one Routing Engine, you can simplify the process by copying files from one Routing Engine to another.

To copy a file, follow these steps:

1. Copy a File from One Routing Engine to Another on page 214
2. Copy Files between the Local Router and a Remote System on page 215

### Copy a File from One Routing Engine to Another

**Purpose** When you have a dual Routing Engine configuration, you can copy a configuration file from Routing Engine 0 to Routing Engine 1 or vice versa.

**Action** To copy a configuration file from Routing Engine 0 to Routing Engine 1, use the following JUNOS command-line interface (CLI) operational mode command:

```
user@host> file copy source destination
```

**Sample Output** `user@host> file copy /config/juniper.conf re1:/var/tmp/copied-juniper.conf`

**Meaning** In this case, *source* is the name of the configuration file on Routing Engine 0. Configuration files are stored in the directory `/config`. The active configuration is `/config/juniper.conf`, and older configurations are in `/config/juniper.conf {1...9}`. *destination* is a file on Routing Engine 1.



**NOTE:** Refer to “Maintain a Single Configuration File for Both Routing Engines” on page 216 for details about naming the Routing Engines correctly.

---

## Copy Files between the Local Router and a Remote System

**Action** You can copy a configuration file from a Routing Engine to a remote system in the network using the File Transfer Protocol (FTP) or secure copy protocol (**scp**) in any one of the following ways:

- To use anonymous FTP to copy a local file to a remote system, enter the following command:

```
root@host> file copy filename ftp://hostname/filename
```

In the following example, `/config/juniper.conf` is the local file and `hostname` is the FTP server:

```
root@host> file copy
/config/juniper.confftp://hostname/juniper.confReceiving ftp:
//hostname/juniper.conf (2198 bytes): 100%
2198 bytes transferred in 0.0 seconds (2.69 MBps)
```

- To use FTP where a valid username and password are required, enter the following command:

```
root@host> file copy filename ftp://user:password@hostname/filename
```

In the following example, `/config/juniper.conf` is the local file, `user` is the username, `testing123` is the password, and `hostname` is the FTP server:

```
root@host> file copy /config/juniper.conf
ftp://user:testing123@hostname/juniper.conf
Receiving ftp: //user:testing123@hostname/juniper.conf (2198 bytes): 100%
2198 bytes transferred in 0.0 seconds (2.69 MBps)
```

- To use FTP where you require more privacy and are prompted for a password, enter the following command:

```
root@host> file copy filename ftp://user@hostname/filename
```

In the following example, `/config/juniper.conf` is the local file, `user` is the username, and `hostname` is the FTP server:

```

root@host> file copy /config/juniper.conf ftp://user@hostname/juniper.conf
Password for user@hostname: *****
Receiving ftp: //user@hostname/juniper.conf (2198 bytes): 100%
2198 bytes transferred in 0.0 seconds (2.69 MBps)

```

- To use scp to copy a local file to a remote system, enter the following command:

```

root@host> file copy filename scp://user@hostname/path/filename

```

In the following example, /config/juniper.conf is the local file, user is the username, and ssh-host is the scp server:

```

root@host> file copy /config/juniper.conf
scp://user@ssh-host/tmp/juniper.conf
user@ssh-host's password: *****
juniper.conf          100%
|*****|
2198          00:00

```



**NOTE:** You cannot use scp or ssh to copy a file in the worldwide version of the JUNOS software.

## Maintain a Single Configuration File for Both Routing Engines

**Purpose** For routers that support multiple Routing Engines, you can specify **re0** and **re1** as group names to ensure that the correct IP addresses are used for each Routing Engine and to maintain a single configuration file for both Routing Engines. It is important that the names of the Routing Engines correspond to a slot position because the names **re0** and **re1** are special group names that you must use for the Routing Engines to recognize which configuration statement to use. Routing Engine 0 must be in slot position 0 and must be named **re0**, and Routing Engine 1 must be in slot position 1 and must be named **re1**.

To maintain a single configuration file for both Routing Engines, follow these steps:

1. Configure the New Group on page 216
2. Apply the New Group on page 218

### Configure the New Group

**Purpose** Each **re0** or **re1** group typically contains, at a minimum, the configuration for the hostname and the management interface (**fxp0**). If each Routing Engine uses a different management interface, the group must also contain the configuration for the backup router and static routes.

**Action** To configure the **re0** and **re1** groups, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```
[edit]
user@host# edit groups
```

2. Configure the group:

```
[edit groups]
user@host# set group-name
```

For example:

```
[edit groups]
user@host# set re0
```

3. To configure the management interface, go to the following hierarchy level:

```
[edit groups]
user@host# edit groups re0
```

4. Include the following statement:

```
[edit groups re0]
user@host# set interfaces interface-name unit unit family inet address address
```

For example:

```
[edit groups re0]
user@host# set interfaces fxp0 unit 0 family inet address 1.1.1.1/24
```

5. To configure the hostname, go to the following hierarchy level:

```
[edit groups re0]
user@host# edit groups re0 system
```

6. Include the following statement:

```
[edit groups re0 system]
user@host# set host-name hostname
```

For example:

```
[edit groups re0 system]
user@host# set host-name foo-re0
```

7. Verify the configuration:

```
[edit groups re0]
user@host# show
re0 {
  system {
    host-name foo-re0;
  }
  interfaces {
    fxp0 {
      unit 0 {
        family inet {
          address 1.1.1.1/24;
        }
      }
    }
  }
}
```

```

    }
  }
}

```

8. Commit the configuration:

```
user@host# commit
```

9. Repeat Step 1 through Step 8 for the **re1** group.

**Meaning** The sample output in Step 7 shows that the **re0** group contains the minimum configuration for a group, the hostname, and the management interface (**fxp0**). If each Routing Engine uses a different management interface, the group must also contain the configuration for the backup router and static routes.

## Apply the New Group

**Action** To apply the **re0** group to maintain a single configuration file for both Routing Engines, follow these steps:

1. In configuration mode, go to the top hierarchy level and include the following statement:

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

```
user@host# set apply-groups group-name
```

For example:

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

```
user@host# set apply-groups re0
```

2. Verify the configuration:

```
user@host# show
```

```

groups {
  re0 {
    system {
      host-name foo-re0;
    }
    interfaces {
      fxp0 {
        unit 0 {
          family inet {
            address 1.1.1.1/24;
          }
        }
      }
    }
  }
  re1 {
    system {

```



```

        host-name foo-re1;
    }
    interfaces {
        fxp0 {
            unit 0 {
                family inet {
                    address 1.1.1.2/24;
                }
            }
        }
    }
}
apply-groups [ re0 re1 ];

```

3. Commit the configuration:

```
user@host# commit
```

**Meaning** The sample output shows that each group, **re0** and **re1**, has its own IP address that is used for each Routing Engine to maintain a single configuration file.

## List Files and Directories on a Router

**Problem** If a system board crashes, you must check that certain files are in specific directories.

**Solution** To display files in the `/var/tmp` and `var/crash` directories, use the following CLI operational mode command:

```
user@host> file list filename or directory
```

**Sample Output**

```

sampled.pkts
vi.recover/
user@host> file list /var/crash/
bounds
minfree
vmcore.0

```

**Meaning** The sample output shows the files in the `/var/tmp/` and `/var/crash/` directories. The Juniper Networks Technical Assistance Center (JTAC) can ask you to verify the existence of similar files.

## Display File Contents

**Purpose** To display the contents of a file on the local router.

**Action** To display the contents of a file on the local router, use the following CLI operational mode command:

```
user@host> file show filename
```

**Sample Output**

```

user@host> file show /var/log/messages
Apr 13 21:00:08 romney /kernel: so-1/1/2: loopback suspected; going to standby.
Apr 13 21:00:40 romney /kernel: so-1/1/2: loopback suspected; going to standby.

```

```

Apr 13 21:02:48 romney last message repeated 4 times
Apr 13 21:07:04 romney last message repeated 8 times
Apr 13 21:07:13 romney /kernel: so-1/1/0: Clearing SONET alarm(s) RDI-P
Apr 13 21:07:29 romney /kernel: so-1/1/0: Asserting SONET alarm(s) RDI-P
Apr 13 21:07:36 romney /kernel: so-1/1/2: loopback suspected; going to standby.
Apr 13 21:08:08 romney /kernel: so-1/1/2: loopback suspected; going to standby.
...Output truncated...

```

**Meaning** The sample output shows the contents of the `/var/log/messages` file.

## Rename a File on a Router

---

**Action** To rename a file on the local router, use the following CLI operational mode command:

```
user@host> file rename source destination
```

**Sample Output**

```

user@host> file list /var/tmp
dcd.core
rpd.core
snmpd.core

user@host> file rename /var/tmp/dcd.core /var/tmp/dcd.core.990413
user@host> file list /var/tmp
dcd.core.990413
rpd.core
snmpd.core

```

**Meaning** The sample output shows that the `dcd.core` file was renamed to `dcd.core.990413`. The original name of the file is the *source* and the new name for the file is the *destination*.

## Delete a File on a Router

---

**Action** To delete a file on the local router, use the following CLI operational mode command:

```
user@host> file delete filename
```

**Sample Output**

```

user@host> file list /var/tmp
dcd.core
rpd.core
snmpd.core

user@host> file delete /var/tmp/snmpd.core
user@host> file list /var/tmp
dcd.core
rpd.core

```

**Meaning** The sample output shows that the `snmpd.core` file was deleted.

## Chapter 20

# Check Time on a Router

This chapter describes how to display the current time on the router, determine whether router components failed during a problem, and check that the local clock time on the router is synchronized with the time on the Network Time Protocol (NTP) server.

- Checklist for Checking Time on a Router on page 221
- Check the Time on a Router on page 222
- Check How Long Router Components Have Been Up on page 222
- Check the NTP Peers on page 224
- Check the NTP Status on page 225

### Checklist for Checking Time on a Router

**Purpose** Table 41 on page 221 provides links commands for checking time on router the current time on the router, determine whether router components failed during a problem, and check that the local clock time on the router is synchronized with the time on the Network Time Protocol (NTP) server.

**Table 41: Checklist for Checking Time on a Router**

| Tasks                                                       | Command or Action                                                                                                                      |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| “Check the Time on a Router” on page 222                    | show system uptime                                                                                                                     |
| “Check How Long Router Components Have Been Up” on page 222 | show chassis fpc detail<br>show chassis routing-engine<br>show chassis feb<br>show chassis scb<br>show chassis sfm<br>show chassis ssb |
| “Check the NTP Peers” on page 224                           | show ntp associations                                                                                                                  |
| “Check the NTP Status” on page 225                          | show ntp status                                                                                                                        |

## Check the Time on a Router

**Purpose** Display the current time on a router and display information about how long the router, router software, and routing protocols have been running.

**Action** To check time on a router, use the following JUNOS command-line interface (CLI) operational mode command:

```
user@host> show system uptime
```

**Sample Output**

```
user@host> show system uptime
Current time:      1998-10-13 19:45:47 UTC
System booted:     1998-10-12 20:51:41 UTC (22:54:06 ago)
Protocols started: 1998-10-13 19:33:45 UTC (00:12:02 ago)
Last configured:   1998-10-13 19:33:45 UTC (00:12:02 ago) by abc
12:45PM up 22:54, 2 users, load averages: 0.07, 0.02, 0.01
```

**Meaning** The sample output shows the current system time in UTC, the date and time when the router was last booted and how long it has been running, when the routing protocols were last started and how long they have been running, when a configuration was last committed, and the name of the user who issued the last commit command. If a different time zone is configured, the output shows that time zone. For information on configuring the time zone, see the *JUNOS System Basics Configuration Guide*.

The sample output shows that the current time is 12:45 PM, the router has been operational for 22:54 hours, and two users are logged in to the router. The output also shows that the load average is 0.07 seconds for the last minute, 0.02 seconds for the last 5 minutes, and 0.01 seconds for the last 15 minutes.

## Check How Long Router Components Have Been Up

**Purpose** When a problem occurs and you check the system to see how long it has been up, you may find that the `show system uptime` command displays the current time and information about how long the router, router software, and routing protocols have been running, but does not tell you if a component failed. Determining whether a component failed when a problem occurred with the router is an important step in the diagnosis of a problem.

**Action** To check how long router components have been up, issue the `show chassis` command for the components on your router:

```
user@host> show chassis fpc detail
user@host> show chassis routing-engine
user@host> show chassis feb
user@host> show chassis scb
user@host> show chassis sfm
user@host> show chassis ssb
```

**Sample Output** The following sample output is for an M20 router:

**Sample Output**

```
user@host> show chassis fpc detail
Slot 0 information:
State                               Empty
```

```

Slot 1 information:
  State                               Online
  Logical slot                        0
  Temperature                         32 degrees C / 89 degrees F
  Total CPU DRAM                      8 MB
  Total SRAM                          1 MB
  Total SDRAM                         128 MB
  Total notification SDRAM            24 MB
  I/O Manager ASIC information        Version 2.0, Foundry IBM, Part number 0
  Start time:                        2003-09-23 17:20:42 UTC
  Uptime:                             1 day, 4 hours, 45 minutes, 14 seconds

Slot 2 information:
  State                               Empty

Slot 3 information:
  State                               Online
  Logical slot                        1
  Temperature                         32 degrees C / 89 degrees F
  Total CPU DRAM                      8 MB
  Total SRAM                          1 MB
  Total SDRAM                         128 MB
  Total notification SDRAM            24 MB
  I/O Manager ASIC information        Version 1.1, Foundry IBM, Part number 0
  Start time:                        2003-09-12 01:28:16 UTC
  Uptime:                             12 days, 20 hours, 37 minutes, 40 seconds

```

**Sample Output**

```

user@host> show chassis routing-engine
Routing Engine status:
Slot 0:
  Current state                       Master
  Election priority                   Master (default)
  Temperature                         30 degrees C / 86 degrees F
  DRAM                               768 MB
  Memory utilization                   17 percent
  CPU utilization:
    User                             0 percent
    Background                       0 percent
    Kernel                           1 percent
    Interrupt                         0 percent
    Idle                             99 percent
  Model                              RE-2.0
  Serial ID                          58000007348d9a01
  Start time                         2003-09-19 07:05:20 PDT
  Uptime                             6 hours, 42 minutes, 26 seconds
  Load averages:                     1 minute   5 minute   15 minute
                                      0.00        0.00        0.00

Routing Engine status:
Slot 1:
  Current state                       Backup
  Election priority                   Backup (default)
  Temperature                         30 degrees C / 86 degrees F
  DRAM                               768 MB
  Memory utilization                   0 percent
  CPU utilization:
    User                             0 percent
    Background                       0 percent
    Kernel                           0 percent
    Interrupt                         0 percent
    Idle                             100 percent
  Model                              RE-2.0
  Serial ID                          d800000734745701

```

```

Start time          2003-06-17 16:37:33 PDT
Uptime              93 days, 20 hours, 58 minutes, 14 seconds

```

**Sample Output**

```

user@host> show chassis ssb
SSB status:
Slot 0 information:
  State          Master
  Temperature    33 degrees C / 91 degrees F
  CPU utilization 2 percent
  Interrupt utilization 0 percent
  Heap utilization 17 percent
  Buffer utilization 43 percent
  Total CPU DRAM 64 MB
  Internet Processor II Version 1, Foundry IBM, Part number 9
  Start time:    2003-09-19 07:06:52 PDT
  Uptime:        6 hours, 43 minutes, 52 seconds
Slot 1 information:
  State          Backup

```

**Meaning** The sample output shows the time when the component started running and how long the component has been running. A short uptime can indicate a problem with the component.

## Check the NTP Peers

**Purpose** Ensure that the clock time on the router is synchronized with the time on the NTP server.

**Action** To check NTP peers, enter the following JUNOS CLI operational mode command:

```
user@host> show ntp associations
```

**Sample Output 1**

```

user@host> show ntp associations
remote          refid          st t when poll reach  delay  offset  jitter
=====
*coetanian.junip .GPS.          1 u  22   64  377   6.861  -1.297  0.811

```

**Sample Output 2**

```

user@jhost> show ntp associations
> remote          refid          st t when poll reach  delay  offset  jitter
> =====
> ntp1.usno.navy. PSC.          1 -  44   64   77   86.829  -1830.3  915.177
> Tick.UH.EDU      USNO.          1 -  36   64   77   42.560  -1835.3  917.667

```

**Meaning** Sample output 1 is synchronized with the NTP server because there is an asterisk (\*) at the beginning of the output. Also, the router with the asterisk (\*) is the master router and the system is synchronizing with this NTP server.

Sample output 2 shows that the time on the server and router is so far apart that NTP will not attempt to synchronize. The **offset** value of **1830** is too large a difference and the **jitter** value of **917.667** is also too large to provide reliability to the **offset** value.

In ordinary conditions, the NTP server synchronizes the router clock in small steps so that the timescale is effectively continuous. In conditions of extreme network congestion, the NTP server discards sample offsets exceeding 128 ms, unless sample

offsets are greater than 128 ms, for longer than 900 seconds. In this case, no matter what the next offset, the NTP server adjusts to the indicated time.

For more detailed information on configuring the NTP server, see the *JUNOS System Basics Configuration Guide*.

## Check the NTP Status

**Purpose** View the configuration of the NTP server and the status of the system.

**Action** To check NTP status, enter the following JUNOS CLI operational mode command:

```
user@host> show ntp status
```

**Sample Output**

```
user@host> show ntp status
status=0644 leap_none, sync_ntp, 4 events, event_peer/strat_chg,
processor="i386", system="JUNOS5.7-20030919-IMAYzc", leap=00, stratum=2,
precision=-28, rootdelay=6.861, rootdispersion=10.465, peer=11004,
refid=coetanian.company.net,
reftime=c315b20a.a5c768df Fri, Sep 19 2003 9:49:14.647, poll=6,
clock=c315b22a.1b31a08b Fri, Sep 19 2003 9:49:46.106, state=4,
phase=-1.297, frequency=74.659, jitter=0.725, stability=0.005
```

**Meaning** The sample output shows when the clock was last adjusted (reftime), together with its status and most recent exception event. Table 42 on page 225 lists and describes the fields in the output of the `show ntp status` command.

**Table 42: Sample Output Fields for the `show ntp status` Command**

| Output Field                                           | Description                                                                                                                                                                                                               |
|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| status=0644                                            | Internal status flags.                                                                                                                                                                                                    |
| leap_none                                              | The router is not doing a leap second.                                                                                                                                                                                    |
| sync_ntp                                               | The server and the router are synchronized.                                                                                                                                                                               |
| 4events                                                | The accumulated number of events since NTP was started.                                                                                                                                                                   |
| event_peer/strat_chg                                   | Last event code.                                                                                                                                                                                                          |
| processor="i386",<br>system="JUNOS5.7-20030919-IMAYzc" | Both fields identify the current system information.                                                                                                                                                                      |
| leap=00                                                | An internal value related to leap seconds.                                                                                                                                                                                |
| stratum=2                                              | The router stratum, which is always one higher than the stratum of the server to which the router is synchronized. If the router is not synchronized, the value is 16 instead of 2.                                       |
| precision=-28                                          | Order of magnitude of how small an interval the local system's clock can measure. In this example, -28 means that the system can measure a period of -28 seconds, approximately 1/64 of a microsecond, or 16 nanoseconds. |

**Table 42: Sample Output Fields for the show ntp status Command** *(continued)*

| Output Field                                                                              | Description                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rootdelay=6.861                                                                           | One-way delay between the local system and the stratum 0 clock source. Essentially, this is the sum of the delays between this router and its synchronized source, the source and its source, and so on, all the way up to the atomic clock (which is stratum 0). |
| rootdispersion=10.465                                                                     | The confidence level of the clock, in microseconds, that encompasses delay, jitter, and so on.                                                                                                                                                                    |
| peer=11004                                                                                | No information is available for this field yet.                                                                                                                                                                                                                   |
| refid=coetanian.company.net,<br>reftime=c315b20a.a5c768df Fri, Sep 19<br>2003 9:49:14.647 | These two fields identify the selected and synchronized source, and the last reference time received from it.                                                                                                                                                     |
| poll=6                                                                                    | The delay interval at which the synchronized server polls. In this example, 6 indicates that the server polls every $2^6$ seconds, or every 64 seconds.                                                                                                           |
| clock=c315b22a.1b31a08b Fri, Sep 19 2003<br>9:49:46.106                                   | The current time.                                                                                                                                                                                                                                                 |
| state=4                                                                                   | No information is available for this field yet.                                                                                                                                                                                                                   |
| phase=-1.297                                                                              | The calculated offset based on the local time, the server's last reported time, and the sense of the delay between the router and the server. This is measured in milliseconds.                                                                                   |
| frequency=74.659                                                                          | The clock frequency, in MHz. Note that this is the same order of magnitude as <b>precision</b> .                                                                                                                                                                  |
| jitter=0.725                                                                              | Variation in the time delay between the router and the server.                                                                                                                                                                                                    |
| stability=0.005                                                                           | A measure of how often the speed on the router must be changed to keep synchronized with the server. If the local clock is not perfectly stable, it will speed up or slow down, and NTP will have to counteract that tendency.                                    |



## Chapter 21

# Check User Accounts and Permissions

This chapter describes how to check user accounts and permissions.

- Checklist for Checking User Accounts and Permissions on page 227
- Understand User Accounts and Permissions on page 228
- Check Users Logged In To a Router on page 228
- Check for Users in Configuration Mode on page 229
- Check the Commands That Users Are Entering on page 230
- Log a User Out of the Router on page 232
- Check When the Last Configuration Change Occurred on page 232
- Force a Message to Logged-In User Terminals on page 234
- Check RADIUS Server Connectivity on page 234

## Checklist for Checking User Accounts and Permissions

**Purpose** Table 43 on page 227 provides links and commands for checking user accounts and permissions.

**Table 43: Checklist for Checking User Accounts and Permissions**

| Tasks                                                           | Command or Action                                                                                            |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>“Understand User Accounts and Permissions” on page 228</b>   |                                                                                                              |
| <b>“Check Users Logged In To a Router” on page 228</b>          | show system users                                                                                            |
| <b>“Check for Users in Configuration Mode” on page 229</b>      | [edit]<br>status                                                                                             |
| <b>“Check the Commands That Users Are Entering” on page 230</b> |                                                                                                              |
| 1. Configure the Log File for Tracking CLI Commands on page 230 | [edit]<br>edit system syslog<br>edit file <i>filename</i><br>set interactive-commands info<br>show<br>commit |
| 2. Display the Configured Log File on page 231                  | [edit system syslog]<br>run show log <i>filename</i>                                                         |
| <b>“Log a User Out of the Router” on page 232</b>               | request system logout <i>username</i>                                                                        |

**Table 43: Checklist for Checking User Accounts and Permissions** *(continued)*

| Tasks                                                                  | Command or Action                                                                                  |
|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <b>“Check When the Last Configuration Change Occurred” on page 232</b> |                                                                                                    |
| 1. Configure Configuration Change Tracking on page 232                 | [edit]<br>edit system syslog<br>edit file <i>filename</i><br>set change-log info<br>show<br>commit |
| 2. Display the Configured Log File on page 233                         | [edit system syslog]<br>run show log <i>filename</i>                                               |
| <b>“Force a Message to Logged-In User Terminals” on page 234</b>       |                                                                                                    |
|                                                                        | request message all message “text”<br>request message message “text” user <i>username</i>          |
| <b>“Check RADIUS Server Connectivity” on page 234</b>                  |                                                                                                    |
|                                                                        | [edit system]<br>show<br>run ping <i>IP-address</i>                                                |

## Understand User Accounts and Permissions

JUNOS software can be configured to support any number of user accounts. Each user account has an access level for which you can define the login name and, optionally, information that identifies the user. After you create an account, the software creates a home directory in the file system for the user.

In this topic, it is assumed that user accounts and permissions are configured on the router. For more detailed information about creating a user account and configuring permissions, see the *JUNOS Network Management Configuration Guide*.

## Check Users Logged In To a Router

**Purpose** You may need to take note of the users currently logged in to a router.

**Action** To list all users who are currently logged in to a router, enter the following JUNOS command-line interface (CLI) operational mode command:

```
user@host> show system users
```

**Sample Output**

```
user@host> show system users
1:49PM PDT up 6:44, 3 users, load averages: 0.00, 0.00, 0.00
USER      TTY      FROM                    LOGIN@  IDLE WHAT
jgchan    p0       big.company.net        1:36PM  12 -csh (csh)
user      p1       pink.company.net       1:49PM  - -cli (cli)
blue      p2       leve15.company.net     2:30PM  - -cli
```

**Meaning** The sample output lists information about the users who are currently logged in to a router. There are three users, one of whom has not recently accessed the router.

Two of the users are running the CLI, and one is working from the UNIX-level shell (csh). Table 43 on page 227 lists and describes the fields in the output of the `show system users` command.

**Table 44: Description of Output Fields for the `show system users` Command**

| Field              | Description                                                                                                 |
|--------------------|-------------------------------------------------------------------------------------------------------------|
| <i>time</i> and up | Current time, in the local time zone, and how long the router has been operational.                         |
| users              | Number of users logged in to the router.                                                                    |
| load averages      | Load averages for the last 1 minute, 5 minutes, and 15 minutes.                                             |
| USER               | Username.                                                                                                   |
| TTY                | Terminal through which the user is logged in.                                                               |
| FROM               | System from which the user is logged in. A hyphen indicates that the user is logged in through the console. |
| LOGIN@             | Time when the user logged in.                                                                               |
| IDLE               | How long the user has been idle.                                                                            |
| WHAT               | Processes that the user is running.                                                                         |

## Check for Users in Configuration Mode

**Purpose** Before you change the configuration or commit a candidate configuration, it is a good idea to check for users in configuration mode.

**Action** To display users currently editing the configuration, follow these steps:

1. To enter configuration mode, type the following command:

```
user@host> edit
```

2. Enter the following configuration mode command:

```
[edit]
user@host# status
```

For example:

```
user@host> show system users
```

```
4:58PM PST up 5 days, 9:52, 5 users, load averages: 0.01, 0.01, 0.00
USER      TTY      FROM                LOGIN@   IDLE   WHAT
mwazna    p0       bigpunk.juniper.net 4:58PM   -      -cli
(ccli)
jgchan    p1       bigpunk.juniper.net 2:25PM   2:32   -csh
```

```

(csh)
jgchan p2 bigpunk.juniper.net 2:35PM 2:18 cli
taffy p3 bigpunk.juniper.net 3:28PM 5 -cli
(cli)
tmauro p4 bigpunk.juniper.net 4:16PM 37 cli

```

**Meaning** The sample output lists the users who are currently logged in to the router. Five users are logged in to the router, with one user logged in twice, **jgchan**. Each user is logged in through a different terminal (TTY—**p0**, **p1**, **p2**, **p3**, and **p4**) from the system **bigpunk.juniper.net**. A hyphen in the **FROM** field indicates that the user logged in through the console.

Additional information includes the time when the user logged in (**LOGIN**), the amount of time the user is not active on the router (**IDLE**), and the processes that the user is running (**WHAT**). In this example, the users are running the command-line interface (**cli**) and the UNIX-level shell (**csh**).

## Check the Commands That Users Are Entering

**Purpose** A common set of operations you can check is when users log in to the router and the CLI commands they issue.

To check the commands that users are entering, follow these steps:

1. Configure the Log File for Tracking CLI Commands on page 230
2. Display the Configured Log File on page 231

### Configure the Log File for Tracking CLI Commands

**Action** To configure the log file for tracking CLI commands, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```

[edit]
user@host# edit system syslog

```

2. Configure the log file:

```

[edit system syslog]
user@host# edit file filename

```

For example:

```

[edit system syslog]
user@host# edit file cli-commands

```

3. Configure the interactive-commands facility and severity level:

```

[edit system syslog filename]
user@host# set interactive-commands info

```

4. Verify the configuration:

```
[edit system syslog]
user@host# show
file cli-commands {
    interactive-commands info;
}
```

5. Commit the configuration:

```
user@host# commit
```

**Meaning** The configuration example shows that the log file `cli-commands` is configured with the `interactive-commands` facility at the `info` severity level. Table 45 on page 231 lists and describes the severity levels.

**Table 45: Severity Levels**

| Severity Level | Description                                                                                                        |
|----------------|--------------------------------------------------------------------------------------------------------------------|
| info           | Log all top-level CLI commands, including the <code>configure</code> command, and all configuration mode commands. |
| notice         | Log the configuration mode commands <code>rollback</code> and <code>commit</code> .                                |
| warning        | Log when any software process restarts.                                                                            |

## Display the Configured Log File

**Purpose** To display the log file in configuration mode, enter the following command:

**Action** [edit system syslog]  
user@host# **run show log filename**

For example:

```
[edit system syslog]
user@host# run show log cli-commands
```

**Sample Output** [edit system syslog]  
user@host# **run show log cli-commands**  
Sep 16 11:24:25 nut mgd[3442]: UI\_COMMIT\_PROGRESS: commit: signaling 'Syslog daemon', pid 2457, signal 1, status 0  
Sep 16 11:24:25 nut mgd[3442]: UI\_COMMIT\_PROGRESS: commit: signaling 'SNMP daemon', pid 2592, signal 31, status 0  
Sep 16 11:28:36 nut mgd[3442]: UI\_CMDLINE\_READ\_LINE: User 'user', command 'run show log cli-commands '  
Sep 16 11:30:39 nut mgd[3442]: UI\_CMDLINE\_READ\_LINE: User 'user', command 'run show log security '  
Sep 16 11:31:26 nut mgd[3442]: UI\_CMDLINE\_READ\_LINE: User 'user', command 'run show log messages '  
Sep 16 11:41:21 nut mgd[3442]: UI\_CMDLINE\_READ\_LINE: User 'user', command 'edit file cli-commands '  
Sep 16 11:41:25 nut mgd[3442]: UI\_CMDLINE\_READ\_LINE: User 'user', command 'show '  
Sep 16 11:44:57 nut mgd[3442]: UI\_CMDLINE\_READ\_LINE: User 'user', command 'set '

```
interactive-commands info '
Sep 16 14:32:15  nut mgd[3442]: UI_CMDLINE_READ_LINE: User 'user', command 'run
show log cli-commands '
```

**Meaning** The sample output shows the CLI commands that were entered since the log file was configured.

## Log a User Out of the Router

**Purpose** Disconnect a user session when that session does not terminate after the user logs out.

**Action** To log a user out of all terminal sessions on a router, enter the following JUNOS CLI operational mode command:

```
user@host> request system logout username
```

**Sample Output**

```
user@host> show system users
10:07PM up 13 days, 1:25, 2 users, load averages: 0.17, 0.05, 0.02
USER    TTY    FROM                LOGIN@  IDLE WHAT
harry   p0     hpot-1t.cmpy.net    10:07PM - -cli (cl
wizard  p1     hpot-1t.cmpy.net    10:06PM - -cli (cl
```

```
user@host> request system logout user harry
user@host> show system users
10:07PM up 13 days, 1:25, 1 user, load averages: 0.24, 0.06, 0.02
USER    TTY    FROM                LOGIN@  IDLE WHAT
wizard  p1     hpot-1t.cmpy.net    10:06PM - -cli (cl
```

**Meaning** The sample output for the first `show system users` command shows there were two users on the router, `harry` and `wizard`. The `request system logout user harry` command was issued to log out user `harry`. Because there is no output to indicate that `harry` was logged out, the `show system users` command was issued again to verify that user `harry` was actually logged out of the router.

## Check When the Last Configuration Change Occurred

**Purpose** When a problem occurs on a router, it is a good idea to check when the last configuration change was made because it may have had some influence on the problem.

To check when the last configuration change occurred, follow these steps:

1. Configure Configuration Change Tracking on page 232
2. Display the Configured Log File on page 233

## Configure Configuration Change Tracking

**Action** To configure this type of logging, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```
[edit]
```

```
user@host# edit system syslog
```

2. Configure the log file:

```
[edit system syslog]
user@host# edit file filename
```

For example:

```
[edit system syslog]
user@host# edit file mw-configuration-changes
```

3. Configure the change-log facility and severity level:

```
[edit system syslog filename]
user@host# set change-log info
```

4. Verify the configuration:

```
[edit system syslog]
user@host# show
file mw-configuration-changes {
  change-log info;
}
```

5. Commit the configuration:

```
user@host# commit
```

## Display the Configured Log File

**Purpose** To display the log file in configuration mode.

**Action** To display the log file in configuration mode, enter the following command:

```
[edit system syslog]
user@host# run show log filename
```

For example:

```
[edit system syslog]
user@host# run show log mw-configuration-changes
```

**Sample Output**

```
[edit system syslog]
user@host# run show log mw-configuration-changes
Sep 17 07:03:22 nut mgd[7793]: UI_CFG_AUDIT_OTHER: User 'root' override:
/config/juniper.conf
Sep 17 07:07:21 nut mgd[2751]: UI_CFG_AUDIT_OTHER: User 'root' set: [interfaces
  lo0 unit 0 family inet address 127.0.0.1/32]
Sep 17 07:07:21 nut mgd[2751]: UI_CFG_AUDIT_SET: User 'root' set: [system
domain-name] "englab.company.net" -> "englab.company.net"
Sep 17 07:07:21 nut mgd[2751]: UI_CFG_AUDIT_OTHER: User 'root' set: [system
name-server 172.17.28.101]
Sep 17 07:07:22 nut mgd[2751]: UI_CFG_AUDIT_OTHER: User 'root' set: [system
domain-search] "englab.company.net"
Sep 17 07:07:22 nut mgd[2751]: UI_CFG_AUDIT_OTHER: User 'root' set: [system
domain-search] "company.net"
```

```
Sep 17 07:07:22  nut mgd[2751]: UI_CFG_AUDIT_OTHER: User 'root' set: [system
domain-search] "jnpr.net"
```

**Meaning** The sample output shows the contents of the log file and that the last configuration change was on September 17 at 07:07:22.

## Force a Message to Logged-In User Terminals

**Purpose** You have a scheduled maintenance window or have other important information to convey to users logged in to the router.

**Action** To force a message to the terminals of logged-in users, enter the following JUNOS CLI operational mode command:

```
user@host> request message all message "text"
```

**Sample Output** user@host> request message all message "This is an experiment, please be patient"

```
Broadcast Message from user@host
(/dev/tty0) at 10:50 PDT...
```

```
This is an experiment, please be patient
```

```
user@host> request message message "Maintenance window in 10 minutes" user maria
Message from user@host on tty0 at 20:27 ...
Maintenance window in 10 minutes
EOF
```

**Meaning** The sample output shows that the message “This is an experiment, please be patient” was sent to the consoles of all logged-in users, and the message “Maintenance window in 10 minutes” was sent to the console of the logged-in user, *maria*. For more detailed information about this command, see the *JUNOS Network Management Configuration Guide*.

**Syntax** request message all message "text"  
request message message "text" (terminal *terminal-name* | user *user-name*)

## Check RADIUS Server Connectivity

**Purpose** It is important to check connectivity to the RADIUS server when attempting to diagnose an authentication problem.

**Action** To ensure that you can ping the RADIUS server, follow these steps:

1. In configuration mode, go to the following hierarchy level:

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

2. Determine the IP address of the RADIUS server:

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



For example:

```
[edit system]
user@host# show
host-name nut;
domain-name englab.company.net;
[...Output truncated...]
radius-server {
  10.10.10.5 {
    secret "$9$14bhIM-VYJGDx7-w2gUD"; # SECRET-DATA
    timeout 5;
    retry 3;
  }
  10.10.10.240 {
    secret "$9$hMKrMXwYoDik-VwgaJHk"; # SECRET-DATA
    timeout 5;
    retry 3;
  }
}
[...Output truncated...]
```

3. Ping the IP address of the RADIUS server:

```
user@host# run ping IP address
```

For example:

```
user@host# run ping 10.10.10.5
PING 10.10.10.5 (10.10.10.5): 56 data bytes
64 bytes from 10.10.10.5: icmp_seq=0 ttl=254 time=0.402 ms
64 bytes from 10.10.10.5: icmp_seq=1 ttl=254 time=0.279 ms
64 bytes from 10.10.10.5: icmp_seq=2 ttl=254 time=0.292 ms
64 bytes from 10.10.10.5: icmp_seq=3 ttl=254 time=0.283 ms
64 bytes from 10.10.10.5: icmp_seq=4 ttl=254 time=0.283 ms
^C
- 10.10.10.5 ping statistics -
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.271/0.295/0.402/0.036 ms
```

**Meaning** The sample output shows that the RADIUS server is connected and that the connection is running at a reasonable speed.



## **Part 5**

# **Search Log Messages**

- Track Normal Operations on page 239
- Track Error Conditions on page 251
- Collect Crash Data on page 273



## Chapter 22

# Track Normal Operations

This chapter describes how to configure system logging to monitor system-wide, high-level operations.

- Checklist for Tracking Normal Operations on page 239
- Configure System Logging on page 240

### Checklist for Tracking Normal Operations

**Purpose** Table 46 on page 239 provides links and commands for tracking normal operations.

**Table 46: Checklist for Tracking Normal Operations**

| Tasks                                              | Command or Action                                                                           |
|----------------------------------------------------|---------------------------------------------------------------------------------------------|
| <b>“Configure System Logging” on page 240</b>      |                                                                                             |
| 1. Log Messages to a Local Log File on page 241    | [edit]<br>[edit system syslog]<br>set file <i>filename facility level</i><br>show<br>commit |
| 2. Log Information to a Remote Host on page 242    | [edit]<br>[edit system syslog]<br>set host <i>hostname facility level</i><br>show<br>commit |
| 3. Log Information to a User Terminal on page 243  | [edit]<br>[edit system syslog]<br>set user <i>username facility level</i><br>show<br>commit |
| 4. Log Information to a Router Console on page 244 | [edit]<br>[edit system syslog]<br>set console <i>facility level</i><br>show<br>commit       |

**Table 46: Checklist for Tracking Normal Operations** *(continued)*

| Tasks                                                     | Command or Action                                                                                                                                                                                                                      |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5. Configure the Number and Size of Log Files on page 244 | <pre>[edit] [edit system syslog] set archive files <i>number</i> size <i>size</i> show commit</pre> <p>or</p> <pre>[edit] [edit system syslog file <i>filename</i>] set archive files <i>number</i> size <i>size</i> show commit</pre> |
| 6. Log BGP State Transition Events on page 245            | <pre>[edit] [edit protocol bgp] set log-updown show commit</pre>                                                                                                                                                                       |
| 7. Display a Log File on page 248                         | <code>show log <i>filename</i></code>                                                                                                                                                                                                  |
| 8. Monitor Messages in Near-Real Time on page 248         | <code>monitor start <i>filename</i></code>                                                                                                                                                                                             |
| 9. Stop Monitoring Log Files on page 249                  | <pre>monitor stop <i>filename</i> or monitor stop</pre>                                                                                                                                                                                |

## Configure System Logging

**Purpose** System logging operations use a system logging mechanism to record system-wide, high-level operations, such as interfaces going up or down and users logging in to or out of a router.

To configure system logging, follow these steps:

1. Log Messages to a Local Log File on page 241
2. Log Information to a Remote Host on page 242
3. Log Information to a User Terminal on page 243
4. Log Information to a Router Console on page 244
5. Configure the Number and Size of Log Files on page 244
6. Log BGP State Transition Events on page 245
7. Display a Log File on page 248
8. Monitor Messages in Near-Real Time on page 248
9. Stop Monitoring Log Files on page 249

## Log Messages to a Local Log File

**Action** To log messages to a local log file on the router, follow these steps:

1. In configuration mode, go to the following hierarchy level:

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

2. Configure the file, facility, and level:

```
user@host# set file filename facility level
```

For example:

```
[edit system syslog]
user@host# set file security authorization info
```

3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit system syslog]
user@host# show
file security
authorization info
```

4. Commit the configuration:

```
user@host# commit
```

Table 47 on page 241 lists the JUNOS system logging facilities. Each message is assigned to a facility, which is a group of messages that are either generated by the same software process or concern a similar condition or activity (such as authentication attempts).

**Table 47: JUNOS System Logging Facilities**

| Facility      | Type of Event or Error                                               |
|---------------|----------------------------------------------------------------------|
| any           | Any (includes messages from all facilities).                         |
| authorization | Authentication and authorization attempts.                           |
| change-log    | Change to the JUNOS configuration.                                   |
| conflict-log  | Configuration that is inconsistent with router hardware.             |
| cron          | Actions performed or errors encountered by the <b>cron</b> process.  |
| daemon        | Actions performed or errors encountered by various system processes. |

**Table 47: JUNOS System Logging Facilities** *(continued)*

| Facility             | Type of Event or Error                                                             |
|----------------------|------------------------------------------------------------------------------------|
| firewall             | Packet filtering actions performed by a firewall filter.                           |
| interactive-commands | Commands issued at the JUNOS command-line interface (CLI) operational mode prompt. |
| kernel               | Actions performed or errors encountered by the JUNOS kernel.                       |
| pfe                  | Actions performed or errors encountered by the Packet Forwarding Engine.           |
| user                 | Actions performed or errors encountered by various user-space processes.           |

Table 48 on page 242 lists the system log message severity levels supported by the JUNOS software. Each message is assigned a severity level, which indicates how seriously it affects router functioning.

**Table 48: System Log Message Severity Levels**

| Severity Level | Description                                                                                                              |
|----------------|--------------------------------------------------------------------------------------------------------------------------|
| emergency      | System panic or other condition that causes the router to stop functioning.                                              |
| alert          | Conditions that require immediate correction, such as a corrupted system database.                                       |
| critical       | Critical conditions, such as hard drive errors.                                                                          |
| error          | Error conditions that generally have less serious consequences than errors at the emergency, alert, and critical levels. |
| warning        | Conditions that warrant monitoring.                                                                                      |
| notice         | Conditions that are not errors but might warrant special handling.                                                       |
| info           | Events or nonerror conditions of interest.                                                                               |
| debug          | Software debugging messages. Specify this level only when directed by a technical support representative.                |

## Log Information to a Remote Host

**Action** To log messages to a remote host, follow these steps:

1. In configuration mode, go to the following hierarchy level:

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

2. Configure the host, facility, and level:



```
user@host# set host hostname facility level
```

For example:

```
[edit system syslog]
user@host# set host junipero.berry.net daemon info
```

3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit system syslog]
user@host# show
host junipero.berry.net
daemon info;
```

4. Commit the configuration:

```
user@host# commit
```

For information on logging facilities and severity levels supported by the JUNOS software, see Table 47 on page 241 and Table 48 on page 242.

## ***Log Information to a User Terminal***

**Action** To log messages to a user terminal, follow these steps:

1. In configuration mode, go to the following hierarchy level:

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

2. Configure the user, facility, and level:

```
user@host# set user username facility level
```

For example:

```
[edit system syslog]
user@host# set user alex any critical
```

3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit system syslog]
user@host# show
user alex
any critical
```

4. Commit the configuration:

```
user@host# commit
```

For information on logging facilities and security levels supported by the JUNOS software, see Table 47 on page 241 and Table 48 on page 242.

## Log Information to a Router Console

**Action** To log messages to a router console, follow these steps:

1. In configuration mode, go to the following hierarchy level:

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

2. Configure the router console, facility, and level:

```
user@host# set console facility level
```

For example:

```
[edit system syslog]
user@host# set console any error
```

3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit system syslog]
user@host# show
console
any error
```

4. Commit the configuration:

```
user@host# commit
```

For information on logging facilities and security levels supported by the JUNOS software, see Table 47 on page 241 and Table 48 on page 242.

## Configure the Number and Size of Log Files

**Purpose** By default, the JUNOS logging facility stops writing messages to a log file when the file reaches 128 KB in size. It closes the file and adds a numerical suffix, then opens and directs messages to a new file with the original name. By default, the JUNOS logging facility creates up to 10 files before it begins overwriting the contents of the oldest file.

**Action** To configure the number and size of the log files, follow these steps:

1. In configuration mode, go to one of the following hierarchy levels:

```
[edit]
```

```

user@host# edit system syslog
or
[edit]
user@host# edit system syslog filename

```

2. Configure the number and size of the archive files:

```

user@host# set archive files number size size

```

For example:

```

[edit system syslog]
user@host# set archive files 10 size 65536

```

3. Verify the configuration:

```

user@host# show

```

For example:

```

[edit system syslog]
user@host# show
archive size 64k files 10

```

4. Commit the configuration:

```

user@host# commit

```

See the *JUNOS System Basics Configuration Guide* for more detailed explanations and examples of log file configurations.

## Log BGP State Transition Events

**Purpose** Border Gateway Protocol (BGP) state transitions indicate a network problem and need to be logged and investigated.

**Action** To log BGP state transition events to the system log, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```

[edit]
user@host# edit protocol bgp

```

2. Configure the system log:

```

user@host# set log-updown

```

3. Verify the configuration:

```

user@host# show

```

4. Commit the configuration:

```

user@host# commit

```

**Meaning** Log messages from BGP state transition events are sufficient to diagnose most BGP session problems. Table 49 on page 246 lists and describes the six states of a BGP session.

**Table 49: Six States of a BGP Session**

| BGP State | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Idle      | <p>This is the first state of a connection. BGP waits for a start event initiated by an administrator. The start event might be the establishment of a BGP session through router configuration or the resetting of an existing session. After the start event, BGP initializes its resources, resets a connect-retry timer, initiates a TCP transport connection, and starts listening for connections initiated by remote peers. BGP then transitions to a <b>Connect</b> state.</p> <p>If there are errors, BGP falls back to the <b>Idle</b> state.</p>                                                                                                                                                                                               |
| Connect   | <p>BGP waits for the transport protocol connection to complete. If the TCP transport connection is successful, the state transitions to <b>OpenSent</b>.</p> <p>If the transport connection is not successful, the state transitions to <b>Active</b>.</p> <p>If the connect-retry timer has expired, the state remains in the <b>Connect</b> state, the timer is reset, and a transport connection is initiated.</p> <p>With any other event, the state goes back to <b>Idle</b>.</p>                                                                                                                                                                                                                                                                    |
| Active    | <p>BGP tries to acquire a peer by initiating a transport protocol connection.</p> <p>If it is successful, the state transitions to <b>OpenSent</b>.</p> <p>If the connect-retry timer expires, BGP restarts the connect timer and falls back to the <b>Connect</b> state. BGP continues to listen for a connection that may be initiated from another peer. The state may go back to <b>Idle</b> in case of other events, such as a stop event.</p> <p>In general, a neighbor state flip-flopping between <b>Connect</b> and <b>Active</b> is an indication that there is a problem with the TCP transport connection. Such a problem might be caused by many TCP retransmissions or the inability of a neighbor to reach the IP address of its peer.</p> |

**Table 49: Six States of a BGP Session (continued)**

| BGP State   | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OpenSent    | <p>BGP receives an open message from its peer. In the <b>OpenSent</b> state, BGP compares its autonomous system (AS) number with the AS number of its peer and recognizes whether the peer belongs to the same AS (internal BGP) or to a different AS (external BGP).</p> <p>The open message is checked for correctness. In case of errors, such as a bad version number of an unacceptable AS, BGP sends an error-notification message and goes back to <b>Idle</b>.</p> <p>For any other errors, such as expiration of the hold timer or a stop event, BGP sends a notification message with the corresponding error code and falls back to the <b>Idle</b> state.</p> <p>If there are no errors, BGP sends keepalive messages and resets the keepalive timer. In this state, the hold time is negotiated. If the hold time is 0, the hold and keepalive timers are not restarted.</p> <p>When a TCP transport disconnect is detected, the state falls back to <b>Active</b>.</p> |
| OpenConfirm | <p>BGP waits for a keepalive or notification message.</p> <p>If a keepalive is received, the state becomes <b>Established</b>, and the neighbor negotiation is complete. If the system receives an update or keepalive message, it restarts the hold timer (assuming that the negotiated hold time is not 0).</p> <p>If a notification message is received, the state falls back to <b>Idle</b>.</p> <p>The system sends periodic keepalive messages at the rate set by the keepalive timer. In case of a transport disconnect notification or in response to a stop event, the state falls back to <b>Idle</b>. In response to other events, the system sends a notification message with a finite state machine (FSM) error code and goes back to <b>Idle</b>.</p>                                                                                                                                                                                                                 |
| Established | <p>This is the final state in the neighbor negotiation. In this state, BGP exchanges update packets with its peers and the hold timer is restarted at the receipt of an update or keepalive message when it is not set to zero.</p> <p>If the system receives a notification message, the state falls back to <b>Idle</b>.</p> <p>Update messages are checked for errors, such as missing attributes, duplicate attributes, and so on. If errors are found, a notification is sent to the peer, and the state falls back to <b>Idle</b>.</p> <p>BGP goes back to <b>Idle</b> when the hold timer expires, a disconnect notification is received from the transport protocol, a stop event is received, or in response to any other event.</p>                                                                                                                                                                                                                                        |

For more detailed BGP protocol packet information, configure BGP-specific tracing. See “Track Error Conditions” on page 251 for more information.

## Display a Log File

**Purpose** To look at a log or trace file.

**Action** To look at a log or trace file, use the following JUNOS CLI operational mode command:

```
user@host> show log filename
```

**Sample Output**

```
user@host> show log messages
Sep 10 07:00:00 host newsyslog[7249]: logfile turned over
Sep 10 07:01:49 host rpd[6451]: bgp_listen_accept: Connection attempt from
unconfigured neighbor: 10.0.8.1+1348
Sep 10 07:04:17 host rpd[6451]: bgp_listen_accept: Connection attempt from
unconfigured neighbor: 10.0.8.1+1349
Sep 10 07:06:45 host rpd[6451]: bgp_listen_accept: Connection attempt from
unconfigured neighbor: 10.0.8.1+1350
Sep 10 07:07:53 host login: 2 LOGIN FAILURES FROM 172.24.16.21
Sep 10 07:07:53 host login: 2 LOGIN FAILURES FROM 172.24.16.21, show configuration
| no-more
Sep 10 07:08:25 host inetd[2785]: /usr/libexec/telnetd[7251]: exit status 0x100
Sep 10 07:09:13 host rpd[6451]: bgp_listen_accept: Connection attempt from
unconfigured neighbor: 10.0.8.1+1351
Sep 10 07:11:41 host rpd[6451]: bgp_listen_accept: Connection attempt from
unconfigured neighbor: 10.0.8.1+1352
Sep 10 07:14:09 host rpd[6451]: bgp_listen_accept: Connection attempt from
unconfigured neighbor: 10.0.8.1+1353
Sep 10 07:16:37 host rpd[6451]: bgp_listen_accept: Connection attempt from
unconfigured neighbor: 10.0.8.1+1354
Sep 10 07:19:05 host rpd[6451]: bgp_listen_accept: Connection attempt from
unconfigured neighbor: 10.0.8.1+1355
Sep 10 07:21:33 host rpd[6451]: bgp_listen_accept: Connection attempt from
unconfigured neighbor:
```

**Meaning** The sample output shows the rpd log messages in the messages file for September 10 from 7:00 to 7:21 AM.



**NOTE:** Local log files are saved in the /var/log directory.

---

## Monitor Messages in Near-Real Time

**Purpose** To monitor messages in near-real time as they are being written to the log file.

**Action** To monitor messages in near-real time as they are being written to the log file, use the following JUNOS CLI operational mode command:

```
user@host> monitor start filename
```

**Sample Output**

```
user@host> monitor start messages
*** messages ***
Sep 10 19:46:30 router rpd[6451]: bgp_listen_accept: Connection attempt from
unconfigured neighbor: 10.0.8.1+1658
```

**Meaning** The sample output shows the routing protocol log messages in the messages file for September 10.

## **Stop Monitoring Log Files**

**Action** To stop monitoring log files, use the following JUNOS CLI operational mode command:

```
user@host> monitor stop filename  
or  
user@host> monitor stop
```





## Chapter 23

# Track Error Conditions

This chapter describes how to configure routing protocol daemon tracing, Border Gateway Protocol (BGP), Intermediate System-to-Intermediate System (IS-IS) protocol, and Open Shortest Path First (OSPF) protocol tracing to diagnose error conditions.

- Checklist for Tracking Error Conditions on page 251
- Configure Routing Protocol Process Tracing on page 253
- Configure BGP-Specific Options on page 258
- Configure IS-IS-Specific Options on page 261
- Configure OSPF-Specific Options on page 267

### Checklist for Tracking Error Conditions

**Problem** Table 50 on page 251 provides links and commands for configuring routing protocol daemon tracing, Border Gateway Protocol (BGP), Intermediate System-to-Intermediate System (IS-IS) protocol, and Open Shortest Path First (OSPF) protocol tracing to diagnose error conditions.

**Table 50: Checklist for Tracking Error Conditions**

| Tasks                                                                             | Command or Action                                                                                                                                                            |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>“Configure Routing Protocol Process Tracing” on page 253</b>                   |                                                                                                                                                                              |
| 1. Configure Routing Protocol Process Tracing on page 253                         | [edit]<br>edit routing-options traceoptions<br>set file <i>filename</i> size <i>size</i> files <i>number</i><br>show<br>commit<br>run show log <i>filename</i>               |
| 2. Configure Routing Protocol Tracing for a Specific Routing Protocol on page 256 | [edit]<br>edit protocol <i>protocol-name</i> traceoptions<br>set file <i>filename</i> size <i>size</i> files <i>number</i><br>show<br>commit<br>run show log <i>filename</i> |
| 3. Monitor Trace File Messages Written in Near-Real Time on page 257              | monitor start <i>filename</i>                                                                                                                                                |
| 4. Stop Trace File Monitoring on page 258                                         | monitor stop <i>filename</i>                                                                                                                                                 |

**Table 50: Checklist for Tracking Error Conditions** *(continued)*

| Tasks                                                          | Command or Action                                                                                                               |
|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>“Configure BGP-Specific Options” on page 258</b>            |                                                                                                                                 |
| 1. Display Detailed BGP Protocol Information on page 258       | [edit]<br>edit protocol bgp traceoptions<br>set flag update detail<br>show<br>commit<br>run show log <i>filename</i>            |
| 2. Display Sent or Received BGP Packets                        | [edit]<br>edit protocol bgp traceoptions<br>set flag update (send   receive)<br>show<br>commit<br>run show log <i>filename</i>  |
| 3. Diagnose BGP Session Establishment Problems on page 260     | [edit]<br>edit protocol bgp<br>set traceoptions flag open detail<br>show<br>commit<br>run show log <i>filename</i>              |
| <b>“Configure IS-IS-Specific Options” on page 261</b>          |                                                                                                                                 |
| 1. Display Detailed IS-IS Protocol Information on page 261     | [edit]<br>edit protocol isis traceoptions<br>set flag hello detail<br>show<br>commit<br>run show log <i>filename</i>            |
| 2. Display Sent or Received IS-IS Protocol Packets on page 264 | [edit]<br>edit protocols isis traceoptions<br>set flag hello (send   receive)<br>show<br>commit<br>run show log <i>filename</i> |
| 3. Analyze IS-IS-Link State Packets in Detail on page 265      | [edit]<br>edit protocols isis traceoptions<br>set flag lsp detail<br>show<br>commit<br>run show log <i>filename</i>             |
| <b>“Configure OSPF-Specific Options” on page 267</b>           |                                                                                                                                 |
| 1. Diagnose OSPF Session Establishment Problems on page 268    | [edit]<br>edit protocols ospf traceoptions<br>set flag hello detail<br>show<br>commit<br>run show log <i>filename</i>           |

**Table 50: Checklist for Tracking Error Conditions** *(continued)*

| Tasks                                                                  | Command or Action                                                                                               |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| 2. Analyze OSPF Link-State Advertisement Packets in Detail on page 271 | <pre>[edit] edit protocols ospf traceoptions set flag lsa update detail show commit run show log filename</pre> |

## Configure Routing Protocol Process Tracing

**Purpose** Routing protocol process (rpd) tracing tracks all general routing operations and records them in a log file.

To configure routing protocol process (rpd) tracing and monitor trace file messages, follow these steps:

1. Configure Routing Protocol Process Tracing on page 253
2. Configure Routing Protocol Tracing for a Specific Routing Protocol on page 256
3. Monitor Trace File Messages Written in Near-Real Time on page 257
4. Stop Trace File Monitoring on page 258

## Configure Routing Protocol Process Tracing

**Action** To configure routing protocol process (rpd) tracing, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```
[edit]
user@host# edit routing-options traceoptions
```

2. Configure the file, file size, number, and flags:

```
[edit routing-options traceoptions]
user@host# set file filename size size file number
[edit routing-options traceoptions]
user@host# set flag flag
```

For example:

```
[edit routing-options traceoptions]
user@host# set file daemonlog size 10240 files 10
[edit routing-options traceoptions]
user@host# set flag general
```

3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit routing-options traceoptions]
user@host# show
file daemonlog size 10k files 10;
flag general;
```

4. Commit the configuration:

```
user@host# commit
```



**NOTE:** Some traceoptions flags generate an extensive amount of information. Tracing can also slow down the operation of routing protocols. Delete the traceoptions configuration if you no longer require it.

1. View the contents of the file containing the detailed messages:

```
user@host# run show log filename
```

For example:

```
[edit routing-options traceoptions]
user@pro4-a# run show log daemonlog
Sep 17 14:17:31 trace_on: Tracing to "/var/log/daemonlog" started
Sep 17 14:17:31 Tracing flags enabled: general
Sep 17 14:17:31 inet_routerid_notify: Router ID: 10.255.245.44
Sep 17 14:17:31 inet_routerid_notify: No Router ID assigned
Sep 17 14:17:31 Initializing LSI globals
Sep 17 14:17:31 LSI initialization complete
Sep 17 14:17:31 Initializing OSPF instances
Sep 17 14:17:31 Reinitializing OSPFv2 instance master
Sep 17 14:17:31 OSPFv2 instance master running
[...Output truncated...]
```

**Meaning** Table 51 on page 254 lists tracing flags and example output for JUNOS-supported routing protocol daemon tracing.

**Table 51: Routing Protocol Daemon Tracing Flags**

| Tracing Flag | Description                                | Example Output |
|--------------|--------------------------------------------|----------------|
| all          | All operations                             | Not available. |
| general      | Normal operations and routing table change | Not available. |
| normal       | Normal operations                          | Not available. |

**Table 51: Routing Protocol Daemon Tracing Flags** (continued)

| Tracing Flag | Description                           | Example Output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| policy       | Policy operations and actions         | Nov 29 22:19:58 export: Dest 10.0.0.0 proto Static<br>Nov 29 22:19:58 policy_match_qual_or: Qualifier proto Sense: 0<br>Nov 29 22:19:58 policy_match_qual_or: Qualifier proto Sense: 0<br>Nov 29 22:19:58 export: Dest 10.10.10.0 proto IS-IS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| route        | Routing table changes                 | Nov 29 22:23:59<br>Nov 29 22:23:59 rtlist_walker_job: rt_list walk for RIB inet.0 started with 42 entries<br>Nov 29 22:23:59 rt_flash_update_callback: flash KRT (inet.0) start<br>Nov 29 22:23:59 rt_flash_update_callback: flash KRT (inet.0) done<br>Nov 29 22:23:59 rtlist_walker_job: rt_list walk for inet.0 ended with 42 entries<br>Nov 29 22:23:59<br>Nov 29 22:23:59 KRT Request: send len 68 v14 seq 0 CHANGE route/user af 2 addr 172.16.0.0 nhop-type unicast nhop 10.10.10.33<br>Nov 29 22:23:59 KRT Request: send len 68 v14 seq 0 ADD route/user af 2 addr 172.17.0.0 nhop-type unicast nhop 10.10.10.33<br>Nov 29 22:23:59 KRT Request: send len 68 v14 seq 0 ADD route/user af 2 addr 10.149.3.0 nhop-type unicast nhop 10.10.10.33<br>Nov 29 22:24:19 trace_on: Tracing to "/var/log/rpdlog" started<br>Nov 29 22:24:19 KRT Request: send len 68 v14 seq 0 DELETE route/user af 2 addr 10.10.218.0 nhop-type unicast nhop 10.10.10.29<br>Nov 29 22:24:19 RELEASE 10.10.218.0 255.255.255.0 gw 10.10.10.29,10.10.10.33 BGP pref 170/-101 metric so-1/1/0.0,so-1/1/1.0 <Release Delete Int Ext> as 65401<br>Nov 29 22:24:19 KRT Request: send len 68 v14 seq 0 DELETE route/user af 2 addr 172.18.0.0 nhop-type unicast nhop 10.10.10.33 |
| state        | State transitions                     | Not available.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| task         | Interface transactions and processing | Nov 29 22:50:04 foreground dispatch running job task_collect for task Scheduler<br>Nov 29 22:50:04 task_collect_job: freeing task MGMT_Listen (DELETED)<br>Nov 29 22:50:04 foreground dispatch completed job task_collect for task Scheduler<br>Nov 29 22:50:04 background dispatch running job rt_static_update for task RT<br>Nov 29 22:50:04 task_job_delete: delete background job rt_static_update for task RT<br>Nov 29 22:50:04 background dispatch completed job rt_static_update for task RT<br>Nov 29 22:50:04 background dispatch running job Flash update for task RT<br>Nov 29 22:50:04 background dispatch returned job Flash update for task RT<br>Nov 29 22:50:04 background dispatch running job Flash update for task RT<br>Nov 29 22:50:04 task_job_delete: delete background job Flash update for task RT<br>Nov 29 22:50:04 background dispatch completed job Flash update for task RT<br>Nov 29 22:50:04 background dispatch running job Flash update for task RT<br>Nov 29 22:50:04 task_job_delete: delete background job Flash update for task RT                                                                                                                                                                                |
| timer        | Timer usage                           | Nov 29 22:52:07 task_timer_hiprio_dispatch: ran 1 timer<br>Nov 29 22:52:07 main: running normal priority timer queue<br>Nov 29 22:52:07 main: ran 1 timer<br>Nov 29 22:52:07 task_timer_hiprio_dispatch: running high priority timer queue<br>Nov 29 22:52:07 task_timer_hiprio_dispatch: ran 1 timer<br>Nov 29 22:52:07 main: running normal priority timer queue<br>Nov 29 22:52:07 main: ran 1 timer<br>Nov 29 22:52:07 main: running normal priority timer queue<br>Nov 29 22:52:07 main: ran 2 timers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

## Configure Routing Protocol Tracing for a Specific Routing Protocol

**Action** To configure routing protocol tracing for a specific routing protocol, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```
[edit]
user@host# edit protocol protocol-name traceoptions
```

2. Configure the file, file size, number, and flags:

```
[edit protocols protocol name traceoptions]
user@host# set file filename size size files number
[edit protocols protocol name traceoptions]
user@host# set flag flag
```

For example:

```
[edit protocols ospf traceoptions]
user@host# set file ospflog size 10240 files 10
[edit protocols ospf traceoptions]
user@host# set flag general
```

3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit protocols ospf traceoptions]
user@host# show
file ospflog size 10k files 10;
flag general;
```

4. Commit the configuration:

```
user@host# commit
```

5. View the contents of the file containing the detailed messages:

```
user@host# run show log filename
```

For example:

```
[edit protocols ospf traceoptions]
user@pro4-a# run show log ospflog
Sep 17 14:23:10 trace_on: Tracing to "/var/log/ospflog" started
Sep 17 14:23:10 rt_flash_update_callback: flash OSPF (inet.0) start
Sep 17 14:23:10 OSPF: multicast address 224.0.0.5/32, route ignored
Sep 17 14:23:10 rt_flash_update_callback: flash OSPF (inet.0) done
Sep 17 14:23:10 CHANGE 10.255.245.46/32 gw 10.10.208.67 OSPF pref 10/0
metric 1/0 fe-0/0/0.0 <Delete Int>
Sep 17 14:23:10 CHANGE 10.255.245.46/32 gw 10.10.208.67 OSPF pref 10/0
metric 1/0 fe-0/0/0.0 <Active Int>
```

```

Sep 17 14:23:10 ADD 10.255.245.46/32 gw 10.10.208.67 OSPF pref 10/0
metric 1/0 fe-0/0/0.0 <Active Int>
Sep 17 14:23:10 CHANGE 10.255.245.48/32 gw 10.10.208.69 OSPF pref 10/0
metric 1/0 fe-0/0/0.0 <Delete Int>
Sep 17 14:23:10 CHANGE 10.255.245.48/32 gw 10.10.208.69 OSPF pref 10/0
metric 1/0 fe-0/0/0.0 <Active Int>
Sep 17 14:23:10 ADD 10.255.245.48/32 gw 10.10.208.69 OSPF pref 10/0
metric 1/0 fe-0/0/0.0 <Active Int>
Sep 17 14:23:10 rt_close: 4/4 routes proto OSPF
[...Output truncated...]

```

**Meaning** Table 52 on page 257 lists standard tracing options that are available globally or that can be applied to specific protocols. You can also configure tracing for a specific BGP peer or peer group. For more information, see the *JUNOS System Basics Configuration Guide*.

**Table 52: Standard Trace Options for Routing Protocols**

| Tracing Flag | Description                                 |
|--------------|---------------------------------------------|
| all          | All operations                              |
| general      | Normal operations and routing table changes |
| normal       | Normal operations                           |
| policy       | Policy operations and actions               |
| route        | Routing table changes                       |
| state        | State transitions                           |
| task         | Interface transactions and processing       |
| timer        | Timer usage                                 |

## Monitor Trace File Messages Written in Near-Real Time

**Purpose** To monitor messages in near-real time as they are being written to a trace file.

**Action** To monitor messages in near-real time as they are being written to a trace file, use the following JUNOS command-line interface (CLI) operational mode command:

```
user@host> monitor start filename
```

**Sample Output**

```

user@host> monitor start isis
user@host>
*** isis ***
Sep 15 18:32:21 Updating LSP isis5.02-00 in database
Sep 15 18:32:21 Updating L2 LSP isis5.02-00 in TED
Sep 15 18:32:21 Adding a half link from isis5.02 to isis6.00
Sep 15 18:32:21 Adding a half link from isis5.02 to isis5.00
Sep 15 18:32:21 Adding a half link from isis5.02 to isis6.00

```

```

Sep 15 18:32:21 Adding a half link from isis5.02 to isis5.00
Sep 15 18:32:21 Scheduling L2 LSP isis5.02-00 sequence 0xd87 on interface fxp2.3
Sep 15 18:32:21 Updating LSP isis5.00-00 in database
Sep 15 18:32:21 Updating L1 LSP isis5.00-00 in TED
Sep 15 18:32:21 Sending L2 LSP isis5.02-00 on interface fxp2.3
Sep 15 18:32:21     sequence 0xd87, checksum 0xc1c8, lifetime 1200

```

## Stop Trace File Monitoring

**Action** To stop monitoring a trace file in near-real time, use the following JUNOS CLI operational mode command after you have started monitoring:

```
user@host monitor stop filename
```

**Sample Output**

```

user@host> monitor start isis
user@host>
*** isis ***
Sep 15 18:32:21 Updating LSP isis5.02-00 in database
Sep 15 18:32:21 Updating L2 LSP isis5.02-00 in TED
Sep 15 18:32:21 Adding a half link from isis5.02 to isis6.00
Sep 15 18:32:21 Adding a half link from isis5.02 to isis5.00
Sep 15 18:32:21 Adding a half link from isis5.02 to isis6.00
Sep 15 18:32:21 Adding a half link from isis5.02 to isis5.00
Sep 15 18:32:21 Scheduling L2 LSP isis5.02-00 sequence 0xd87 on interface fxp2.3
Sep 15 18:32:21 Updating LSP isis5.00-00 in database
Sep 15 18:32:21 Updating L1 LSP isis5.00-00 in TED
Sep 15 18:32:21 Sending L2 LSP isis5.02-00 on interface fxp2.3
Sep 15 18:32:21     sequence 0xd87, checksum 0xc1c8, lifetime 1200
monitor stop isis
user@host>

```

## Configure BGP-Specific Options

**Purpose** When unexpected events or problems occur, or if you want to diagnose BGP establishment issues, you can view more detailed information by configuring options specific to BGP. You can also configure tracing for a specific BGP peer or peer group. For more information, see the *JUNOS System Basics Configuration Guide*.

1. Display Detailed BGP Protocol Information on page 258
2. Diagnose BGP Session Establishment Problems on page 260

### Display Detailed BGP Protocol Information

**Action** To display BGP protocol information in detail, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```

[edit]
user@host# edit protocol bgp traceoptions

```

2. Configure the flag to display detailed BGP protocol messages:

```

[edit protocols bgp traceoptions]
user@host# set flag update detail

```



3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit protocols bgp traceoptions]
user@host# show
flag update detail;
```

4. Commit the configuration:

```
user@host# commit
```

5. View the contents of the file containing the detailed messages:

```
user@host# run show log filename
```

For example:

```
[edit protocols bgp traceoptions]
user@pro5-a# run show log bgp
Sep 17 14:47:16 trace_on: Tracing to "/var/log/bgp" started
Sep 17 14:47:17 bgp_read_v4_update: receiving packet(s) from 10.255.245.53
  (Internal AS 10458)
Sep 17 14:47:17 BGP RECV 10.255.245.53+179 -> 10.255.245.50+1141
Sep 17 14:47:17 BGP RECV message type 2 (Update) length 128
Sep 17 14:47:17 BGP RECV flags 0x40 code Origin(1): IGP
Sep 17 14:47:17 BGP RECV flags 0x40 code ASPath(2): 2
Sep 17 14:47:17 BGP RECV flags 0x80 code MultiExitDisc(4): 0
Sep 17 14:47:17 BGP RECV flags 0x40 code LocalPref(5): 100
Sep 17 14:47:17 BGP RECV flags 0xc0 code Extended Communities(16):
  2:10458:1
[...Output truncated...]
```

**Meaning** Table 53 on page 259 lists tracing flags specific to BGP and presents example output for some of the flags. You can also configure tracing for a specific BGP peer or peer group. For more information, see the *JUNOS System Basics Configuration Guide*.

**Table 53: BGP Protocol Tracing Flags**

| Tracing Flags | Description                           | Example Output                                                                                                                                                                                                                                                                                     |
|---------------|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| aspath        | AS path regular expression operations | Not available.                                                                                                                                                                                                                                                                                     |
| damping       | Damping operations                    | Nov 28 17:01:12 bgp_damp_change: Change event<br>Nov 28 17:01:12 bgp_dampen: Damping 10.10.1.0<br>Nov 28 17:01:12 bgp_damp_change: Change event<br>Nov 28 17:01:12 bgp_dampen: Damping 10.10.2.0<br>Nov 28 17:01:12 bgp_damp_change: Change event<br>Nov 28 17:01:12 bgp_dampen: Damping 10.10.3.0 |

**Table 53: BGP Protocol Tracing Flags** (continued)

| Tracing Flags | Description              | Example Output                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| keepalive     | BGP keepalive messages   | Nov 28 17:09:27 bgp_send: sending 19 bytes to 10.217.5.101 (External AS 65471)<br>Nov 28 17:09:27<br>Nov 28 17:09:27 BGP SEND 10.217.5.1+179 -> 10.217.5.101+52162<br>Nov 28 17:09:27 BGP SEND message type 4 (KeepAlive) length 19<br>Nov 28 17:09:28<br>Nov 28 17:09:28 BGP RECV 10.217.5.101+52162 -> 10.217.5.1+179<br>Nov 28 17:09:28 BGP RECV message type 4 (KeepAlive) length 19                                                          |
| open          | BGP open packets         | Nov 28 18:37:42 bgp_send: sending 37 bytes to 10.217.5.101 (External AS 65471)<br>Nov 28 18:37:42<br>Nov 28 18:37:42 BGP SEND 10.217.5.1+179 -> 10.217.5.101+38135<br>Nov 28 18:37:42 BGP SEND message type 1 (Open) length 37                                                                                                                                                                                                                    |
| packets       | All BGP protocol packets | Sep 27 17:45:31 BGP RECV 10.0.100.108+179 -> 10.0.100.105+1033<br>Sep 27 17:45:31 BGP RECV message type 4 (KeepAlive) length 19<br>Sep 27 17:45:31 bgp_send: sending 19 bytes to 10.0.100.108 (Internal AS 100)<br>Sep 27 17:45:31 BGP SEND 10.0.100.105+1033 -> 10.0.100.108+179<br>Sep 27 17:45:31 BGP SEND message type 4 (KeepAlive) length 19<br>Sep 27 17:45:31 bgp_read_v4_update: receiving packet(s) from 10.0.100.108 (Internal AS 100) |
| update        | Update packets           | Nov 28 19:05:24 BGP SEND 10.217.5.1+179 -> 10.217.5.101+55813<br>Nov 28 19:05:24 BGP SEND message type 2 (Update) length 53<br>Nov 28 19:05:24 bgp_send: sending 65 bytes to 10.217.5.101 (External AS 65471)<br>Nov 28 19:05:24<br>Nov 28 19:05:24 BGP SEND 10.217.5.1+179 -> 10.217.5.101+55813<br>Nov 28 19:05:24 BGP SEND message type 2 (Update) length 65<br>Nov 28 19:05:24 bgp_send: sending 55 bytes to 10.217.5.101 (External AS 65471) |

## Diagnose BGP Session Establishment Problems

**Purpose** To trace BGP session establishment problems.

**Action** To trace BGP session establishment problems, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```
[edit]
user@host# edit protocol bgp
```

2. Configure BGP open messages:

```
[edit protocols bgp]
user@host# set traceoptions flag open detail
```

3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit protocols bgp]
user@host# show
traceoptions {
  file bgplog size 10k files 10;
  flag open detail;
}
```

4. Commit the configuration:

```
user@host# commit
```

5. View the contents of the file containing the detailed messages:

```
user@host# run show log filename
```

For example:

```
[edit protocols bgp]
user@host# run show log bgplog

Sep 17 17:13:14 trace_on: Tracing to "/var/log/bgplog" started
Sep 17 17:13:14 bgp_read_v4_update: done with 201.0.0.2 (Internal AS 10458)
received 19 octets 0 updates 0 routes
Sep 17 17:13:15 bgp_read_v4_update: receiving packet(s) from 201.0.0.3
(Internal AS 10458)
Sep 17 17:13:15 bgp_read_v4_update: done with 201.0.0.3 (Internal AS 10458)
received 19 octets 0 updates 0 routes
Sep 17 17:13:44 bgp_read_v4_update: receiving packet(s) from 201.0.0.2
(Internal AS 10458)
[...Output truncated...]
```

## Configure IS-IS-Specific Options

**Purpose** When unexpected events or problems occur, or if you want to diagnose IS-IS adjacency establishment issues, you can view more detailed information by configuring options specific to IS-IS.

To configure IS-IS options, follow these steps:

1. Display Detailed IS-IS Protocol Information on page 261
2. Display Sent or Received IS-IS Protocol Packets on page 264
3. Analyze IS-IS-Link State Packets in Detail on page 265

### Display Detailed IS-IS Protocol Information

**Action** To trace IS-IS messages in detail, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```
[edit]
user@host# edit protocols isis traceoptions
```

2. Configure the flag to display detailed IS-IS protocol messages:

```
[edit protocols isis traceoptions]
user@host# set flag hello detail
```

3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit protocols isis traceoptions]
user@host# show
file isislog size 10k files 10;
flag hello detail;
```

4. Commit the configuration:

```
user@host# commit
```

5. View the contents of the file containing the detailed messages:

```
user@host# run show log filename
```

For example:

```
user@host# run show log isislog
```

```
Nov 29 23:17:50 trace_on: Tracing to "/var/log/isislog" started
Nov 29 23:17:50 Sending PTP IIH on so-1/1/1.0
Nov 29 23:17:53 Sending PTP IIH on so-1/1/0.0
Nov 29 23:17:54 Received PTP IIH, source id abc-core-01 on so-1/1/0.0
Nov 29 23:17:54   from interface index 11
Nov 29 23:17:54   max area 0, circuit type 12, packet length 4469
Nov 29 23:17:54   hold time 30, circuit id 6
Nov 29 23:17:54   neighbor state up
Nov 29 23:17:54   speaks IP
Nov 29 23:17:54   area address 99.0008 (1)
Nov 29 23:17:54   IP address 10.10.10.29
Nov 29 23:17:54   4396 bytes of total padding
Nov 29 23:17:54   updating neighbor abc-core-01
Nov 29 23:17:55 Received PTP IIH, source id abc-core-02 on so-1/1/1.0
Nov 29 23:17:55   from interface index 12
Nov 29 23:17:55   max area 0, circuit type 12, packet length 4469
Nov 29 23:17:55   hold time 30, circuit id 6
Nov 29 23:17:55   neighbor state up
Nov 29 23:17:55   speaks IP
Nov 29 23:17:55   area address 99.0000 (1)
Nov 29 23:17:55   IP address 10.10.10.33
Nov 29 23:17:55   4396 bytes of total padding
Nov 29 23:17:55   updating neighbor abc-core-02
```

**Meaning** Table 54 on page 263 lists tracing flags that can be configured specific to IS-IS and presents example output for some of the flags.

**Table 54: IS-IS Protocol Tracing Flags**

| Tracing Flags  | Description                         | Example Output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| csn            | Complete sequence number PDU (CSNP) | <p>Nov 28 20:02:48 Sending L2 CSN on interface so-1/1/0.0<br/> Nov 28 20:02:48 Sending L2 CSN on interface so-1/1/1.0</p> <p>With the detail option.</p> <p>Nov 28 20:06:08 Sending L2 CSN on interface so-1/1/1.0<br/> Nov 28 20:06:08 LSP abc-core-01.00-00 lifetime 1146<br/> Nov 28 20:06:08 sequence 0x1c4f8 checksum 0xa1e9<br/> Nov 28 20:06:08 LSP abc-core-02.00-00 lifetime 411<br/> Nov 28 20:06:08 sequence 0x7435 checksum 0x5424<br/> Nov 28 20:06:08 LSP abc-brdr-01.00-00 lifetime 465<br/> Nov 28 20:06:08 sequence 0xf73 checksum 0xab10<br/> Nov 28 20:06:08 LSP abc-edge-01.00-00 lifetime 1089<br/> Nov 28 20:06:08 sequence 0x1616 checksum 0xdb29<br/> Nov 28 20:06:08 LSP abc-edge-02.00-00 lifetime 1103<br/> Nov 28 20:06:08 sequence 0x45cc checksum 0x6883</p> |
| hello          | Hello packet                        | <p>Nov 28 20:13:50 Sending PTP IIH on so-1/1/1.0<br/> Nov 28 20:13:50 Received PTP IIH, source id abc-core-01 on so-1/1/0.0<br/> Nov 28 20:13:53 Received PTP IIH, source id abc-core-02 on so-1/1/1.0<br/> Nov 28 20:13:57 Sending PTP IIH on so-1/1/0.0<br/> Nov 28 20:13:58 Received PTP IIH, source id abc-core-01 on so-1/1/0.0<br/> Nov 28 20:13:59 Sending PTP IIH on so-1/1/1.0</p>                                                                                                                                                                                                                                                                                                                                                                                                |
| lsp            | Link-state PDU (LSP) packets        | <p>Nov 28 20:15:46 Received L2 LSP abc-edge-01.00-00, interface so-1/1/0.0<br/> Nov 28 20:15:46 from abc-core-01<br/> Nov 28 20:15:46 sequence 0x1617, checksum 0xd92a, lifetime 1197<br/> Nov 28 20:15:46 Updating L2 LSP abc-edge-01.00-00 in TED<br/> Nov 28 20:15:47 Received L2 LSP abc-edge-01.00-00, interface so-1/1/1.0<br/> Nov 28 20:15:47 from abc-core-02<br/> Nov 28 20:15:47 sequence 0x1617, checksum 0xd92a, lifetime 1197</p>                                                                                                                                                                                                                                                                                                                                            |
| lsp-generation | LSP generation packets              | <p>Nov 28 20:21:24 Regenerating L1 LSP abc-edge-03.00-00, old sequence 0x682<br/> Nov 28 20:21:27 Rebuilding L1, fragment abc-edge-03.00-00<br/> Nov 28 20:21:27 Rebuilt L1 fragment abc-edge-03.00-00, size 59<br/> Nov 28 20:31:52 Regenerating L2 LSP abc-edge-03.00-00, old sequence 0x689<br/> Nov 28 20:31:54 Rebuilding L2, fragment abc-edge-03.00-00<br/> Nov 28 20:31:54 Rebuilt L2 fragment abc-edge-03.00-00, size 256<br/> Nov 28 20:34:05 Regenerating L1 LSP abc-edge-03.00-00, old sequence 0x683<br/> Nov 28 20:34:08 Rebuilding L1, fragment abc-edge-03.00-00<br/> Nov 28 20:34:08 Rebuilt L1 fragment abc-edge-03.00-00, size 59</p>                                                                                                                                   |
| packets        | All IS-IS protocol packets          | Not available.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

**Table 54: IS-IS Protocol Tracing Flags** *(continued)*

| Tracing Flags | Description                                | Example Output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| psn           | Partial sequence number PDU (PSNP) packets | Nov 28 20:40:39 Received L2 PSN, source abc-core-01, interface so-1/1/0.0<br>Nov 28 20:40:39 Received L2 PSN, source abc-core-02, interface so-1/1/1.0<br>Nov 28 20:41:36 Sending L2 PSN on interface so-1/1/1.0<br>Nov 28 20:41:36 Sending L2 PSN on interface so-1/1/0.0<br>Nov 28 20:42:35 Received L2 PSN, source abc-core-02, interface so-1/1/1.0<br>Nov 28 20:42:35 LSP abc-edge-03.00-00 lifetime 1196<br>Nov 28 20:42:35 sequence 0x68c checksum 0x746d<br>Nov 28 20:42:35 Received L2 PSN, source abc-core-01, interface so-1/1/0.0<br>Nov 28 20:42:35 LSP abc-edge-03.00-00 lifetime 1196<br>Nov 28 20:42:35 sequence 0x68c checksum 0x746d<br>Nov 28 20:42:49 Sending L2 PSN on interface so-1/1/1.0<br>Nov 28 20:42:49 LSP abc-core-01.00-00 lifetime 1197<br>Nov 28 20:42:49 sequence 0x1c4fb checksum 0x9bec<br>Nov 28 20:42:49 Sending L2 PSN on interface so-1/1/0.0Nov 28 20:42:49 LSP<br>abc-core-01.00-00 lifetime 1197<br>Nov 28 20:42:49 sequence 0x1c4fb checksum 0x9bec |
| spf           | Shortest path first (SPF) calculations     | Nov 28 20:44:01 Scheduling SPF for L1: Reconfig<br>Nov 28 20:44:01 Scheduling multicast SPF for L1: Reconfig<br>Nov 28 20:44:01 Scheduling SPF for L2: Reconfig<br>Nov 28 20:44:01 Scheduling multicast SPF for L2: Reconfig<br>Nov 28 20:44:02 Running L1 SPF<br>Nov 28 20:44:02 L1 SPF initialization complete: 0.000099s cumulative time<br>Nov 28 20:44:02 L1 SPF primary processing complete: 0.000303s cumulative time<br>Nov 28 20:44:02 L1 SPF result postprocessing complete: 0.000497s cumulative time<br>Nov 28 20:44:02 L1 SPF RIB postprocessing complete: 0.000626s cumulative time<br>Nov 28 20:44:02 L1 SPF routing table postprocessing complete: 0.000736s cumulative time                                                                                                                                                                                                                                                                                                    |

## Display Sent or Received IS-IS Protocol Packets

**Action** To configure the tracing for only sent or received IS-IS protocol packets, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```
[edit]
user@host# edit protocol isis traceoptions
```

2. Configure the flag to display sent, received, or both sent and received packets:

```
[edit protocols isis traceoptions]
user@host# set flag hello send
```

or

```
[edit protocols isis traceoptions]
user@host# set flag hello receive
```

or

```
[edit protocols isis traceoptions]
user@host# set flag hello
```

3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit protocols isis traceoptions]
user@host# show
file isislog size 10k files 10;
flag hello send;
```

or

```
[edit protocols isis traceoptions]
user@host# show
file isislog size 10k files 10;
flag hello receive;
```

or

```
[edit protocols isis traceoptions]
user@host# show
file isislog size 10k files 10;
flag hello send receive;
```

4. Commit the configuration:

```
user@host# commit
```

5. View the contents of the file containing the detailed messages:

```
user@host# run show log filename
```

For example:

```
user@host# run show log isislog
Sep 27 18:17:01 ISIS periodic xmit to 01:80:c2:00:00:15 (IFL 2)
Sep 27 18:17:01 ISIS periodic xmit to 01:80:c2:00:00:14 (IFL 2)
Sep 27 18:17:03 ISIS periodic xmit to 01:80:c2:00:00:15 (IFL 2)
Sep 27 18:17:04 ISIS periodic xmit to 01:80:c2:00:00:14 (IFL 2)
Sep 27 18:17:06 ISIS L2 hello from 0000.0000.0008 (IFL 2) absorbed
Sep 27 18:17:06 ISIS periodic xmit to 01:80:c2:00:00:15 (IFL 2)
Sep 27 18:17:06 ISIS L1 hello from 0000.0000.0008 (IFL 2) absorbed
```

## Analyze IS-IS-Link State Packets in Detail

**Action** To analyze IS-IS link-state packets (LSPs) in detail, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```
[edit]
user@host# edit protocols isis traceoptions
```

2. Configure IS-IS open messages:

```
[edit protocols isis traceoptions]
user@host# set flag lsp detail
```

3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit protocols isis traceoptions]
user@host# show
file isislog size 5m world-readable;
flag error;
flag lsp detail;
```

4. Commit the configuration:

```
user@host# commit
```

5. View the contents of the file containing the detailed messages:

```
user@host# run show log filename
```

For example:

```
user@host# run show log isislog
Nov 28 20:17:24 Received L2 LSP abc-core-01.00-00, interface so-1/1/0.0
Nov 28 20:17:24   from abc-core-01
Nov 28 20:17:24   sequence 0x1c4f9, checksum 0x9fea, lifetime 1199
Nov 28 20:17:24   max area 0, length 426
Nov 28 20:17:24   no partition repair, no database overload
Nov 28 20:17:24   IS type 3, metric type 0
Nov 28 20:17:24   area address 99.0908 (1)
Nov 28 20:17:24   speaks CLNP
Nov 28 20:17:24   speaks IP
Nov 28 20:17:24   dyn hostname abc-core-01
Nov 28 20:17:24   IP address 10.10.134.11
Nov 28 20:17:24   IP prefix: 10.10.10.0/30 metric 1 up
Nov 28 20:17:24   IP prefix: 10.10.10.4/30 metric 5 up
Nov 28 20:17:24   IP prefix: 10.10.10.56/30 metric 5 up
Nov 28 20:17:24   IP prefix: 10.10.10.52/30 metric 1 up
Nov 28 20:17:24   IP prefix: 10.10.10.64/30 metric 5 up
Nov 28 20:17:24   IP prefix: 10.10.10.20/30 metric 5 up
Nov 28 20:17:24   IP prefix: 10.10.10.28/30 metric 5 up
Nov 28 20:17:24   IP prefix: 10.10.10.44/30 metric 5 up
Nov 28 20:17:24   IP prefix 10.10.10.0 255.255.255.252
Nov 28 20:17:24   internal, metrics: default 1
Nov 28 20:17:24   IP prefix 10.10.10.4 255.255.255.252
Nov 28 20:17:24   internal, metrics: default 5
Nov 28 20:17:24   IP prefix 10.10.10.56 255.255.255.252
Nov 28 20:17:24   internal, metrics: default 5
Nov 28 20:17:24   IP prefix 10.10.10.52 255.255.255.252
Nov 28 20:17:24   internal, metrics: default 1
```



```

Nov 28 20:17:24 IP prefix 10.10.10.64 255.255.255.252
Nov 28 20:17:24 internal, metrics: default 5
Nov 28 20:17:24 IP prefix 10.10.10.20 255.255.255.252
Nov 28 20:17:24 internal, metrics: default 5
Nov 28 20:17:24 IP prefix 10.10.10.28 255.255.255.252
Nov 28 20:17:24 internal, metrics: default 5
Nov 28 20:17:24 IP prefix 10.10.10.44 255.255.255.252
Nov 28 20:17:24 internal, metrics: default 5
Nov 28 20:17:24 IS neighbors:
Nov 28 20:17:24 IS neighbor abc-core-02.00
Nov 28 20:17:24 internal, metrics: default 1
[...Output truncated...]
Nov 28 20:17:24 internal, metrics: default 5
Nov 28 20:17:24 IS neighbor abc-brdr-01.00
Nov 28 20:17:24 internal, metrics: default 5
Nov 28 20:17:24 IS neighbor abc-core-02.00, metric: 1
Nov 28 20:17:24 IS neighbor abc-esr-02.00, metric: 5
Nov 28 20:17:24 IS neighbor abc-edge-03.00, metric: 5
Nov 28 20:17:24 IS neighbor abc-edge-01.00, metric: 5
Nov 28 20:17:24 IS neighbor abc-edge-02.00, metric: 5
Nov 28 20:17:24 IS neighbor abc-brdr-01.00, metric: 5
Nov 28 20:17:24 IP prefix: 10.10.134.11/32 metric 0 up
Nov 28 20:17:24 IP prefix: 10.11.0.0/16 metric 5 up
Nov 28 20:17:24 IP prefix: 10.211.0.0/16 metric 0 up
Nov 28 20:17:24 IP prefix 10.10.134.11 255.255.255.255
Nov 28 20:17:24 internal, metrics: default 0
Nov 28 20:17:24 IP prefix 10.11.0.0 255.255.0.0
Nov 28 20:17:24 internal, metrics: default 5
Nov 28 20:17:24 IP prefix 10.211.0.0 255.255.0.0
Nov 28 20:17:24 internal, metrics: default 0
Nov 28 20:17:24 Updating LSP
Nov 28 20:17:24 Updating L2 LSP abc-core-01.00-00 in TED
Nov 28 20:17:24 Analyzing subtlv's for abc-core-02.00
Nov 28 20:17:24 Analysis complete
Nov 28 20:17:24 Analyzing subtlv's for abc-esr-02.00
Nov 28 20:17:24 Analysis complete
Nov 28 20:17:24 Analyzing subtlv's for abc-edge-03.00
Nov 28 20:17:24 Analysis complete
Nov 28 20:17:24 Analyzing subtlv's for abc-edge-01.00
Nov 28 20:17:24 Analysis complete
Nov 28 20:17:24 Analyzing subtlv's for abc-edge-02.00
Nov 28 20:17:24 Analysis complete
Nov 28 20:17:24 Analyzing subtlv's for abc-brdr-01.00
Nov 28 20:17:24 Analysis complete
Nov 28 20:17:24 Scheduling L2 LSP abc-core-01.00-00 sequence 0x1c4f9
on interface so-1/1/1.0

```

## Configure OSPF-Specific Options

**Purpose** When unexpected events or problems occur, or if you want to diagnose OSPF neighbor establishment issues, you can view more detailed information by configuring options specific to OSPF.

To configure OSPF options, follow these steps:

1. Diagnose OSPF Session Establishment Problems on page 268
2. Analyze OSPF Link-State Advertisement Packets in Detail on page 271

## **Diagnose OSPF Session Establishment Problems**

**Action** To trace OSPF messages in detail, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```
[edit]
user@host# edit protocols ospf traceoptions
```

2. Configure OSPF hello messages:

```
[edit protocols ospf traceoptions]
user@host# set flag hello detail
```

3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit protocols ospf traceoptions]
user@host# show
file ospf size 5m world-readable;
flag hello detail;
```

4. Commit the configuration:

```
user@host# commit
```

5. View the contents of the file containing the detailed messages:

```
user@host# run show log filename
```

For example:

```
user@host# run show log ospf
```

```
Dec 2 16:14:24 Version 2, length 44, ID 10.0.0.6, area 1.0.0.0
Dec 2 16:14:24 checksum 0xf01a, authtype 0
Dec 2 16:14:24 mask 0.0.0.0, hello_ivl 10, opts 0x2, prio 128
Dec 2 16:14:24 dead_ivl 40, DR 0.0.0.0, BDR 0.0.0.0
Dec 2 16:14:24 OSPF sent Hello (1) -> 224.0.0.5 (so-1/1/2.0)
Dec 2 16:14:24 Version 2, length 44, ID 10.0.0.6, area 1.0.0.0
Dec 2 16:14:24 checksum 0xf01a, authtype 0
Dec 2 16:14:24 mask 0.0.0.0, hello_ivl 10, opts 0x2, prio 128
Dec 2 16:14:24 dead_ivl 40, DR 0.0.0.0, BDR 0.0.0.0
Dec 2 16:14:26 OSPF rcvd Hello 10.10.10.33 -> 224.0.0.5 (so-1/1/1.0)
Dec 2 16:14:26 Version 2, length 48, ID 10.10.134.12, area 0.0.0.0
Dec 2 16:14:26 checksum 0x99b8, authtype 0Dec 2 16:14:26 mask
255.255.255.252, hello_ivl 10, opts 0x2, prio 1
ec 2 16:14:26 dead_ivl 40, DR 0.0.0.0, BDR 0.0.0.0
Dec 2 16:14:29 OSPF rcvd Hello 10.10.10.29 -> 224.0.0.5 (so-1/1/0.0)
```

```
Dec 2 16:14:29 Version 2, length 48, ID 10.108.134.11, area 0.0.0.0
Dec 2 16:14:29 checksum 0x99b9, authtype 0Dec 2 16:14:29 mask
255.255.255.252, hello_ivl 10, opts 0x2, prio 1
Dec 2 16:14:29 dead_ivl 40, DR 0.0.0.0, BDR 0.0.0.0
```

**Meaning** Table 55 on page 269 lists OSPF tracing flags and presents example output for some of the flags.

**Table 55: OSPF Protocol Tracing Flags**

| Tracing Flags        | Description                      | Example Output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| database-description | All database description packets | <pre>Dec 2 15:44:51 RPD_OSPF_NBRDOWN: OSPF neighbor 10.10.10.29 (so-1/1/0.0) state changed from Full to Down Dec 2 15:44:51 RPD_OSPF_NBRDOWN: OSPF neighbor 10.10.10.33 (so-1/1/1.0) state changed from Full to Down Dec 2 15:44:55 RPD_OSPF_NBRUP: OSPF neighbor 10.10.10.33 (so-1/1/1.0) state changed from Init to ExStart Dec 2 15:44:55 OSPF sent DbD (2) -&gt; 224.0.0.5 (so-1/1/1.0) Dec 2 15:44:55 Version 2, length 32, ID 10.0.0.6, area 0.0.0.0 Dec 2 15:44:55 checksum 0xf76b, authtype 0 Dec 2 15:44:55 options 0x42, i 1, m 1, ms 1, seq 0xa009eee, mtu 4470 Dec 2 15:44:55 OSPF rcvd DbD 10.10.10.33 -&gt; 224.0.0.5 (so-1/1/1.0) Dec 2 15:44:55 Version 2, length 32, ID 10.10.134.12, area 0.0.0.0 Dec 2 15:44:55 checksum 0x312c, authtype 0 Dec 2 15:44:55 options 0x42, i 1, m 1, ms 1, seq 0x2154, mtu 4470</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| error                | OSPF errored packets             | <pre>Dec 2 15:49:34 OSPF packet ignored: no matching interface from 172.16.120.29 Dec 2 15:49:44 OSPF packet ignored: no matching interface from 172.16.120.29 Dec 2 15:49:54 OSPF packet ignored: no matching interface from 172.16.120.29 Dec 2 15:50:04 OSPF packet ignored: no matching interface from 172.16.120.29 Dec 2 15:50:14 OSPF packet ignored: no matching interface from 172.16.120.29</pre>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| event                | OSPF state transitions           | <pre>Dec 2 15:52:35 OSPF interface ge-2/2/0.0 state changed from DR to DR Dec 2 15:52:35 OSPF interface ge-3/1/0.0 state changed from DR to DR Dec 2 15:52:35 OSPF interface ge-3/2/0.0 state changed from DR to DR Dec 2 15:52:35 OSPF interface ge-4/2/0.0 state changed from DR to DR Dec 2 15:53:21 OSPF neighbor 10.10.10.29 (so-1/1/0.0) state changed from Full to Down Dec 2 15:53:21 RPD_OSPF_NBRDOWN: OSPF neighbor 10.10.10.29 (so-1/1/0.0) state changed from Full to Down Dec 2 15:53:21 OSPF neighbor 10.10.10.33 (so-1/1/1.0) state changed from Full to Down Dec 2 15:53:21 RPD_OSPF_NBRDOWN: OSPF neighbor 10.10.10.33 (so-1/1/1.0) state changed from Full to Down Dec 2 15:53:25 OSPF neighbor 10.10.10.33 (so-1/1/1.0) state changed from Down to Init Dec 2 15:53:25 OSPF neighbor 10.10.10.33 (so-1/1/1.0) state changed from Init to ExStart Dec 2 15:53:25 RPD_OSPF_NBRUP: OSPF neighbor 10.10.10.33 (so-1/1/1.0) state changed from Init to ExStart Dec 2 15:53:25 OSPF neighbor 10.10.10.33 (so-1/1/1.0) state changed from ExStart to Exchange Dec 2 15:53:25 OSPF neighbor 10.10.10.33 (so-1/1/1.0) state changed from Exchange to Full Dec 2 15:53:25 RPD_OSPF_NBRUP: OSPF neighbor 10.10.10.33 (so-1/1/1.0) state changed from Exchange to Full</pre> |

**Table 55: OSPF Protocol Tracing Flags** (continued)

| Tracing Flags | Description                       | Example Output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| flooding      | Link-state flooding packets       | Dec 2 15:55:21 OSPF LSA Summary 10.218.0.0 10.0.0.6 flooding on so-1/1/0.0<br>Dec 2 15:55:21 OSPF LSA Summary 10.218.0.0 10.0.0.6 flooding on so-1/1/1.0<br>Dec 2 15:55:21 OSPF LSA Summary 10.218.0.0 10.0.0.6 on no so-1/1/2.0<br>rexmit lists, no flood<br>Dec 2 15:55:21 OSPF LSA Summary 10.218.0.0 10.0.0.6 on no so-1/1/3.0<br>rexmit lists, no flood<br><br>Dec 2 15:55:21 OSPF LSA Summary 10.245.0.1 10.0.0.6 on no so-1/1/2.0<br>rexmit lists, no flood<br>Dec 2 15:55:21 OSPF LSA Summary 10.245.0.1 10.0.0.6 on no so-1/1/3.0<br>rexmit lists, no flood                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| hello         | Hello packets                     | Dec 2 15:57:25 OSPF sent Hello (1) -> 224.0.0.5 (ge-3/1/0.0)<br>Dec 2 15:57:25 Version 2, length 44, ID 10.0.0.6, area 2.0.0.0<br>Dec 2 15:57:25 checksum 0xe43f, authtype 0<br>Dec 2 15:57:25 mask 255.255.0.0, hello_ivl 10, opts 0x2, prio 128<br>Dec 2 15:57:25 dead_ivl 40, DR 10.218.0.1, BDR 0.0.0.0<br>Dec 2 15:57:25 OSPF rcvd Hello 10.10.10.33 -> 224.0.0.5 (so-1/1/1.0)<br>Dec 2 15:57:25 Version 2, length 48, ID 10.10.134.12, area 0.0.0.0<br>Dec 2 15:57:25 checksum 0x99b8, authtype 0<br>Dec 2 15:57:25 mask 255.255.255.252, hello_ivl 10, opts 0x2, prio 1<br>Dec 2 15:57:25 dead_ivl 40, DR 0.0.0.0, BDR 0.0.0.0<br>Dec 2 15:57:27 OSPF sent Hello (1) -> 224.0.0.5 (ge-3/2/0.0)<br>Dec 2 15:57:27 Version 2, length 44, ID 10.0.0.6, area 2.0.0.0<br>Dec 2 15:57:27 checksum 0xe4a5, authtype 0<br>Dec 2 15:57:27 mask 255.255.0.0, hello_ivl 10, opts 0x2, prio 128<br>Dec 2 15:57:27 dead_ivl 40, DR 10.116.0.1, BDR 0.0.0.0<br>Dec 2 15:57:28 OSPF rcvd Hello 10.10.10.29 -> 224.0.0.5 (so-1/1/0.0)<br>Dec 2 15:57:28 Version 2, length 48, ID 10.10.134.11, area 0.0.0.0<br>Dec 2 15:57:28 checksum 0x99b9, authtype 0<br>Dec 2 15:57:28 mask 255.255.255.252, hello_ivl 10, opts 0x2, prio 1<br>Dec 2 15:57:28 dead_ivl 40, DR 0.0.0.0, BDR 0.0.0.0 |
| lsa-ack       | Link-state acknowledgment packets | Dec 2 16:00:11 OSPF rcvd LSAck 10.10.10.29 -> 224.0.0.5 (so-1/1/0.0)<br>Dec 2 16:00:11 Version 2, length 44, ID 10.10.134.11, area 0.0.0.0<br>Dec 2 16:00:11 checksum 0xcdbf, authtype 0<br>Dec 2 16:00:11 OSPF rcvd LSAck 10.10.10.33 -> 224.0.0.5 (so-1/1/1.0)<br>Dec 2 16:00:11 Version 2, length 144, ID 10.10.134.12, area 0.0.0.0<br>Dec 2 16:00:11 checksum 0x73bc, authtype 0<br>Dec 2 16:00:16 OSPF rcvd LSAck 10.10.10.33 -> 224.0.0.5 (so-1/1/1.0)<br>Dec 2 16:00:16 Version 2, length 44, ID 10.10.134.12, area 0.0.0.0<br>Dec 2 16:00:16 checksum 0x8180, authtype 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| lsa-request   | Link-state request packets        | Dec 2 16:01:38 OSPF rcvd LSReq 10.10.10.29 -> 224.0.0.5 (so-1/1/0.0)<br>Dec 2 16:01:38 Version 2, length 108, ID 10.10.134.11, area 0.0.0.0<br>Dec 2 16:01:38 checksum 0xe86, authtype 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

**Table 55: OSPF Protocol Tracing Flags** (continued)

| Tracing Flags | Description                                | Example Output                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| lsa-update    | Link-state update packets                  | Dec 2 16:09:12 OSPF built router LSA, area 0.0.0.0<br>Dec 2 16:09:12 OSPF built router LSA, area 1.0.0.0<br>Dec 2 16:09:12 OSPF built router LSA, area 2.0.0.0<br>Dec 2 16:09:13 OSPF sent LSUpdate (4) -> 224.0.0.5 (so-1/1/0.0)<br>Dec 2 16:09:13 Version 2, length 268, ID 10.0.0.6, area 0.0.0.0<br>Dec 2 16:09:13 checksum 0x8047, authtype 0<br>Dec 2 16:09:13 adv count 7<br>Dec 2 16:09:13 OSPF sent LSUpdate (4) -> 224.0.0.5 (so-1/1/1.0)<br>Dec 2 16:09:13 Version 2, length 268, ID 10.0.0.6, area 0.0.0.0<br>Dec 2 16:09:13 checksum 0x8047, authtype 0<br>Dec 2 16:09:13 adv count 7                                                                                                                                                                                                                                                      |
| packets       | All OSPF packets                           | Not available.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| packet-dump   | Dump the contents of selected packet types | Not available.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| spf           | SPF calculations                           | Dec 2 16:08:03 OSPF full SPF refresh scheduled<br>Dec 2 16:08:04 OSPF SPF start, area 1.0.0.0<br>Dec 2 16:08:04 OSPF add LSA Router 10.0.0.6 distance 0 to SPF list<br>Dec 2 16:08:04 SPF elapsed time 0.000525s<br>Dec 2 16:08:04 Stub elapsed time 0.000263s<br>Dec 2 16:08:04 OSPF SPF start, area 2.0.0.0<br>Dec 2 16:08:04 OSPF add LSA Router 10.0.0.6 distance 0 to SPF list<br>Dec 2 16:08:04 SPF elapsed time 0.000253s<br>Dec 2 16:08:04 Stub elapsed time 0.000249s<br>Dec 2 16:08:04 OSPF SPF start, area 0.0.0.0<br>Dec 2 16:08:04 OSPF add LSA Router 10.0.0.6 distance 0 to SPF list<br>Dec 2 16:08:04 OSPF add LSA Router 10.10.134.11 distance 1 to SPF list<br>Dec 2 16:08:04 IP nexthop so-1/1/0.0 0.0.0.0<br>Dec 2 16:08:04 OSPF add LSA Router 10.10.134.12 distance 1 to SPF list<br>Dec 2 16:08:04 IP nexthop so-1/1/1.0 0.0.0.0 |

### Analyze OSPF Link-State Advertisement Packets in Detail

**Action** To analyze OSPF link-state advertisement packets in detail, follow these steps:

1. In configuration mode, go to the following hierarchy level:

```
[edit]
user@host# edit protocols ospf traceoptions
```

2. Configure OSPF link-state packages:

```
[edit protocols ospf traceoptions]
user@host# set flag lsa-update detail
```

3. Verify the configuration:

```
user@host# show
```

For example:

```
[edit protocols ospf traceoptions]
user@host# show
file ospf size 5m world-readable;
flag hello detail;
flag lsa-update detail;
```

4. Commit the configuration:

```
user@host# commit
```

5. View the contents of the file containing the detailed messages:

```
user@host# run show log filename
```

For example:

```
user@host# run show log ospf
```

```
Dec 2 16:23:47 OSPF sent LSUpdate (4) -> 224.0.0.5 (so-1/1/0.0) ec 2
16:23:47 Version 2, length 196, ID 10.0.0.6, area 0.0.0.0
Dec 2 16:23:47 checksum 0xcc46, authtype 0
Dec 2 16:23:47 adv count 6 Dec 2 16:23:47 OSPF sent LSUpdate (4) ->
224.0.0.5 (so-1/1/1.0)
Dec 2 16:23:47 Version 2, length 196, ID 10.0.0.6, area 0.0.0.0 Dec 2
16:23:47 checksum 0xcc46, authtype 0
Dec 2 16:23:47 adv count 6
```

Chapter 24

# Collect Crash Data

This chapter explains the crashes that can occur in different areas of the JUNOS software, and provides procedures you use to collect the crash data necessary for troubleshooting by the Juniper Networks Technical Assistance Center (JTAC).

- Checklist for Collecting Crash Data on page 273
- Understand Crash Data Collection on page 275
- Collect Crash Data for a Routing Engine Kernel on page 275
- Collect Crash Data for Routing Engine Daemons on page 279
- Collect Crash Data for the Packet Forwarding Engine Microkernel on page 283

## Checklist for Collecting Crash Data

**Problem** Table 56 on page 273 provides links commands for collection crash data.

**Table 56: Checklist for Collecting Crash Data**

| Tasks                                                               | Command or Action                                                               |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------|
| <b>“Understand Crash Data Collection” on page 275</b>               |                                                                                 |
| <b>“Collect Crash Data for a Routing Engine Kernel” on page 275</b> |                                                                                 |
| 1. Check the Routing Engine Core Files on page 276                  | file list detail /var/crash                                                     |
| 2. Clear the NVRAM Contents on page 287                             |                                                                                 |
| a. List the Core Files on page 276                                  | start shell<br>su<br>root password<br>cd /var/crash<br>ls -l                    |
| b. Compress the vmcore File on page 277                             | gzip vmcore.number<br><br>To unzip the vmcore file:<br>gzip -d vmcore.number.gz |
| c. Log Software Version Information                                 | show version                                                                    |
| d. Open a Case with JTAC on page 278                                | support@juniper.net<br>ftp ftp.juniper.net                                      |

**Table 56: Checklist for Collecting Crash Data** *(continued)*

| Tasks                                                                                | Command or Action                                                                                         |
|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>“Collect Crash Data for Routing Engine Daemons” on page 279</b>                   |                                                                                                           |
| 1. Check for Daemon Core Files on page 279                                           | file list detail /var/tmp                                                                                 |
| 2. Collect and Send Routing Engine Crash Data to JTAC                                |                                                                                                           |
| a. List the Daemon Core Files on page 280                                            | start shell<br>su<br>root password<br>cd /var/tmp<br>ls -l                                                |
| b. Compress the Daemon Core Files on page 281                                        | gzip daemon-executable-name.core.number                                                                   |
| c. Log Software Version Information                                                  | show version                                                                                              |
| d. Open a Case with JTAC on page 278                                                 | support@juniper.net<br>ftp ftp.juniper.net                                                                |
| <b>“Collect Crash Data for the Packet Forwarding Engine Microkernel” on page 283</b> |                                                                                                           |
| 1. Display the Crash Stack Traceback and Registration Information on page 284        | start shell<br>su<br>root password<br>vty component-executable-name<br>show nvram<br>show syslog messages |
| 2. Clear the NVRAM Contents on page 287                                              | start shell<br>su<br>root password<br>vty component-executable-name<br>clear nvram                        |
| 3. Check Packet Forwarding Engine Microkernel Core Files on page 288                 | file list detail /var/crash                                                                               |
| 4. Collect and Send Routing Engine Crash Data to JTAC                                |                                                                                                           |
| a. List the Core Files Generated by the Crash on page 288                            | start shell<br>su<br>root password<br>cd /var/crash<br>ls -l                                              |
| b. Compress the Core Files on page 289                                               | gzip filename                                                                                             |
| c. Log Software Version Information                                                  | show version                                                                                              |
| d. Open a Case with JTAC on page 278                                                 | support@juniper.net<br>ftp ftp.juniper.net                                                                |



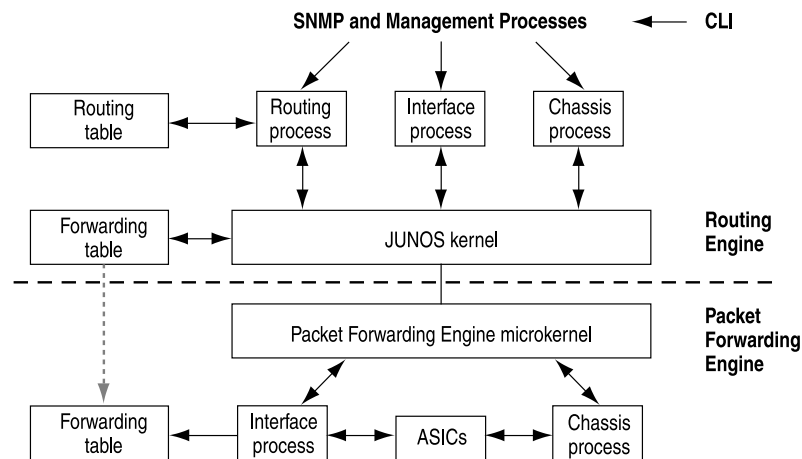
## Understand Crash Data Collection

A crash can occur in one of three areas in the JUNOS software architecture (see Figure 22 on page 275):

- Routing Engine kernel
- Routing Engine daemons (processes)
- Packet Forwarding Engine microkernel

**Figure 22: Three Areas Where a Software Crash Can Occur**

Software Architecture



## Collect Crash Data for a Routing Engine Kernel

**Purpose** When a Routing Engine kernel crashes, the Routing Engine automatically reboots. By default, the Juniper Networks router does not attempt to dump a core if the Routing Engine kernel crashes. As a result, there is no crash data on the router to help investigate the crash. In addition, the system log messages are similar to those generated when the router is powered down and restarted, so you cannot tell if the Routing Engine restart was caused by a kernel crash or a normal power restart.

To collect crash data for a Routing Engine kernel crash, follow these steps:

1. Check the Routing Engine Core Files on page 276
2. List the Core Files on page 276
3. Compress the vmcore File on page 277
4. Log Software Version Information on page 277
5. Open a Case with JTAC on page 278

## Check the Routing Engine Core Files

**Purpose** If you observe disruption to the Routing Engine kernel, check the `/var/crash` directory for any core files created around the time of the crash.

**Action** To check the `/var/crash` directory, use the following JUNOS command-line interface (CLI) operational mode command:

```
user@host> file list detail /var/crash
```

**Sample Output**

```
user@host> file list detail /var/crash
total 1577912
drwxr-x---  2 root  wheel           512 Sep  9 11:59 ./
drwxr-xr-x 22 root  wheel           512 Oct 29  2001 ../
-rw-r--r--  1 root  wheel             2 Jul 20 01:11 bounds
-rw-r--r--  1 root  wheel      2166913 Jul 20 01:11 kernel.0
-rw-r--r--  1 root  wheel             5 Feb 15  2002 minfree
-rw-----  1 root  wheel    805306368 Jul 20 01:11 vmcore.0
```

**Meaning** The sample output lists the contents of the `/var/crash/` directory. Check the date and timestamp for any kernel core files created around the time of the crash. In the example above, two core files are listed: `kernel.0` and `vmcore.0`.

## List the Core Files

**Purpose** To list the core files, follow these steps:

**Action** 1. Exit from the CLI environment and create a UNIX-level shell by entering the `start shell` command:

```
user@host> start shell
```

2. Type `su` and the root password when prompted. You are now in the shell and the prompt is `%` instead of `>`, for example:

```
% su
Password: ****
```

3. Change the directory to `/var/crash` and type `ls -l`, for example:

```
root@host% cd /var/crash
root@host% ls -l
```

4. Look for any core files created around the time of the crash.

**Sample Output**

```
user@host> start shell
% su
Password: ****
root@host% cd /var/crash
root@host% ls -l
total 1577908
-rw-r--r--  1 root  wheel             2 Jul 20 01:11 bounds
-rw-r--r--  1 root  wheel      2166913 Jul 20 01:11 kernel.0
-rw-r--r--  1 root  wheel             5 Feb 15  2002 minfree
-rw-----  1 root  wheel    805306368 Jul 20 01:11 vmcore.0
```

**Meaning** The sample output lists the contents of the `/var/crash` directory and shows the current core files `kernel.0` and `vm.core.0`.

## Compress the vmcore File

**Purpose** The `gzip` compression utility is used to compress files. Compress the `vmcore` file if it is larger than 50 MB. Files created using the `gzip` command end with the file extension `.gz`.



**NOTE:** Use lowercase for the `gzip` command when you are in the shell.

**Action** To compress the `vmcore` file with `gzip`, use the following command from the shell:

```
root@host% gzip vmcore .number
```

To unzip the `vmcore` file with `gzip`, use the following command from the shell:

```
root@host% gzip -d vmcore .number.gz
```

**Meaning** The contents of the `vmcore` file are compressed into a single compressed file named `vmcore.number.gz`. The `gzip` command preserves the mode, ownership, and timestamps of files when compressing or decompressing them.

## Log Software Version Information

**Purpose** To log the JUNOS software version information.

**Action** To log the JUNOS software version information, use the following JUNOS CLI operational mode command:

```
user@host> show version
```

**Sample Output**

```
user@host> show version
Hostname: host
Model: m10
JUNOS Base OS boot [5.0R5]
JUNOS Base OS Software Suite [5.0R5]
JUNOS Kernel Software Suite [5.0R5]
JUNOS Routing Software Suite [5.0R5]
JUNOS Packet Forwarding Engine Support [5.0R5]
JUNOS Crypto Software Suite [5.0R5]
JUNOS Online Documentation [5.0R5]
KERNEL 5.0R5 #0 built by builder on 2002-03-02 05:10:28 UTC
MGD release 5.0R5 built by builder on 2002-03-02 04:45:32 UTC
CLI release 5.0R5 built by builder on 2002-03-02 04:44:22 UTC
CHASSISD release 5.0R5 built by builder on 2002-03-02 04:43:37 UTC
DCD release 5.0R5 built by builder on 2002-03-02 04:42:47 UTC
RPD release 5.0R5 built by builder on 2002-03-02 04:46:17 UTC
SNMPD release 5.0R5 built by builder on 2002-03-02 04:52:26 UTC
MIB2D release 5.0R5 built by builder on 2002-03-02 04:45:37 UTC
APSD release 5.0R5 built by builder on 2002-03-02 04:43:31 UTC
VRRPD release 5.0R5 built by builder on 2002-03-02 04:52:34 UTC
```

```

ALARM release 5.0R5 built by builder on 2002-03-02 04:43:24 UTC
PFED release 5.0R5 built by builder on 2002-03-02 04:46:06 UTC
CRAFTD release 5.0R5 built by builder on 2002-03-02 04:44:30 UTC
SAMPLED release 5.0R5 built by builder on 2002-03-02 04:52:20 UTC
ILMID release 5.0R5 built by builder on 2002-03-02 04:45:21 UTC
BPRELAYD release 5.0R5 built by builder on 2002-03-02 04:42:41 UTC
RMOPD release 5.0R5 built by builder on 2002-03-02 04:46:11 UTC
jkernel-dd release 5.0R5 built by builder on 2002-03-02 04:41:07 UTC
jroute-dd release 5.0R5 built by builder on 2002-03-02 04:41:21 UTC
jdocs-dd release 5.0R5 built by builder on 2002-03-02 04:39:11 UTC

```

**Meaning** The sample output shows the hostname, router model, and the different JUNOS software packages, processes, and documents.

## Open a Case with JTAC

**Problem** To open a case with JTAC, follow these steps:

**Solution**

1. Send an e-mail to [support@juniper.net](mailto:support@juniper.net), and include the information from the `show version` command.
2. At the support engineer's request, ftp the `vmcore.number.gz` file to a case-number directory at [ftp.juniper.net](ftp://ftp.juniper.net). To ftp the core file to a directory, follow these steps:
  - a. At the shell prompt, enter `ftp ftp.juniper.net`.
  - b. At the name prompt, enter `anonymous`.
  - c. At the password prompt, enter your e-mail address as the password.
  - d. At the ftp prompt, enter the `cd pub/ incoming` string.
  - e. Enter the `mkdir case-number` command, where the *case-number* is the value of the case you opened with JTAC, for example, `1999-1231-9999`. If a directory has already been created, continue with the next step.
  - f. Enter the `cd case-number` command.
  - g. Enter the `binary` command so that the file transfer is in binary and not ASCII.
  - h. Enter the `put vmcore.O.gz` command.

**Meaning** The following output is an example of copying a core file from the shell to an ftp directory at [ftp.juniper.net](ftp://ftp.juniper.net):

**Sample Output**

```

root@host% ftp ftp.juniper.net
Connected to colo-ftp.juniper.net.
220 colo-ftp.juniper.net FTP server (Version 6.00LS) ready.
Name (ftp.juniper.net: root): anonymous
331 Guest login ok, send your email address as password.
Password: ****
230 Guest login ok, access restrictions apply.
ftp> cd pub/ incoming
250 CWD command successful
ftp> mkdir 1999-1231-9999
257 MKD command successful.
ftp> cd 1999-1231-9999

```

```

250 CWD command successful.
ftp> bin
200 Type set to I.
ftp> put vmcore.0.gz

```

**Meaning** The sample output shows that there is a connection to `ftp.juniper.net`, that the login name and password were entered, and that the core file was successfully copied from the shell to an ftp directory at `ftp.juniper.net`.

## Collect Crash Data for Routing Engine Daemons

---

To collect crash data for Routing Engine daemons, follow these steps:

1. Check for Daemon Core Files on page 279
2. List the Daemon Core Files on page 280
3. Compress the Daemon Core Files on page 281
4. Log Software Version Information on page 281
5. Open a Case with JTAC on page 282

### Check for Daemon Core Files

**Purpose** If you observe disruption to routing protocol operation, system log operation, Simple Network Management Protocol (SNMP) operation, or other operations handled by Routing Engine daemons, check the `/var/tmp` directory for any daemon core files created around the time of the crash.

**Action** To check the `/var/tmp` directory, use the following JUNOS CLI operational mode command:

```
user@host> file list detail /var/tmp
```

**Sample Output**

```

user@host> file list detail /var/tmp
total 1292622
drwxrwxrwt  3 root  field      512 Dec 31 06:48 ./
drwxr-xr-x 21 root  field      512 Mar  5 1999 ../
-rw-rw----  1 root  field 119713792 Nov 17 21:58 rpd.core.0
-rw-rw----  1 root  field 120782848 Nov 17 22:12 rpd.core.1

```

**Meaning** The sample output lists the contents of the `/var/tmp/` directory. Look for any daemon core files created around the time of the crash. In the example above, two core files are listed: `rpdc.core.0` and `rpdc.core.1`.

Table 57 on page 280 lists the major Routing Engine daemons supported by the JUNOS software.

**Table 57: Major Routing Engine Daemons**

| Executable Name | Definition                                | Description                                                                                                                                                            |
|-----------------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| rpd             | Routing protocol daemon                   | Provides routing protocol intelligence (Border Gateway Protocol [BGP], Intermediate System-to-Intermediate System [ISIS], Open Shortest Path First [OSPF], and so on). |
| dcd             | Device control daemon                     | Manages all interface devices.                                                                                                                                         |
| mgd             | Management daemon                         | Provides user configuration access to the system. The CLI is a client of <b>mgd</b> .                                                                                  |
| snmpd           | Simple Network Management Protocol daemon | Provides remote network management information to the network management system.                                                                                       |
| chassisd        | Chassis daemon                            | Monitors and manages Flexible PIC Concentrator (FPC) slots and other environmental components.                                                                         |
| alarmd          | Alarm daemon                              | Manages system alarm notifications.                                                                                                                                    |
| apsd            | Automatic protection switching daemon     | Provides SONET Automatic Protection Switching (APS) functionality.                                                                                                     |
| sampled         | Traffic sampling daemon                   | Gathers traffic sampling information.                                                                                                                                  |
| vrrpd           | Virtual Router Redundancy Protocol daemon | Provides Virtual Router Redundancy Protocol (VRRP) functionality.                                                                                                      |
| syslogd         | System log daemon                         | Manages the router system logging operation.                                                                                                                           |
| mib2d           | MIB2 daemon                               | Management Information Base (MIB) subagent for MIB2.                                                                                                                   |

## List the Daemon Core Files

**Purpose** To list the daemon core files.

**Action** To list the daemon core files, follow these steps:

1. Exit from the CLI environment and create a UNIX-level shell by entering the **start shell** command:

```
user@host> start shell
```

2. Type **su** and the root password when prompted. You are now in the shell and the prompt is **%** instead of **>**, for example:

```
% su  
Password: ****
```

3. Change the directory to **/var/tmp** and type **ls -l**, for example:

```
root@host% cd /var/tmp
```

```
root@host% ls -l
```

4. Look for any daemon core files created around the time of the crash.

**Sample Output**

```
user@host> start shell
% su
Password: ****
root@host% cd /var/tmp
root@host% ls -l
total 1292618
-rw-rw---- 1 root field 119713792 Nov 17 21:58 rpd.core.0
-rw-rw---- 1 root field 120782848 Nov 17 22:12 rpd.core.1
```

**Meaning** The sample output lists the contents of the `/var/tmp` directory and shows the current core file (`rpdc.core.1`) and one previous core file (`rpdc.core.0`) for the routing protocol daemon (`rpdc`). For each daemon, you can have a total of five core files in the `/var/tmp` directory: the current core file and the four previous core files numbered 0 through 4 (from oldest to newest).

## Compress the Daemon Core Files

**Purpose** The `gzip` compression utility is used to compress the files if they are large. Files created using the `gzip` command end with the file extension `.gz`. Compress the core file if it is over 50 MB.



**NOTE:** Use lowercase for the `gzip` command when you are in the shell.

You only need to compress the daemon core files when the tarball file is not created.

---

**Action** To compress the daemon core file with `gzip`, use the following command from the shell:

```
root@host% gzip daemon-executable-name.core.number
```

**Sample Output**

```
root@host% gzip rpd.core.0
gzip rpd.core.0
```

**Meaning** The contents of the daemon core file are compressed into a single compressed file named `daemon.number.gz`. The `gzip` command preserves the mode, ownership, and timestamps of files when compressing or decompressing them.

## Log Software Version Information

**Purpose** To log the JUNOS software version information.

**Action** To log the JUNOS software version information, use the following JUNOS CLI operational mode command:

```
user@host> show version
```

**Sample Output**

```

user@host> show version
Hostname: host
Model: m10
JUNOS Base OS boot [5.0R5]
JUNOS Base OS Software Suite [5.0R5]
JUNOS Kernel Software Suite [5.0R5]
JUNOS Routing Software Suite [5.0R5]
JUNOS Packet Forwarding Engine Support [5.0R5]
JUNOS Crypto Software Suite [5.0R5]
JUNOS Online Documentation [5.0R5]
KERNEL 5.0R5 #0 built by builder on 2002-03-02 05:10:28 UTC
MGD release 5.0R5 built by builder on 2002-03-02 04:45:32 UTC
CLI release 5.0R5 built by builder on 2002-03-02 04:44:22 UTC
CHASSISD release 5.0R5 built by builder on 2002-03-02 04:43:37 UTC
DCD release 5.0R5 built by builder on 2002-03-02 04:42:47 UTC
RPD release 5.0R5 built by builder on 2002-03-02 04:46:17 UTC
SNMPD release 5.0R5 built by builder on 2002-03-02 04:52:26 UTC
MIB2D release 5.0R5 built by builder on 2002-03-02 04:45:37 UTC
APSD release 5.0R5 built by builder on 2002-03-02 04:43:31 UTC
VRRPD release 5.0R5 built by builder on 2002-03-02 04:52:34 UTC
ALARM release 5.0R5 built by builder on 2002-03-02 04:43:24 UTC
PFED release 5.0R5 built by builder on 2002-03-02 04:46:06 UTC
CRAFTD release 5.0R5 built by builder on 2002-03-02 04:44:30 UTC
SAMPLED release 5.0R5 built by builder on 2002-03-02 04:52:20 UTC
ILMID release 5.0R5 built by builder on 2002-03-02 04:45:21 UTC
BPRELAYD release 5.0R5 built by builder on 2002-03-02 04:42:41 UTC
RMOPD release 5.0R5 built by builder on 2002-03-02 04:46:11 UTC
jkernel-dd release 5.0R5 built by builder on 2002-03-02 04:41:07 UTC
jroute-dd release 5.0R5 built by builder on 2002-03-02 04:41:21 UTC
jdocs-dd release 5.0R5 built by builder on 2002-03-02 04:39:11 UTC

```

**Meaning** The sample output shows the hostname, router model, and the different JUNOS software packages, processes, and documents.

## Open a Case with JTAC

**Problem** To open a case with JTAC, follow these steps:

- Solution**
1. Send an e-mail to [support@juniper.net](mailto:support@juniper.net), and include the information from the `show version` command.
  2. At the support engineer's request, ftp the `vmcore.number.gz` file to a case-number directory at [ftp.juniper.net](ftp://ftp.juniper.net). To ftp the core file to a directory, follow these steps:
    - a. At the shell prompt, enter `ftp ftp.juniper.net`.
    - b. At the name prompt, enter `anonymous`.
    - c. At the password prompt, enter your e-mail address as the password.
    - d. At the ftp prompt, enter the `cd pub/ incoming` string.
    - e. Enter the `mkdir case-number` command, where the *case-number* is the value of the case you opened with JTAC, for example, `1999-1231-9999`. If a directory has already been created, continue with the next step.
    - f. Enter the `cd case-number` command.



- g. Enter the `binary` command so that the file transfer is in binary and not ASCII.
- h. Enter the `put vmcore.0.gz` command.

**Meaning** The following output is an example of copying a core file from the shell to an ftp directory at ftp.juniper.net:

**Sample Output**

```

root@host% ftp ftp.juniper.net
Connected to colo-ftp.juniper.net.
220 colo-ftp.juniper.net FTP server (Version 6.00LS) ready.
Name (ftp.juniper.net: root): anonymous
331 Guest login ok, send your email address as password.
Password: ****
230 Guest login ok, access restrictions apply.
ftp> cd pub/ incoming
250 CWD command successful
ftp> mkdir 1999-1231-9999
257 MKD command successful.
ftp> cd 1999-1231-9999
250 CWD command successful.
ftp> bin
200 Type set to I.
ftp> put vmcore.0.gz

```

**Meaning** The sample output shows that there is a connection to ftp.juniper.net, that the login name and password were entered, and that the core file was successfully copied from the shell to an ftp directory at ftp.juniper.net.

## Collect Crash Data for the Packet Forwarding Engine Microkernel

**Purpose** Each of the following Packet Forwarding Engine components of a Juniper Networks router runs a microkernel:

- Flexible PIC Concentrator (FPC) on M-series platforms except for the M5 and M10 Internet routers
- Gibson Flexible PIC Concentrator (GFPC) on T640 and T320 Internet routing nodes
- Switched Printed Mezzanine Board (SPMB) on T640 and T320 Internet routing nodes
- Forwarding Engine Board (FEB) on M5 and M10 Internet routers
- System Switching Board (SSB) on an M20 Internet router
- System Control Board (SCB) on an M40 Internet router
- Switching and Forwarding Module (SFM) on M160 and M40e Internet routers

When a crash occurs, crash stack traceback and registration information is placed into nonvolatile random access memory (NVRAM) on the different components. Table 58 on page 284 shows where the NVRAM is located for the components for each router.

**Table 58: NVRAM Location on the Microkernel of the Packet Forwarding Engine Components**

| Router Type | NVRAM Location                                                     |
|-------------|--------------------------------------------------------------------|
| M5 and M10  | FEB                                                                |
| M20         | SSB and crash stack traceback and register information for the FPC |
| M40         | SCB and crash stack traceback and register information for the FPC |
| M40e        | FPC<br>SFM                                                         |
| M160        | FPC<br>SFM                                                         |
| T320        | GFPC<br>SPMB                                                       |
| T640        | GFPC<br>SPMB                                                       |

To collect crash data for the Packet Forwarding Engine microkernel, follow these steps:

1. Display the Crash Stack Traceback and Registration Information on page 284
2. Clear the NVRAM Contents on page 287
3. Check Packet Forwarding Engine Microkernel Core Files on page 288
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### **Display the Crash Stack Traceback and Registration Information**

**Purpose** To display the crash stack traceback and registration information.

**Action** To display the crash stack traceback and registration information, follow these steps:

1. Exit from the CLI environment and create a UNIX-level shell by entering the **start shell** command:

```
user@host> start shell
```

2. Type **su** and the root password when prompted. You are now in the shell and prompt is % instead of >, for example:

```
% su  
Password: ****
```

3. Establish a vty session to the appropriate component. Use the **vtty** command followed by the executable name for the component; for example, **scb**, **ssb0**, **ssb1**, **fpc0**, or **fpc1**:

```
root@host% vty sfm0
```



**NOTE:** For the M40e and M160 routers, you can also create a **cty** session to the components if the components are not online.

4. Type the **show nvram** command to view the NVRAM information.
5. Type the **show syslog messages** command to view the system log messages.

### Sample Output 1

```
user@host> start shell
% su
Password: ****
root@host% vty sfm0

SFM platform (266Mhz PPC 603e processor, 64Mb memory, 512Kb flash)
SFM3(host vty)# show nvram
System NVRAM :
  4080 available bytes, 4080 used, 0 free
Contents:

mpc106 machine check caused by error on the PCI Bus
mpc106 error detect register 1: 0x08, 2: 0x00
mpc106 error ack count = 0
mpc106 error address: 0x0a000000
mpc106 PCI bus error status register: 0x02
  mpc106 was the PCI master
  C/BE bits: I/O read [0b0010]
mpc106 error detection reg1: PCI cycle
mpc106 PCI status reg: parity error

System Exception: Vector/Code 0x00700, Signal 4
Event occurred at: Oct 26 13:32:40.952

Juniper Embedded Microkernel Version 4.2R1
Built by tlim on 2000-09-23 06:11:28 UTC
Copyright (C) 1998-2000, Juniper Networks, Inc.
All rights reserved.
Reason string: "Program Check"
Context: Thread (PFE Manager)

Registers:
R00: 0x06f5f81c R01: 0x06f5f9cc R02: 0x00003344 R03: 0x00000000
R04: 0x00008000 R05: 0x00000000 R06: 0x0010052c R07: 0x06f637e4
R08: 0x06f5f81c R09: 0x00169810 R10: 0x000000e8 R11: 0x00000001
R12: 0x00046cdf R13: 0xffffffff R14: 0xffffffff R15: 0xffffffff
R16: 0xffffffff R17: 0xffffffff R18: 0xffffffff R19: 0xffffffff
R20: 0xffffffff R21: 0xffffffff R22: 0xffffffff R23: 0xffffffff
R24: 0x00000003 R25: 0x00000000 R26: 0x00000001 R27: 0x0000fc78
R28: 0x00150000 R29: 0x0016c4b0 R30: 0x06f5eb7c R31: 0x97cb1d36
MSR: 0x0008b030 CTR: 0x000ac008 Link:0x06f5f81c SP: 0x06f5f9cc
CCR: 0x22200024 XER: 0x20000000 PC: 0x06f5f81c
DSISR: 0x00000000 DAR: 0xffffffff K_MSR: 0x00001030
```

**Stack Traceback :**

```

Frame 01: sp = 0x06f5f9cc, pc = 0x06f5f81c
Frame 02: sp = 0x06f5f9e4, pc = 0x000c7e28
Frame 03: sp = 0x06f5fa04, pc = 0x00026620

```

```
ROM NVRAM:
```

```
0 available bytes, 0 used, 0 free
```

```
SFM3(host vty)# show syslog messages
```

```

Oct 26 12:02:05 router tnp_sfm_2 PFEMAN: sent Resync request to Master
Oct 26 12:02:07 router tnp_sfm_3 CM(3): Slot 1: On-line
Oct 26 12:02:07 router tnp_sfm_3 CM(3): Slot 2: On-line
Oct 26 12:02:07 router tnp_sfm_3 CM(3): Slot 6: On-line
Oct 26 12:02:07 router tnp_sfm_3 PFEMAN: sent Resync request to Master
Oct 26 12:05:58 router tnp_sfm_3 mpc106 machine check caused by error on the
PCI Bu
s
Oct 26 12:05:58 router tnp_sfm_3 mpc106 error detect register 1: 0x08,
2: 0x00
Oct 26 12:05:58 router tnp_sfm_3 mpc106 error ack count = 0
Oct 26 12:05:58 router tnp_sfm_3 mpc106 error address: 0x0a000000
Oct 26 12:05:58 router tnp_sfm_3 mpc106 PCI bus error status register: 0x02
Oct 26 12:05:58 router tnp_sfm_3 mpc106 was the PCI master
Oct 26 12:05:58 router tnp_sfm_3 C/BE bits: I/O read [0b0010]
Oct 26 12:05:58 router tnp_sfm_3 mpc106 error detection reg1: PCI cycle
Oct 26 12:05:58 router tnp_sfm_3 mpc106 PCI status reg: parity error
Oct 26 12:05:58 router tnp_sfm_3 ^B
Oct 26 12:05:58 router tnp_sfm_3 last message repeated 7 times
Oct 26 12:05:58 router tnp_sfm_3 Registers:
Oct 26 12:05:58 router tnp_sfm_3 R00: 0x06f5f81c R01: 0x06f5f9cc
R02: 0x00003344 R0
3: 0x00000000
Oct 26 12:05:58 router tnp_sfm_3 R04: 0x00008000 R05: 0x00000000
R06: 0x0010052c R0
7: 0x06f637e4
Oct 26 12:05:58 router tnp_sfm_3 R08: 0x06f5f81c R09: 0x00169810
R10: 0x000003b4 R1
1: 0x00000001
Oct 26 12:05:58 router tnp_sfm_3 R12: 0x00017b97 R13: 0xffffffff
R14: 0xffffffff R1
5: 0xffffffff
Oct 26 12:05:58 router tnp_sfm_3 R16: 0xffffffff R17: 0xffffffff
R18: 0xffffffff R1
9: 0xffffffff
Oct 26 12:05:58 router tnp_sfm_3 R20: 0xffffffff R21: 0xffffffff
R22: 0xffffffff R2
3: 0xffffffff
Oct 26 12:05:58 router tnp_sfm_3 R24: 0x00000003 R25: 0x00000000
R26: 0x00000001 R2
7: 0x0000fc78
Oct 26 12:05:58 router tnp_sfm_3 R28: 0x00150000 R29: 0x0016c4b0
R30: 0x06f5eb7c R3
1: 0x97c9c35e
Oct 26 12:05:58 router tnp_sfm_3 MSR: 0x0008b030 CTR: 0x000ac008
Link:0x06f5f81c SP
: 0x06f5f9cc
Oct 26 12:05:58 router tnp_sfm_3 CCR: 0x22200024 XER: 0x20000000
PC: 0x06f5f81c
Oct 26 12:05:58 router tnp_sfm_3 DSISR: 0x00000000 DAR: 0xffffffff
K_MSR: 0x0000103
0

```

**Sample Output** The following sample output is another example of displaying the crash stack traceback and registration information:

```

Sample Output root@host% vty fpc1
                  FPC160 platform (PPC 603e processor, 32Mb memory, 512Kb flash)

                  FPC1(host vty)# show nvram
                  System NVRAM :
                    4080 available bytes, 4080 used, 0 free
                    Contents:
                    00000000 R06: 0x0000005c R07: 0x850400d0
                    R08: 0x00000000 R09: 0x00000020 R10: 0x00000000 R11: 0x00000129
                    R12: 0x00000000 R13: 0x00000000 R14: 0x4005009a R15: 0x20000260
                    R16: 0xc8828784 R17: 0x84212800 R18: 0xc0004c61 R19: 0x80005900
                    R20: 0x80206000 R21: 0x84000304 R22: 0xd0410180 R23: 0x8c2005ac
                    R24: 0x00000003 R25: 0x00000000 R26: 0x00000001 R27: 0x0000fc48
                    R28: 0x001d0000 R29: 0x00000001 R30: 0x00136bb8 R31: 0x00000000
                    MSR: 0x0000b030 CTR: 0x001331e0 Link:0x000308c8 SP: 0x01baba34
                    CCR: 0x42200020 XER: 0x00000000 PC: 0x000308cc
                    DSISR: 0x00000000 DAR: 0xffffffff K_MSR: 0x00001030
Stack Traceback:
                    Frame 01: sp = 0x01baba34, pc = 0x000308c8
                    Frame 02: sp = 0x01babac4, pc = 0x0002647c
                    Frame 03: sp = 0x01babad4, pc = 0x00026590
                    Frame 04: sp = 0x01babadc, pc = 0x00106fcc
                    Frame 05: sp = 0x01babafc, pc = 0x00026620
                    ROM NVRAM:
                    0 available bytes, 0 used, 0 free

                  FPC1(host vty)# show syslog messages
                  [0+00:00:00.780 LOG: Info] Version 4.0R5 by tlim on 2000-08-10 04:45:54 UTC
                  [0+00:00:00.780 LOG: Info] On-board NVRAM contains diagnostic information.
                  [0+00:00:03.175 LOG: Info] PFEMAN: Established connection to Master
                  [Jan 30 21:53:05.804 LOG: Info] SNTPD: Initial time of day set.

```

**Meaning** Sample output 1 and 2 show the stack trace from the microkernel crash. Save the output from the `show nvram` and `show syslog` commands so that you can send them to JTAC when you open a case.

## Clear the NVRAM Contents

**Purpose** Currently the storage area for the logs on the NVRAM is limited to 4 KB. You need to delete old NVRAM logs to make room for new ones.

**Action** To clear the content of the NVRAM after you have captured the necessary information, follow these steps:

1. Exit from the CLI environment and create a UNIX-level shell by entering the `start shell` command:

```
user@host> start shell
```

2. Type `su` and the root password when prompted. You are now in the shell and the prompt is `%` instead of `>`, for example:

```
% su
Password: ****
```

3. Establish a vty session to the appropriate component. Use the **vtty** command followed by the abbreviation for the component, for example:

```
root@host% vtty sfm0
SFM3(host vty)#
FPC1(host vty)#
```

4. Type the **clear nvram** command, for example:

```
SFM3(host vty)# clear nvram
FPC1(host vty)# clear nvram
```

### Check Packet Forwarding Engine Microkernel Core Files

**Purpose** If you observe disruption to the Packet Forwarding Engine microkernel, check the **/var/crash** directory for any core files created around the time of the crash.

**Action** To check the **/var/crash** directory, use the following JUNOS CLI operational mode command:

```
user@host> file list detail /var/crash
```

**Sample Output**

```
user@host> file list detail /var/crash
var/crash:
total 456630
-rw-r--r--  1 root  wheel   6814720 Dec 18 08:03 core-FPC4.100111808032
-rw-r--r--  1 root  wheel   65613824 Dec 10 04:58 core-SCB.100111004570
-rw-r--r--  1 root  wheel   65613824 Dec 19 00:23 core-SCB.100111900221
-rw-r--r--  1 root  wheel   65545216 Feb  9 20:46 core-SCB.101010920452
```

**Meaning** The sample output lists the contents of the **/var/crash/** directory. Check the date and timestamp for any core files created around the time of the crash. In the example above, four core files are listed.

### List the Core Files Generated by the Crash

**Purpose** To list the core files generated by the crash.

**Action** To list the core files, follow these steps:

1. Exit from the CLI environment and create a UNIX-level shell by entering the **start shell** command:

```
user@host> start shell
```

2. Type **su** and the root password when prompted. You are now in the shell and the prompt is **%** instead of **>**, for example:

```
% su
Password: ****
```

3. Change the directory to **/var/crash** and type **ls -l**, for example:

```
root@host% cd /var/crash
```

```
root@host% ls -l
```

4. Look for any core files created around the time of the crash.

**Sample Output**

```
user@host> start shell
% su
Password: ****
root@host% cd /var/crash
root@host% ls -l
total 456630
-rw-r--r--  1 root  wheel   6814720 Dec 18 08:03 core-FPC4.100111808032
-rw-r--r--  1 root  wheel   65613824 Dec 10 04:58 core-SCB.100111004570
-rw-r--r--  1 root  wheel   65613824 Dec 19 00:23 core-SCB.100111900221
-rw-r--r--  1 root  wheel   65545216 Feb  9 20:46 core-SCB.101010920452
```

**Meaning** The sample output shows the current core files for the different components on the router; for example, `core-FPC4.100111808032` and `core-SCB.100111004570`.

## Compress the Core Files

**Purpose** `gzip` is a compression utility used to compress the core files. Files created using the `gzip` command end with the file extension `.gz`. Compress the core files if they are larger than 50 MB.

**Action** To compress the core files with `gzip`, use the following command from the shell:

```
root@host% gzip filename
```

**Sample Output**

```
root@host% gzip core-SCB.101010920452
```

**Meaning** The contents of the core file are compressed into a single compressed file named `core-SCB.10101092045.gz`. The `gzip` command preserves the mode, ownership, and timestamps of files when compressing or decompressing them.

## Log Software Version Information

**Purpose** To log the JUNOS software version information.

**Action** To log the JUNOS software version information, use the following JUNOS CLI operational mode command:

```
user@host> show version
```

**Sample Output**

```
user@host> show version
Hostname: host
Model: m10
JUNOS Base OS boot [5.0R5]
JUNOS Base OS Software Suite [5.0R5]
JUNOS Kernel Software Suite [5.0R5]
JUNOS Routing Software Suite [5.0R5]
JUNOS Packet Forwarding Engine Support [5.0R5]
JUNOS Crypto Software Suite [5.0R5]
JUNOS Online Documentation [5.0R5]
KERNEL 5.0R5 #0 built by builder on 2002-03-02 05:10:28 UTC
```

```

MGD release 5.0R5 built by builder on 2002-03-02 04:45:32 UTC
CLI release 5.0R5 built by builder on 2002-03-02 04:44:22 UTC
CHASSISD release 5.0R5 built by builder on 2002-03-02 04:43:37 UTC
DCD release 5.0R5 built by builder on 2002-03-02 04:42:47 UTC
RPD release 5.0R5 built by builder on 2002-03-02 04:46:17 UTC
SNMPD release 5.0R5 built by builder on 2002-03-02 04:52:26 UTC
MIB2D release 5.0R5 built by builder on 2002-03-02 04:45:37 UTC
APSD release 5.0R5 built by builder on 2002-03-02 04:43:31 UTC
VRRPD release 5.0R5 built by builder on 2002-03-02 04:52:34 UTC
ALARM release 5.0R5 built by builder on 2002-03-02 04:43:24 UTC
PFED release 5.0R5 built by builder on 2002-03-02 04:46:06 UTC
CRAFTD release 5.0R5 built by builder on 2002-03-02 04:44:30 UTC
SAMPLED release 5.0R5 built by builder on 2002-03-02 04:52:20 UTC
ILMID release 5.0R5 built by builder on 2002-03-02 04:45:21 UTC
BPRELAYD release 5.0R5 built by builder on 2002-03-02 04:42:41 UTC
RMOPD release 5.0R5 built by builder on 2002-03-02 04:46:11 UTC
jkernel-dd release 5.0R5 built by builder on 2002-03-02 04:41:07 UTC
jroute-dd release 5.0R5 built by builder on 2002-03-02 04:41:21 UTC
jdocs-dd release 5.0R5 built by builder on 2002-03-02 04:39:11 UTC

```

**Meaning** The sample output shows the hostname, router model, and the different JUNOS software packages, processes, and documents.

## Open a Case with JTAC

**Problem** To open a case with JTAC, follow these steps:

- Solution**
1. Send an e-mail to [support@juniper.net](mailto:support@juniper.net), and include the information from the `show version` command.
  2. At the support engineer's request, ftp the `vmcore.number.gz` file to a case-number directory at [ftp.juniper.net](ftp://ftp.juniper.net). To ftp the core file to a directory, follow these steps:
    - a. At the shell prompt, enter `ftp ftp.juniper.net`.
    - b. At the name prompt, enter `anonymous`.
    - c. At the password prompt, enter your e-mail address as the password.
    - d. At the ftp prompt, enter the `cd pub/ incoming` string.
    - e. Enter the `mkdir case-number` command, where the *case-number* is the value of the case you opened with JTAC, for example, `1999-1231-9999`. If a directory has already been created, continue with the next step.
    - f. Enter the `cd case-number` command.
    - g. Enter the `binary` command so that the file transfer is in binary and not ASCII.
    - h. Enter the `put vmcore.O.gz` command.

**Meaning** The following output is an example of copying a core file from the shell to an ftp directory at [ftp.juniper.net](ftp://ftp.juniper.net):

**Sample Output**

```

root@host% ftp ftp.juniper.net
Connected to colo-ftp.juniper.net.
220 colo-ftp.juniper.net FTP server (Version 6.00LS) ready.

```



```
Name (ftp.juniper.net: root): anonymous
331 Guest login ok, send your email address as password.
Password: ****
230 Guest login ok, access restrictions apply.
ftp> cd pub/ incoming
250 CWD command successful
ftp> mkdir 1999-1231-9999
257 MKD command successful.
ftp> cd 1999-1231-9999
250 CWD command successful.
ftp> bin
200 Type set to I.
ftp> put vmcore.0.gz
```

**Meaning** The sample output shows that there is a connection to **ftp.juniper.net**, that the login name and password were entered, and that the core file was successfully copied from the shell to an ftp directory at **ftp.juniper.net**.



## **Part 7**

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