



JUNOS® Software

System Basics Configuration Guide

Release 9.6

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Overview

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About This Guide

This preface provides the following guidelines for using the *JUNOS® Software System Basics Configuration Guide*:

- JUNOS Documentation and Release Notes on page xliii
- Objectives on page xlv
- Audience on page xlv
- Supported Platforms on page xlv
- Using the Indexes on page xlv
- Using the Examples in This Manual on page xlv
- Documentation Conventions on page xlv
- Documentation Feedback on page xlviii
- Requesting Technical Support on page xlix

JUNOS Documentation and Release Notes

For a list of related JUNOS documentation, see <http://www.juniper.net/techpubs/software/junos/>.

If the information in the latest release notes differs from the information in the documentation, follow the *JUNOS Software Release Notes*.

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

Juniper Networks supports a technical book program to publish books by Juniper Networks engineers and subject matter experts with book publishers around the world. These books go beyond the technical documentation to explore the nuances of network architecture, deployment, and administration using JUNOS Software and Juniper Networks devices. In addition, the Juniper Networks Technical Library, published in conjunction with O'Reilly Media, explores improving network security, reliability, and availability using JUNOS configuration techniques. All the books are for sale at technical bookstores and book outlets around the world. The current list can be viewed at <http://www.juniper.net/books>.

Objectives

This guide describes Juniper Networks routers, 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.



NOTE: For additional information about JUNOS Software—either corrections to or information that might have been omitted from this guide—see the software release notes at <http://www.juniper.net/>.

Audience

This guide is designed for network administrators who are configuring and monitoring a Juniper Networks M Series, MX Series, T Series, EX Series, or J Series router or switch.

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

Personnel operating the equipment must be trained and competent; must not conduct themselves in a careless, willfully negligent, or hostile manner; and must abide by the instructions provided by the documentation.

Supported Platforms

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

- J Series
- M Series

- MX Series
- T Series
- EX Series

Using the Indexes

This reference contains two indexes: a standard index with topic entries, and an index of commands.

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.xml; }
```

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 xlvii defines notice icons used in this guide.

Table 1: Notice Icons





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

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

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the <code>configure</code> command: user@host> configure
Fixed-width text like this	Represents output that appears on the terminal screen.	user@host> show chassis alarms No alarms currently active
<i>Italic text like this</i>	<ul style="list-style-type: none"> Introduces important new terms. Identifies book names. Identifies RFC and Internet draft titles. 	<ul style="list-style-type: none"> A policy <i>term</i> is a named structure that defines match conditions and actions. <i>JUNOS System Basics Configuration Guide</i> RFC 1997, <i>BGP Communities Attribute</i>
<i>Italic text like this</i>	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# set system domain-name <i>domain-name</i>
Plain text like this	Represents names of configuration statements, commands, files, and directories; IP addresses; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none"> To configure a stub area, include the stub statement at the [edit protocols ospf area area-id] hierarchy level. The console port is labeled CONSOLE.
< > (angle brackets)	Enclose optional keywords or variables.	stub <default-metric <i>metric</i> >;

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

Convention	Description	Examples
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	broadcast multicast (string1 string2 string3)
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	rsvp { # Required for dynamic MPLS only
[] (square brackets)	Enclose a variable for which you can substitute one or more values.	community name members [community-ids]
Indentation and braces ({ })	Identify a level in the configuration hierarchy.	[edit] routing-options { static { route default { nexthop address; retain; } } }
;(semicolon)	Identifies a leaf statement at a configuration hierarchy level.	
J-Web GUI Conventions		
Bold text like this	Represents J-Web graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none">■ In the Logical Interfaces box, select All Interfaces.■ To cancel the configuration, click Cancel.
> (bold right angle bracket)	Separates levels in a hierarchy of J-Web selections.	In the configuration editor hierarchy, select Protocols > Ospf .

Documentation Feedback

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

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

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or JNASC support contract, or are covered under warranty, and need postsales 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, visit us at <http://www.juniper.net/support/requesting-support.html>.

Part 1

Overview

- Introduction to JUNOS Software on page 3
- JUNOS Configuration Basics on page 17

Chapter 1

Introduction to JUNOS Software

- JUNOS Software Overview on page 3
- JUNOS Software Architecture Overview on page 4
- Router Hardware Components on page 7
- JUNOS Software Commit Model for Router Configuration on page 8
- JUNOS Software Routing Engine Components and Processes on page 9
- JUNOS Software Support for IPv4 Routing Protocols on page 11
- JUNOS Software Support for IPv6 Routing Protocols on page 13
- JUNOS Software Routing and Forwarding Tables on page 13
- Routing Policy Overview on page 14
- JUNOS Software Support for VPNs on page 15

JUNOS Software Overview

Juniper Networks provides high-performance network routers that create a responsive and trusted environment for accelerating the deployment of services and applications over a single network. JUNOS Software is the foundation of these high-performance networks. Unlike other complex, monolithic software architectures, JUNOS Software incorporates key design and developmental differences to deliver increased network availability, operational efficiency, and flexibility. These key advantages are:

- One operating system
- One software release
- One modular software architecture

One Operating System

Unlike other network operating systems that share a common name but splinter into many different programs, JUNOS Software is a single, cohesive operating system that is shared across all routers and product lines. This enables Juniper Network engineers to develop software features once and share the features across all product lines simultaneously. Because features are common to a single source, generally these features are implemented the same way for all the product lines, thus reducing the training required to learn different tools and methods for each product. Furthermore, because all Juniper Networks products use the same code base, interoperability among products is not an issue.

One Software Release

Each new version of JUNOS Software is released concurrently for all product lines following a preset quarterly schedule. Each new version of software must include all working features released in previous releases of the software and must achieve zero critical regression errors. This discipline ensures reliable operations for the entire release.

One Modular Software Architecture

Although individual modules of the JUNOS Software communicate through well-defined interfaces, each module runs in its own protected memory space, preventing one module from disrupting another. It also enables the independent restart of each module as necessary. This is in contrast to monolithic operating systems for which a malfunction in one module can ripple to others and cause a full system crash or restart. This modular architecture then provides for a high level of performance, high availability, security, and device scalability not found in other operating systems.

The JUNOS Software is preinstalled on your Juniper Networks router when you receive it from the factory. Thus, when you first power on the router, all software starts automatically. You simply need to configure the software so that the router can participate in the network.

You can upgrade the router software as new features are added or software problems are fixed. You normally obtain new software by downloading the images from the Juniper Networks Support Web page onto your router or onto another system on your local network. Then you install the software upgrade onto the router.

Juniper Networks routers run only binaries supplied by Juniper Networks. Each JUNOS Software image includes a digitally signed manifest of executables, which are registered with the system only if the signature can be validated. JUNOS Software will not execute any binary without a registered fingerprint. This feature protects the system against unauthorized software and activity that might compromise the integrity of your router.

Related Topics ■ JUNOS Software Architecture Overview on page 4

JUNOS Software Architecture Overview

This topic provides an overview of the JUNOS Software product and routing process architecture:

- Product Architecture on page 4
- Routing Process Architecture on page 5

Product Architecture

The JUNOS Software provides IP routing protocol software as well as software for interface, network, and chassis management. The JUNOS Software runs on all Juniper Networks J Series, M Series, MX Series, and T Series routers.

- J Series Services Routers (J2300, J4300, and J6300) are deployed at the remote edge of distributed networks.
- Most M Series routers are deployed in small and medium cores in peering, route reflector, data center applications; or at the IP or Multiprotocol Label Switching (MPLS) edge to support high-performance Layer 2 and Layer 3 services. All M Series routers have redundant power and cooling and the M10i, M20, M40e, M120, M160, and M320 routers have fully redundant hardware, including Routing Engines, switch interface components, and packet forwarding components. The M120 router also supports Forwarding Engine Board (FEB) failover. In the event of a FEB failure, a backup FEB can quickly take over packet forwarding.
- The MX Series Ethernet Services Routers are Ethernet-optimized edge routers that provide both switching and carrier-class Ethernet routing. The MX Series routers support two types of Dense Port Concentrators (DPCs) with built-in Ethernet ports: Gigabit Ethernet 40-port and 10-Gigabit Ethernet 4-port.
- T Series routers (T320, T640, T1600, TX Matrix, and TX Matrix Plus routers) are deployed at the core of provider networks. These routers have fully redundant hardware, including power and cooling, Routing Engines, and Switch Interface Boards.

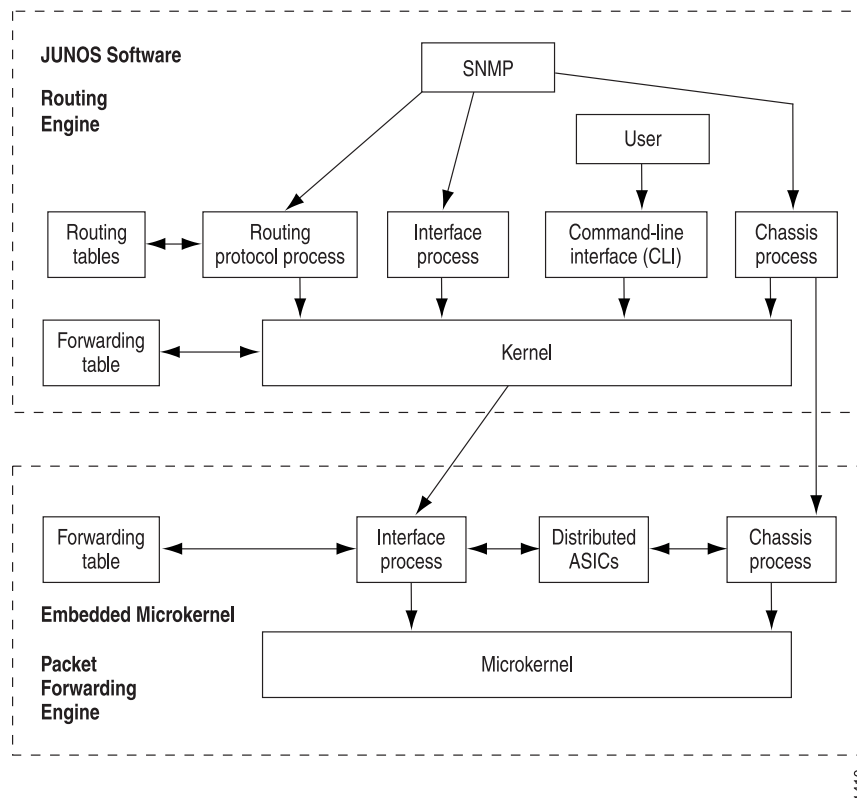
A *routing matrix* is a multichassis architecture composed of either one TX Matrix router and from one to four T640 routers connected to the TX Matrix router, or one TX Matrix Plus router and from one to four T1600 routers connected to the TX Matrix Plus router. From the perspective of the user interface, the routing matrix appears as a single router. On a routing matrix composed of a TX Matrix router and T640 routers, the TX Matrix router controls all the T640 routers. On a routing matrix composed of a TX Matrix Plus router and T1600 routers, the TX Matrix Plus router controls all the T1600 routers.

Routing Process Architecture

The routing process is handled by the following two components (see Figure 1 on page 6):

- Routing Engine
- Packet Forwarding Engine

Because this architecture separates control operations such as routing updates and system management from packet forwarding, the router can deliver superior performance and highly reliable Internet operation.

Figure 1: Product Architecture

Packet Forwarding Engine

The Packet Forwarding Engine uses application-specific integrated circuits (ASICs) to perform Layer 2 and Layer 3 packet switching, route lookups, and packet forwarding. The Packet Forwarding Engine forwards packets between input and output interfaces. The M Series routers (except the M7i, M40, and M320 routers) have redundant Packet Forwarding Engines. The J Series Services Routers have a software-based Packet Forwarding Engine.

Routing Engine

The Routing Engine controls the routing updates and system management. The Routing Engine consists of routing protocol software processes running inside a protected memory environment on a general-purpose computer platform. The Routing Engine handles all the routing protocol processes and other software processes that control the routers' interfaces, some of the chassis components, system management, and user access to the router. These routers and software processes run on top of a kernel that interacts with the Packet Forwarding Engine. All M Series (except the M7i and M40) routers and T Series routers have redundant Routing Engines.

The Routing Engine has these features:

- Routing protocol packets processing—All routing protocol packets from the network are directed to the Routing Engine, and therefore do not delay the Packet Forwarding Engine unnecessarily.
- Software modularity—Software functions have been divided into separate processes, so a failure of one process has little or no effect on other software processes.
- In-depth IP functionality—Each routing protocol is implemented with a complete set of IP features and provides full flexibility for advertising, filtering, and modifying routes. Routing policies are set according to route parameters, such as prefix, prefix lengths, and Border Gateway Protocol (BGP) attributes.
- Scalability—The JUNOS routing tables are designed to hold all the routes used in current and near-future networks. Additionally, the JUNOS Software can efficiently support large numbers of interfaces and virtual circuits.
- Management interfaces—System management is possible with a command-line interface (CLI), a craft interface, and Simple Network Management Protocol (SNMP).
- Storage and change management—Configuration files, system images, and microcode can be held and maintained in one primary and two secondary storage systems, permitting local or remote upgrades.
- Monitoring efficiency and flexibility—Alarms can be generated and packets can be counted without adversely affecting packet forwarding performance.

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 forwarding table in the Packet Forwarding Engine can be updated without interrupting the router's forwarding.

In a JUNOS-FIPS environment, hardware configurations with two Routing Engines must use IPsec and a private routing instance for all communications between the Routing Engines. IPsec communication between the Routing Engines and Adaptive Services (AS) II FIPS PICs is also required.

Related Topics ■ JUNOS Software Overview on page 3

Router Hardware Components

The JUNOS Software runs on four types of Juniper Networks routers: J Series, M Series, MX Series, and T Series. The routers consist of the major hardware components as shown in Table 3 on page 7. One or more of the major hardware components shown is used in each system.

Table 3: Major Router Hardware Components

	M Series	MX Series	T Series	J Series
Routing Engines (RE)	X	X	X	X

Table 3: Major Router Hardware Components *(continued)*

	M Series	MX Series	T Series	J Series
Control Board	X		X	
Switch Interface Board (SIB)	X		X	
Forwarding Engine Board (FEB)	X			
Power Supply	X	X	X	X
Cooling System	X	X	X	X
Dense Port Concentrators (DPC)		X		
Switch Control Board (SCB)		X		
Flexible PIC Concentrators (FPC)	X		X	
Physical Interface Module (PIM)				X
Physical Interface Card (PIC)	X		X	

Flexible PIC Concentrators (FPCs) are each populated by PICs for various interface types. On some routers, the PICs are installed directly in the chassis.

For information about specific components in your router, see the hardware guide for your router.

Related Topics ■ JUNOS Software Architecture Overview on page 4

JUNOS Software Commit Model for Router Configuration

The router configuration is saved using a commit model: a candidate configuration is modified as desired and then committed to the system. Once committed, the router checks the configuration for syntax errors and if no errors are found, the configuration is saved as `juniper.conf.gz` and activated. The former active configuration file is saved as the first rollback configuration file (`juniper.conf.1.gz`) and all other rollback configuration files are incremented by 1. For example, `juniper.conf.1.gz` is incremented to `juniper.conf.2.gz`, making it the second rollback configuration file. The router can have a maximum of 49 rollback configurations (1–49) saved on the system.

On the router, the active configuration file and the first three rollback files (`juniper.conf.gz.1`, `juniper.conf.gz.2`, `juniper.conf.gz.3`) are located in the `/config` directory. If the recommended rescue file `rescue.conf.gz` is saved on the system, this file should also be saved in the `/config` directory. The factory default files are located in the `/etc/config` directory.

There are two mechanisms used to propagate the configurations between Routing Engines within a router:

- Synchronization—Propagates a configuration from one Routing Engine to a second Routing Engine within the same router chassis.

To synchronize a router's configurations, use the **commit synchronize** CLI command. If one of the Routing Engines is locked, the synchronization fails. If synchronization fails because of a locked configuration file, you can use the **commit synchronize force** command. This command overrides the lock and synchronizes the configuration files.

- Distribution—Propagates a configuration across the routing plane on a multichassis router. Distribution occurs automatically. There is no user command available to control the distribution process. If a configuration is locked during a distribution of a configuration, the locked configuration does not receive the distributed configuration file, so the synchronization fails. You need to clear the lock before the configuration and resynchronize the routing planes.



NOTE: When you use the **commit synchronize force** CLI command on a multichassis platform, the forced synchronization of the configuration files does not affect the distribution of the configuration file across the routing plane. If a configuration file is locked on a router remote from the router where the command was issued, the synchronization fails on the remote router. You need to clear the lock and reissue the **synchronize** command.

JUNOS Software Routing Engine Components and Processes

The JUNOS system software runs on the Routing Engine. The JUNOS system software consists of software processes that support Internet routing protocols, control router interfaces and the router chassis, and enable router system management. The JUNOS Software processes run on top of a kernel, which enables communication between processes and provides a direct link to the Packet Forwarding Engine software. The JUNOS Software can be used to configure routing protocols and router interface properties, as well as to monitor and troubleshoot protocol and network connectivity problems.

The Routing Engine software consists of several software processes that control router functionality and a kernel that provides the communication among all the processes:

Routing Engine Kernel

The Routing Engine kernel provides the underlying infrastructure for all JUNOS Software processes. In addition, it provides the link between the routing tables and the Routing Engine's forwarding table. It is also responsible for all communication with the Packet Forwarding Engine, which includes keeping the Packet Forwarding Engine's copy of the forwarding table synchronized with the master copy in the Routing Engine.

Initialization Process

Within the JUNOS Software, an initialization process (init) starts and monitors all the other software processes when the router boots.

If a software process terminates or fails to start when called, the init process attempts to restart it a limited number of times and logs any failure information for further investigation.

Management Process

The management process (mgd) manages the configuration of the router and all user commands. The management process is responsible for notifying other daemons when a new configuration is committed. A dedicated management process handles JUNOScript XML requests from its client, which may be the command-line interface (CLI) or any JUNOScript client.

Process Limits

There are limits to the total number of JUNOS Software processes that can run simultaneously on a system. There are also limits set for the maximum number iterations of any single process. The limit for iterations of any single process can only be reached if the limit of overall system processes is not exceeded.

There are limits to the total number of JUNOS Software processes that can run simultaneously on a system. There are also limits set for the maximum number iterations of any single process. The limit for iterations of any single process can only be reached if the limit of overall system processes is not exceeded.

Access methods such as telnet and SSH spawn multiple system processes for each session created. For this reason, it might not be possible to simultaneously support the maximum number of access sessions for multiple services.

Routing Protocol Process

Within the JUNOS Software, the routing protocol process (rpd) controls the routing protocols that run on the router. This process starts all configured routing protocols and handles all routing messages. It maintains one or more routing tables, which consolidate the routing information learned from all routing protocols. From this routing information, the routing protocol process determines the active routes to network destinations and installs these routes into the Routing Engine's forwarding table. Finally, it implements routing policy, which enables you to control the routing information that is transferred between the routing protocols and the routing table. Using routing policy, you can filter and limit the transfer of information as well as set properties associated with specific routes.

Interface Process

The JUNOS interface process enables you to configure and control the physical interface devices and logical interfaces present in a router. You can configure interface

properties such as the interface location (which slot the Flexible PIC Concentrator [FPC] is installed in and which location on the FPC the Physical Interface Card [PIC] is installed in), the interface encapsulation, and interface-specific properties. You can configure the interfaces currently present in the router, as well as interfaces that are not present but that you might add later.

The JUNOS interface process communicates through the JUNOS kernel with the interface process in the Packet Forwarding Engine, enabling the JUNOS Software to track the status and condition of the router's interfaces.

Chassis Process

The JUNOS chassis process enables you to configure and control the properties of the router, including conditions that trigger alarms. The chassis process (chassisd) on the Routing Engine communicates directly with its peer processes running on the Packet Forwarding Engine.

SNMP and MIB II Processes

The JUNOS Software supports the Simple Network Management Protocol (SNMP), which helps administrators monitor the state of a router. The software supports SNMP version 1 (SNMPv1), version 2 (SNMPv2, also known as version 2c, or v2c), and version 3 (SNMPv3). The JUNOS implementation of SNMP does not include any of the security features that were originally included in the IETF SNMP drafts but were later dropped. The SNMP software is controlled by the JUNOS SNMP and Management Information Base II (MIB II) processes, which consist of an SNMP master agent and various subagents.

Related Topics ■ JUNOS Software Architecture Overview on page 4

JUNOS Software Support for IPv4 Routing Protocols

JUNOS system software implements full IP routing functionality, providing support for IP version 4 (IPv4). The routing protocols are fully interoperable with existing IP routing protocols, and they have been developed to provide the scale and control necessary for the Internet core.

JUNOS Software provides the following routing and Multiprotocol Label Switching (MPLS) applications protocols:

- Unicast routing protocols:
 - BGP—Border Gateway Protocol, version 4, is an exterior gateway protocol (EGP) that guarantees loop-free exchange of routing information between routing domains (also called autonomous systems). BGP, in conjunction with JUNOS routing policy, provides a system of administrative checks and balances that can be used to implement peering and transit agreements.
 - ICMP—Internet Control Message Protocol router discovery enables hosts to discover the addresses of operational routers on the subnet.
 - IS-IS—Intermediate System-to-Intermediate System is a link-state interior gateway protocol (IGP) for IP networks that uses the shortest-path-first (SPF)

algorithm, which also is referred to as the Dijkstra algorithm, to determine routes. The JUNOS IS-IS software is a new and complete implementation of the protocol, addressing issues of scale, convergence, and resilience.

- OSPF—Open Shortest Path First, version 2, is an IGP that was developed for IP networks by the Internet Engineering Task Force (IETF). OSPF is a link-state protocol that makes routing decisions based on the SPF algorithm. The JUNOS OSPF software is a new and complete implementation of the protocol, addressing issues of scale, convergence, and resilience.
- RIP—Routing Information Protocol, version 2, is an IGP for IP networks based on the Bellman-Ford algorithm. RIP is a distance-vector protocol. RIP dynamically routes packets between a subscriber and a service provider without the subscriber having to configure BGP or participate in the service provider's IGP discovery process.
- Multicast routing protocols:
 - DVMRP—Distance Vector Multicast Routing Protocol is a dense-mode (flood-and-prune) multicast routing protocol.
 - IGMP—Internet Group Management Protocol, versions 1 and 2, is used to manage membership in multicast groups.
 - MSDP—Multicast Source Discovery Protocol enables multiple Protocol Independent Multicast (PIM) sparse mode domains to be joined. A rendezvous point (RP) in a PIM sparse mode domain has a peer relationship with an RP in another domain, enabling it to discover multicast sources from other domains.
 - PIM sparse mode and dense mode—Protocol-Independent Multicast is a multicast routing protocol. PIM sparse mode routes to multicast groups that might span wide-area and interdomain internets. PIM dense mode is a flood-and-prune protocol.
 - SAP/SDP—Session Announcement Protocol and Session Description Protocol handle conference session announcements.
- MPLS applications protocols:
 - LDP—The Label Distribution Protocol provides a mechanism for distributing labels in nontraffic-engineered applications. LDP enables routers to establish label-switched paths (LSPs) through a network by mapping network-layer routing information directly to data-link layer switched paths. LSPs created by LDP can also traverse LSPs created by the Resource Reservation Protocol (RSVP).
 - MPLS—Multiprotocol Label Switching, formerly known as tag switching, enables you to manually or dynamically configure LSPs through a network. It lets you direct traffic through particular paths rather than rely on the IGP's least-cost algorithm to choose a path.
 - RSVP—The Resource Reservation Protocol, version 1, provides a mechanism for engineering network traffic patterns that is independent of the shortest path decided upon by a routing protocol. RSVP itself is not a routing protocol; it operates with current and future unicast and multicast routing protocols.

The primary purpose of the JUNOS RSVP software is to support dynamic signaling for MPLS LSPs.

JUNOS Software Support for IPv6 Routing Protocols

The JUNOS Software implements IP routing functionality, providing support for IP version 6 (IPv6). The routing protocols have been developed to provide the scale and control necessary for the Internet core.

The software supports the following unicast routing protocols:

- BGP—Border Gateway Protocol version 4, is an EGP that guarantees loop-free exchange of routing information between routing domains (also called autonomous systems). BGP, in conjunction with JUNOS routing policies, provides a system of administrative checks and balances that can be used to implement peering and transit agreements.
- ICMP—Internet Control Message Protocol router discovery enables hosts to discover the addresses of operational routers on the subnet.
- IS-IS—Intermediate System-to-Intermediate System is a link-state IGP for IP networks that uses the SPF algorithm, which also is referred to as the Dijkstra algorithm, to determine routes. The JUNOS Software supports a new and complete implementation of the protocol, addressing issues of scale, convergence, and resilience.
- OSPF version 3 (OSPFv3) supports IPv6. The fundamental mechanisms of OSPF such as flooding, designated router (DR) election, area-based topologies, and the SPF calculations remain unchanged. Some differences exist either because of changes in protocol semantics between IPv4 and IPv6, or because of the need to handle the increased address size of IPv6.
- RIP—Routing Information Protocol version 2 is an IGP for IP networks based on the Bellman-Ford algorithm. RIP is a distance-vector protocol. RIP dynamically routes packets between a subscriber and a service provider without the subscriber having to configure BGP or to participate in the service provider's IGP discovery process.

JUNOS Software Routing and Forwarding Tables

A major function of the JUNOS routing protocol process is to maintain the Routing Engine's routing tables and from these tables determine the active routes to network destinations. The routing protocol process then installs these routes into the Routing Engine's forwarding table. The JUNOS kernel then copies this forwarding table to the Packet Forwarding Engine.

The routing protocol process maintains multiple routing tables. By default, it maintains the following three routing tables. You can configure additional routing tables to suit your requirements.

- Unicast routing table—Stores routing information for all unicast routing protocols running on the router. BGP, IS-IS, OSPF, and RIP all store their routing information in this routing table. You can configure additional routes, such as static routes,

to be included in this routing table. BGP, IS-IS, OSPF, and RIP use the routes in this routing table when advertising routing information to their neighbors.

- Multicast routing table (cache)—Stores routing information for all the running multicast protocols. DVMRP and PIM both store their routing information in this routing table, and you can configure additional routes to be included in this routing table.
- MPLS routing table—Stores MPLS path and label information.

With each routing table, the routing protocol process uses the collected routing information to determine active routes to network destinations.

For unicast routes, the routing protocol process determines active routes by choosing the most preferred route, which is the route with the lowest preference value. By default, the route's preference value is simply a function of how the routing protocol process learned about the route. You can modify the default preference value using routing policy and with software configuration parameters.

For multicast traffic, the routing protocol process determines active routes based on traffic flow and other parameters specified by the multicast routing protocol algorithms. The routing protocol process then installs one or more active routes to each network destination into the Routing Engine's forwarding table.

Related Topics ■ Routing Policy Overview on page 14

Routing Policy Overview

By default, all routing protocols place their routes into the routing table. When advertising routes, the routing protocols by default advertise only a limited set of routes from the routing table. Specifically, each routing protocol exports only the active routes that were learned by that protocol. In addition, the interior gateway protocols (IS-IS, OSPF, and RIP) export the direct (interface) routes for the interfaces on which they are explicitly configured.

You can control the routes that a protocol places into each table and the routes from that table that the protocol advertises. You do this by defining one or more routing policies and then applying them to the specific routing protocol.

Routing policies applied when the routing protocol places routes into the routing table are referred to as *import policies* because the routes are being imported into the routing table. Policies applied when the routing protocol is advertising routes that are in the routing table are referred to as *export policies* because the routes are being exported from the routing table. In other words, the terms *import* and *export* are used with respect to the routing table.

A routing policy enables you to control (filter) which routes a routing protocol imports into the routing table and which routes a routing protocol exports from the routing table. A routing policy also enables you to set the information associated with a route as it is being imported into or exported from the routing table. Filtering imported routes enables you to control the routes used to determine active routes. Filtering routes being exported from the routing table enables you to control the routes that a protocol advertises to its neighbors.

You implement routing policy by defining policies. A policy specifies the conditions to use to match a route and the action to perform on the route when a match occurs. For example, when a routing table imports routing information from a routing protocol, a routing policy might modify the route's preference, mark the route with a color to identify it and allow it to be manipulated later, or prevent the route from even being installed in a routing table. When a routing table exports routes into a routing protocol, a policy might assign metric values, modify the BGP community information, tag the route with additional information, or prevent the route from being exported altogether. You also can define policies for redistributing the routes learned from one protocol into another protocol.

- Related Topics**
- JUNOS Software Support for IPv4 Routing Protocols on page 11
 - JUNOS Software Support for IPv6 Routing Protocols on page 13

JUNOS Software Support for VPNs

The JUNOS Software supports several types of virtual private networks (VPNs):

- **Layer 2 VPNs**—A Layer 2 VPN links a set of sites that share routing information, and whose connectivity is controlled by a collection of policies. A Layer 2 VPN is not aware of routes within a customer's network. It simply provides private links between a customer's sites over the service provider's existing public Internet backbone.
- **Layer 3 VPNs**—A Layer 3 VPN is the same thing as a Layer 2 VPN, but it is aware of routes within a customer's network, requiring more configuration on the part of the service provider than a Layer 2 VPN. The sites that make up a Layer 3 VPN are connected over a service provider's existing public Internet backbone.
- **Interprovider VPNs**—An interprovider VPN supplies connectivity between two VPNs in separate autonomous systems (ASs). This functionality can be used by a VPN customer with connections to several Internet service providers (ISPs), or different connections to the same ISP in various geographic regions.
- **Carrier-of-carrier VPNs**—Carrier-of-carrier VPNs allow a VPN service provider to supply VPN service to a customer who is also a service provider. The latter service provider supplies Internet or VPN service to an end customer.

Chapter 2

JUNOS Configuration Basics

This chapter covers the following topics:

- JUNOS Software Configuration Basics on page 17
- JUNOS Software Configuration from External Devices on page 17
- Methods for Configuring the JUNOS Software on page 18
- Configuring a Router for the First Time on page 21
- JUNOS Software Tools for Monitoring the Router on page 31
- JUNOS Software Features for Router Security on page 31

JUNOS Software Configuration Basics

Your router comes with JUNOS Software installed on it. When you power on the router, all software starts automatically. You simply need to configure the software so that the router will be ready to participate in the network.

To configure the JUNOS Software, you must specify a hierarchy of configuration statements that define the preferred software properties. You can configure all properties of the JUNOS Software, including interfaces, general routing information, routing protocols, and user access, as well as some system hardware properties. After you have created a candidate configuration, you commit the configuration to be evaluated and activated by the JUNOS Software.

JUNOS Software Configuration from External Devices

You can configure the router from a system console connected to the router's console port or by using Telnet to access the router remotely. The router provides three ports on the craft interface for connecting external management devices to the Routing Engine and the JUNOS Software:

- Console port—Connects a system console using an RS-232 serial cable.
- Auxiliary port—Connects a laptop or modem using an RS-232 serial cable.
- Ethernet management port—Connects the Routing Engine to a management LAN (or any other device that plugs into an Ethernet connection) for remote management through a PC or other client device. The Ethernet port is 10/100 megabits per second (Mbps) autosensing and requires an RJ-45 connector.

Related Topics ■ Methods for Configuring the JUNOS Software on page 18

Methods for Configuring the JUNOS Software

You can use any of the methods shown in Table 4 on page 18 to configure JUNOS system software:

Table 4: Methods for Configuring JUNOS Software

Method	Description
Command-line interface (CLI)	Create the configuration for the router using the CLI. You can enter commands from a single command line, and scroll through recently executed commands.
ASCII file	Load an ASCII file containing a router configuration that you created earlier, either on this system or on another system. You can then activate and run the configuration file, or you can edit it using the CLI and then activate it.
J-Web graphical user interface (GUI)	Use the J-Web graphical user interface (GUI) to configure the router. J-Web enables you to monitor, configure, troubleshoot, and manage the router on a client by means of a Web browser. The J-Web GUI is preinstalled on J Series Services Routers and is an optional software package that can be installed on M Series and T Series routers.
JUNOScript application programming interface (API)	Use JUNOScript Perl client modules to develop custom applications for configuring information on routers that run JUNOS Software. Client applications use the JUNOScript API to request and change configuration information on Juniper Networks J Series, M Series, and T Series routers. The JUNOScript API is customized for JUNOS Software and operations in the API are equivalent to JUNOS CLI.
NETCONF application programming interface (API)	Use NETCONF Perl client modules to develop custom applications for configuring information on routers that run JUNOS Software. Client applications use the NETCONF API to request and change configuration information on Juniper Networks J Series, M Series, and T Series routers. The NETCONF API includes features that accommodate the configuration data models of multiple vendors.
Configuration commit scripts	Create scripts that run at commit time to enforce custom configuration rules. Commit scripts are written in Extensible Stylesheet Language Transformations (XSLT).

The following sections contain complete descriptions of the methods you can use to configure JUNOS system software:

- JUNOS Command-Line Interface (CLI) on page 19
- ASCII File on page 19
- J-Web Package on page 19
- JUNOScript API Software on page 20

- NETCONF API Software on page 20
- Configuration Commit Scripts on page 20

JUNOS Command-Line Interface (CLI)

The JUNOS CLI is a straightforward command interface. You use Emacs-style keyboard sequences to move around on a command line and scroll through a buffer that contains recently executed commands. You type commands on a single line, and the commands are executed when you press the Enter key. The CLI also provides command help and command completion. For more information about the CLI, see the *JUNOS CLI User Guide* and *JUNOS System Basics and Services Command Reference*.

ASCII File

You can load an ASCII file containing a router configuration that you created earlier, either on this system or another system. You can then activate and run the configuration file as is, or you can edit it using the CLI and then activate it.

J-Web Package

As an alternative to entering CLI commands, the JUNOS Software supports a J-Web graphical user interface (GUI). The J-Web user interface enables you to monitor, configure, troubleshoot, and manage the router on a client by means of a Web browser with Hypertext Transfer Protocol (HTTP) or HTTP over Secure Sockets Layer (HTTPS) enabled.

The J-Web user interface is preinstalled on J Series Services Routers. It is provided as an optional, licensed software package (**jweb** package) on M Series and T Series routers. The **jweb** package is not included in **jinstall** and **jbundle** software bundles. It must be installed separately. To install the package on M Series and T Series routers, follow the procedure described in the *JUNOS Software Installation and Upgrade Guide*.

J-Web supports weak (56-bit) encryption by default. This enables international customers to install J-Web and use HTTPS connections for J-Web access. Domestic customers can also install the **jcrypto** strong encryption package. This package automatically overrides the weak encryption. For more information about the J-Web GUI, see the *J-Web Interface User Guide*.



NOTE: Because the J-Web package is bundled separately from other packages, it is possible to have a version mismatch between J-Web and other JUNOS Software packages you have installed.

To check for a version mismatch, use the **show system alarms** CLI command. If the version number does not match exactly, a system alarm appears. For example, if you install the 7.4R1.2 **jroute** package and the 7.4R1.1 **jweb** package, an alarm is activated. For more information on the **show system alarms** command, see the *JUNOS System Basics and Services Command Reference*.

JUNOScript API Software

The JUNOScript API is an Extensible Markup Language (XML) application that client applications use to request and change configuration information on Juniper Networks J Series, M Series, MX Series, and T Series routers. This API is customized for JUNOS Software, and operations in the API are equivalent to JUNOS CLI configuration mode commands. The JUNOScript API includes a set of Perl modules that enable client applications to communicate with a JUNOScript server on the router. The Perl modules are used to develop custom applications for configuring and monitoring JUNOS Software.

For a complete description of how to use JUNOS XML and JUNOScript API software, see the *JUNOScript API Guide*.

NETCONF API Software

The NETCONF API is an Extensible Markup Language (XML) application that client applications can use to request and change configuration information on Juniper Networks J Series, M Series, MX Series, and T Series routers. This API is customized for JUNOS Software, and includes features that accommodate the configuration data models of multiple vendors. The NETCONF API includes a set of Perl modules that enable client applications to communicate with a NETCONF server on the router. The Perl modules are used to develop custom applications for configuring and monitoring JUNOS Software.

For a complete description of how to use JUNOS XML and NETCONF API software, see the *NETCONF API Guide*.

Configuration Commit Scripts

You can create and use scripts that run at commit time to enforce custom configuration rules. If a configuration breaks the custom rules, the script can generate actions that the JUNOS Software performs. These actions include:

- Generating custom error messages
- Generating custom warning messages
- Generating custom system log messages
- Making changes to the configuration

Configuration commit scripts also enable you to create macros, which expand simplified custom aliases for frequently used configuration statements into standard JUNOS configuration statements. Commit scripts are written in Extensible Stylesheet Language Transformations (XSLT). For more information, see the *JUNOS Configuration and Diagnostic Automation Guide*.

Related Topics ■ JUNOS Software Configuration from External Devices on page 17

Configuring a Router for the First Time

This section covers the following topics:

- Initial Router Configuration Using the JUNOS Software on page 21
- Configuring the JUNOS Software the First Time on a Router with a Single Routing Engine on page 22
- Configuring the JUNOS Software the First Time on a Router with Dual Routing Engines on page 27
- JUNOS Software Default Settings for Router Security on page 29
- JUNOS Software Configuration Using the CLI on page 29
- Activation of the JUNOS Software Candidate Configuration on page 30
- Disk Space Management for JUNOS Software Installation on page 30

Initial Router Configuration Using the JUNOS Software

This topic provides an overview of initial router configuration tasks using the JUNOS Software.

On most JUNOS routers, the JUNOS Software is installed on the CompactFlash card and on the hard disk. When you first turn on a router, it runs the version of the JUNOS Software installed on the CompactFlash card. The copy of JUNOS Software on the hard disk is a backup. Another backup copy of the JUNOS Software is available on removable media, such as a PC Card or a CompactFlash card. Be sure to put the backup JUNOS Software (on removable media) in a safe place.

When you turn on a router the first time, the JUNOS Software automatically boots and starts. You must enter basic configuration information so that the router is on the network and you can log in to it over the network.

To configure the router initially, you must connect a terminal or laptop computer to the router through the console port—a serial port on the front of the router. Only console access to the router is enabled by default. Remote management access to the router and all management access protocols, including Telnet, FTP, and SSH, are disabled by default.

When you first connect to the router console, you must log in as the user **root**. At first, the root account requires no password. You see that you are the user **root**, because the router command prompt shows the username **root@#**.

You must start the JUNOS Software command-line interface (CLI) using the command **cli**. The command prompt **root@>** indicates that you are the user **root** and that you are in the JUNOS Software operational mode. Enter the JUNOS Software configuration mode by typing the command **configure**. The command prompt **root@#** indicates that you are in the JUNOS Software configuration mode.

When you first configure a router, you must configure the following basic properties:

- Router hostname
- Domain name
- IP address of the router Ethernet management interface—On all routers other than the TX Matrix Plus router and the T1600 routers in a routing matrix, the management Ethernet Interface is **fxp0**. On a TX Matrix Plus router and the T1600 routers in a routing matrix, the management Ethernet interface is **em0**.



NOTE: The management Ethernet interface created on a T1600 standalone router (not part of routing matrix and not connected to a TX Matrix Plus router) continues to be **fxp0** and not **em0**. The **em0** management Ethernet interface is only applicable for a TX Matrix Plus router and T1600 routers connected to a TX Matrix Plus router in a routing matrix.

- IP address of a backup router
- IP address of one or more DNS name servers on your network
- Password for the root account

Related Topics

- Configuring the JUNOS Software the First Time on a Router with a Single Routing Engine on page 22
- Configuring the JUNOS Software the First Time on a Router with Dual Routing Engines on page 27

Configuring the JUNOS Software the First Time on a Router with a Single Routing Engine

When you turn on a router the first time, the JUNOS Software automatically boots and starts. You must enter basic configuration information so that the router is on the network and you can log in to it over the network.

To configure the router initially, you must connect a terminal or laptop computer to the router through the console port—a serial port on the front of the router. Only console access to the router is enabled by default. Remote management access to the router and all management access protocols, including Telnet, FTP, and SSH, are disabled by default.

To configure the JUNOS Software for the first time on a router with a single Routing Engine, follow these steps:

1. Connect a terminal or laptop computer to the router through the console port—a serial port on the front of the router. Only console access to the router is enabled by default.
2. Power on the router and wait for it to boot.

The JUNOS Software boots automatically. The boot process is complete when you see the **login:** prompt on the console.

3. Log in as the user **root**.

Initially, the **root** user account requires no password. You can see that you are the **root** user, because the prompt on the router shows the username **root@#**.

4. Start the JUNOS Software command-line interface (CLI):

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

5. Enter JUNOS Software configuration mode:

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

6. Configure the name of the router (the router hostname). We do not recommend spaces in the router name. However, if the name does include spaces, enclose the entire name in quotation marks (" ").

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

7. Configure the router's domain name:

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

8. Configure the IP address and prefix length for the router management Ethernet interface. The management Ethernet interface provides a separate out-of-band management network for the router.

- For all routers *except* the TX Matrix Plus router and T1600 routers in a routing matrix:

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

- For a TX Matrix Plus router and T1600 routers in a routing matrix only:

```
[edit]
root@# set interfaces em0 unit 0 family inet address address/prefix-length
```

To use **em0** as an out-of-band management Ethernet interface, you must configure its logical port, **em0.0**, with a valid IP address.

- For a T1600 standalone router (not connected to a TX Matrix Plus router and not in a routing matrix):

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

9. Configure the IP address of a backup or default router. This device is called the backup router, because it is used only while the routing protocol process is not running. Choose a router that is directly connected to the local router by way of the management interface. The router uses this backup router only when it is booting and only or when the JUNOS routing software (the routing protocol process, **ripd**) is not running.

For routers with two Routing Engines, the backup Routing Engine, **RE1**, uses the backup router as a default gateway after the router boots. This enables you to access the backup Routing Engine. (RE0 is the default master Routing Engine.)

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

10. Configure the IP address of a DNS server. The router uses the DNS name server to translate hostnames into IP addresses.

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

11. Set the root password, entering either a clear-text password that the system will encrypt, a password that is already encrypted, or an SSH public key string.

Choose one of the following:

- a. To enter a clear-text password, use the following command:

```
[edit]
root@# set system root-authentication plain-text-password
New password: type password
Retype new password: retry password
```

- b. To enter a password that is already encrypted, use the following command:

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

- c. To enter an SSH public key, use the following command:

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

12. Optionally, display the configuration statements:

```
[edit]
root@ show
system {
  host-name hostname;
  domain-name domain.name;
  backup-router address ;
  root-authentication {
    (encrypted-password "password" | public-key);
    ssh-rsa "public-key";
    ssh-dsa "public-key";
  }
  name-server {
    address;
  }
  interfaces {
    fxp0 {
      unit 0 {
        family inet {
```

```

        address address ;
    }
}
}
}

```

On a TX Matrix Plus router, the management Ethernet interface is **em0** and not **fxp0**. Therefore, when you issue the **show** command in the configuration mode, the configuration statements would be:

```

[edit]
root@ show
system {
    host-name hostname;
    domain-name domain.name;
    backup-router address ;
    root-authentication {
        (encrypted-password "password" | public-key);
        ssh-rsa "public-key";
        ssh-dsa "public-key";
    }
    name-server {
        address;
    }
    interfaces {
        em0 {
            unit 0 {
                family inet {
                    address address ;
                }
            }
        }
    }
}

```

13. Commit the configuration, which activates the configuration on the router:

```

[edit]
root@# commit

```

After committing the configuration, you see the newly configured hostname appear after the username in the prompt—for example, **user@host#**.

JUNOS Software defaults are now set on the router.

If you want to configure additional JUNOS Software properties at this time, remain in the CLI configuration mode and add the necessary configuration statements. You need to commit your configuration changes to activate them on the router.

14. Exit from the CLI configuration mode.

```

[edit]
root@ hostname# exit

```

```
root@hostname>
```

15. Back up the configuration on the hard drive.

After you have installed the software on the router, committed the configuration, and are satisfied that the new configuration is successfully running, you should issue the **request system snapshot** command to back up the new software to the `/altconfig` file system. If you do not issue the **request system snapshot** command, the configuration on the alternate boot device will be out of sync with the configuration on the primary boot device.

The **request system snapshot** command causes the root file system to be backed up to `/altroot`, and `/config` to be backed up to `/altconfig`. The root and `/config` file systems are on the router's CompactFlash card, and the `/altroot` and `/altconfig` file systems are on the router's hard disk.



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

- Related Topics**
- Initial Router Configuration Using the JUNOS Software on page 21
 - Format for Specifying IP Addresses, Network Masks, and Prefixes in JUNOS Configuration Statements on page 39
 - Default Directories for JUNOS Software File Storage on the Router on page 41
 - Configuring the Basic Router Properties on page 56

Configuring the JUNOS Software the First Time on a Router with Dual Routing Engines

If a router has dual Routing Engines, you must initially configure each router independently. The sequence is irrelevant.

Configure the hostnames and addresses of the two Routing Engines using configuration groups at the **[edit groups]** hierarchy level. Use the reserved configuration group **re0** for the Routing Engine in slot 0 and **re1** for the Routing Engine in slot 1 to define properties specific to the individual Routing Engines. Configuring **re0** and **re1** groups enables both Routing Engines to use the same configuration file.

Use the **apply-groups** statement to reproduce the configuration group information in the main part of the configuration.

The **commit synchronize** command commits the same configuration on both Routing Engines. The command makes the active or applied configuration the same for both Routing Engines with the exception of the groups, **re0** being applied to only **RE0** and **re1** being applied only to **RE1**. If you do not synchronize the configurations between two Routing Engines and one of them fails, the router may not forward traffic correctly, because the backup Routing Engine may have a different configuration.

To initially configure a router with dual Routing Engines, follow these steps:

1. Go to “Configuring the JUNOS Software the First Time on a Router with a Single Routing Engine” on page 22 and follow Step 1 through Step 5 to initially configure the backup Routing Engine.
2. Instead of Step 6 and Step 8 in “Configuring the JUNOS Software the First Time on a Router with a Single Routing Engine” on page 22, configure a hostname for each Routing Engine and an IP address for each management Ethernet interface **fxp0** or **em0** as follows:

On routers other than a TX Matrix Plus router or a T1600 standalone router not in a routing matrix

```
[edit]
root@# edit groups
[edit groups]
root@# set re0 system host-name router1
root@# set re0 interfaces fxp0 unit 0 family inet address 10.10.10.1/24
root@# set re0 system host-name router2
root@# set re1 interfaces fxp0 unit 0 family inet address 10.10.10.2/24
```

On a TX Matrix Plus router and T1600 routers in a routing matrix

```
[edit]
root@# edit groups
[edit groups]
root@# set re0 system host-name router1
root@# set re0 interfaces em0 unit 0 family inet address 10.10.10.1/24
root@# set re0 system host-name router2
root@# set re1 interfaces em0 unit 0 family inet address 10.10.10.2/24
```

3. Configure the router’s domain name:

```
[edit]
```

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

4. Set the loopback interface address for each Routing Engine.

```
[edit groups]
root@# set re0 interfaces lo0 unit 0 family inet address 2.2.2.1/32
root@# set re1 interfaces lo0 unit 0 family inet address 2.2.2.2/32
```

5. Configure the `apply-groups` statement to reproduce the configuration group information to the main part of the configuration.

```
[edit groups]
root@# top
[edit]
root@# set apply-groups [re0 re1]
```

6. Configure Routing Engine redundancy:

```
[edit]
root@# set chassis redundancy routing-engine 0 master
root@# set chassis redundancy routing-engine 1 backup
root@# set chassis redundancy routing-engine graceful-switchover
```

7. Save the configuration change on both Routing Engines:

```
[edit]
user@host> commit synchronize
root@#
```

8. Continue with Step 9 through Step 12 in “Configuring the JUNOS Software the First Time on a Router with a Single Routing Engine” on page 22.
9. After you have installed the new software and are satisfied that it is successfully running, issue the `request system snapshot` command to back up the new software on both master and backup Routing Engines.

```
{master}
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 CompactFlash card, and the `/altroot` and `/altconfig` file systems are on the router’s hard disk.



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

- Related Topics**
- Configuring the JUNOS Software the First Time on a Router with a Single Routing Engine on page 22
 - Initial Router Configuration Using the JUNOS Software on page 21
 - Format for Specifying IP Addresses, Network Masks, and Prefixes in JUNOS Configuration Statements on page 39

- Default Directories for JUNOS Software File Storage on the Router on page 41
- Configuring the Basic Router Properties on page 56

JUNOS Software Default Settings for Router Security

The JUNOS Software protects against common router security weaknesses with the following default settings:

- The JUNOS Software does not forward directed broadcast messages. Directed broadcast services send ping requests from a spoofed source address to a broadcast address and can be used to attack other Internet users. For example, if broadcast ping messages were allowed on the 200.0.0.0/24 network, a single ping request could result in up to 254 responses to the supposed source of the ping. The source would actually become the victim of a denial-of-service (DoS) attack.
- Only console access to the router is enabled by default. Remote management access to the router and all management access protocols, including Telnet, FTP, and SSH (Secure Shell), are disabled by default.
- The JUNOS Software does not support the SNMP set capability for editing configuration data. Although the software supports the SNMP set capability for monitoring and troubleshooting the network, this support exposes no known security issues. (You can configure the software to disable this SNMP set capability.)
- The JUNOS Software ignores martian addresses that contain the following prefixes: 0.0.0.0/8, 127.0.0.0/8, 128.0.0.0/16, 191.255.0.0/16, 192.0.0.0/24, 223.255.55.0/24, and 240.0.0.0/4. Martian addresses are reserved host or network addresses about which all routing information should be ignored.

Related Topics ■ Example: Consolidated Security Configuration on page 258

JUNOS Software Configuration Using the CLI

You configure the JUNOS Software using the JUNOS Command Line Interface (CLI). The CLI is described in detail in the *JUNOS CLI User Guide*.

After completing the initial minimal configuration, you can configure software properties. If you configure the software interactively using the CLI, you enter software configuration statements to create a candidate configuration that contains a hierarchy of statements. At any hierarchy level, you generally can enter statements in any order. While you are configuring the software, you can display all or portions of the candidate configuration, and you can insert or delete statements. Any changes you make affect only the candidate configuration, not the active configuration that is running on the router.

The configuration hierarchy logically groups related functions, which results in configuration statements that have a regular, consistent syntax. For example, you configure routing protocols, routing policies, interfaces, and SNMP management in their own separate portions of the configuration hierarchy.

At each level of the hierarchy, you can display a list of the statements available at that level, along with short descriptions of the statements' functions. To have the CLI complete the statement name if it is unambiguous or to provide a list of possible completions, you can type a partial statement name followed by a space or tab.

More than one user can edit a router's configuration simultaneously. All changes made by all users are visible to everyone editing the configuration.

Related Topics ■ Activation of the JUNOS Software Candidate Configuration on page 30

Activation of the JUNOS Software Candidate Configuration

You enter software configuration statements using the CLI to create a candidate configuration that contains a hierarchy of statements. To have a candidate configuration take effect, you commit the changes. At this point, the candidate file is checked for proper syntax, activated, and marked as the current, operational software configuration file. If multiple users are editing the configuration, when you commit the candidate configuration, all changes made by all the users take effect.

The CLI always maintains a copy of previously committed versions of the software configuration. If you need to return to a previous configuration, you can do this from within the CLI.

Disk Space Management for JUNOS Software Installation

A JUNOS Software installation or upgrade may fail if your router has a shortage of disk space. If a disk space error occurs, use one or more of the following options to complete the installation:

- Use the **request system storage cleanup** command to delete unnecessary files and increase storage space on the router.
- Specify the **unlink** option when you use the **request system software add** command to install the JUNOS Software:
 - On the J Series routers, the **unlink** option removes the software package at the earliest opportunity to create enough disk space for the installation to finish.
 - On the M Series, MX Series, and T Series routers, the **unlink** option removes the software package after a successful upgrade.
- Download the software packages you need from the Juniper Networks Support Web site, <http://www.juniper.net/support/>. The download program provides intelligent disk space management to enable installation.



NOTE: If you are upgrading the J Series router from a remote location, the installation program automatically checks for enough disk space for the process to finish.

JUNOS Software Tools for Monitoring the Router

The primary method of monitoring and troubleshooting the JUNOS Software, routing protocols, network connectivity, and the router hardware is to enter commands from the CLI. The CLI enables you to display information in the routing tables and routing protocol-specific data, and to check network connectivity using **ping** and **traceroute** commands.

The J-Web graphical user interface (GUI) is a Web-based alternative to using CLI commands to monitor, troubleshoot, and manage the router.

The JUNOS Software includes SNMP software, which enables you to manage routers. The SNMP software consists of an SNMP master agent and a MIB II agent, and supports MIB II SNMP version 1 traps and version 2 notifications, SNMP version 1 **Get** and **GetNext** requests, and version 2 **GetBulk** requests.

The software also supports tracing and logging operations so that you can track events that occur in the router—both normal router operations and error conditions—and track the packets that are generated by or pass through the router. Logging operations use a syslog-like mechanism to record system-wide, high-level operations, such as interfaces going up or down and users logging in to or out of the router. Tracing operations record more detailed messages about the operation of routing protocols, such as the various types of routing protocol packets sent and received, and routing policy actions.

JUNOS Software Features for Router Security

Router security consists of three major elements: physical security of the router, operating system security, and security that can be effected through configuration. Physical security involves restricting access to the router. Exploits that can easily be prevented from remote locations are extremely difficult or impossible to prevent if an attacker can gain access to the router's management port or console. The inherent security of the JUNOS operating system also plays an important role in router security. The JUNOS Software is extremely stable and robust. The JUNOS Software also provides features to protect against attacks, allowing you to configure the router to minimize vulnerabilities.

The following are JUNOS Software features available to improve router security:

- Methods of Remote Access for Router Management on page 32
- JUNOS Software Supported Protocols and Methods for User Authentication on page 32
- JUNOS Software Plain-Text Password Requirements on page 33
- JUNOS Software Support for Routing Protocol Security Features and IPsec on page 34
- JUNOS Software Support for Firewall Filters on page 34
- JUNOS Software Auditing Support for Security on page 34

Methods of Remote Access for Router Management

When you first install the JUNOS Software, all remote access to the router is disabled, thereby ensuring that remote access is possible only if deliberately enabled by an authorized user. You can establish remote communication with a router in one of the following ways:

- Out-of-band management—enables connection to the router through an interface dedicated to router management. Juniper Networks routers support out-of-band management with a dedicated management Ethernet interface, as well as EIA-232 console and auxiliary ports. On all routers other than the TX Matrix Plus router and T1600 routers connected to a TX Matrix Plus router in a routing matrix, the management Ethernet Interface is labeled, **fxp0**. On a TX Matrix Plus router and T1600 routers in a routing matrix, the management Ethernet Interface is labeled **em0**. The management Ethernet interface connects directly to the Routing Engine. No transit traffic is allowed through this interface, providing complete separation of customer and management traffic and ensuring that congestion or failures in the transit network do not affect the management of the router.
- Inband management—enables connection to the routers using the same interfaces through which customer traffic flows. Although this approach is simple and requires no dedicated management resources, it has some disadvantages:
 - Management flows and transit traffic flows are mixed together. Any attack traffic that is mixed with the normal traffic can affect the communication with the router.
 - The links between router components might not be totally trustworthy, leading to the possibility of wiretapping and replay attacks.

For management access to the router, the standard ways to communicate with the router from a remote console are with Telnet and SSH. SSH provides secure encrypted communications and is therefore useful for inband router management. Telnet provides unencrypted, and therefore less secure, access to the router.

JUNOS Software Supported Protocols and Methods for User Authentication

On a router, you can create local user login accounts to control who can log in to the router and the access privileges they have. A password, either an SSH key or a Message Digest 5 (MD5) password, is associated with each login account. To define access privileges, you create login classes into which you group users with similar jobs or job functions. You use these classes to explicitly define what commands their users are and are not allowed to issue while logged in to the router.

The management of multiple routers by many different personnel can create a user account management problem. One solution is to use a central authentication service to simplify account management, creating and deleting user accounts only on a single, central server. A central authentication system also simplifies the use of one-time password systems such as SecureID, which offer protection against password sniffing and password replay attacks (attacks in which someone uses a captured password to pose as a router administrator).

The JUNOS Software supports two protocols for central authentication of users on multiple routers:

- Remote Authentication Dial-In User Service (RADIUS) and Terminal Access Controller Access Control System Plus (TACACS+).
- RADIUS, a multivendor IETF standard whose features are more widely accepted than those of TACACS+ or other proprietary systems. All one-time-password system vendors support RADIUS.

The JUNOS Software also supports the following authentication methods:

- Internet Protocol Security (IPsec). IPsec architecture provides a security suite for the IPv4 and IPv6 network layers. The suite provides such functionality as authentication of origin, data integrity, confidentiality, replay protection, and nonrepudiation of source. In addition to IPsec, the JUNOS Software also supports the Internet Key Exchange (IKE), which defines mechanisms for key generation and exchange, and manages security associations (SAs).
- MD5 authentication of MSDP peering sessions. This authentication provides protection against spoofed packets being introduced into a peering session.
- SNMPv3 authentication and encryption. SNMPv3 uses the user-based security model (USM) for message security and the view-based access control model (VACM) for access control. USM specifies authentication and encryption. VACM specifies access-control rules.

JUNOS Software Plain-Text Password Requirements

The JUNOS Software has special requirements when you create plain-text passwords on a router. The default requirements for plain-text passwords are as follows:

- The password must be between 6 and 128 characters long.
- You can include uppercase letters, lowercase letters, numbers, punctuation marks, and any of the following special characters:
! @ # \$ % ^ & * , + = < > : ;
Control characters are not recommended.
- The password must contain at least one change of case or character class.

You can change the requirements for plain-text passwords.

You can include the `plain-text-password` statement at the following hierarchy levels:

- `[edit system diag-port-authentication]`
- `[edit system pic-console-authentication]`
- `[edit system root-authentication]`
- `[edit system login userusername authentication]`

JUNOS Software Support for Routing Protocol Security Features and IPsec

The main task of a router is to forward user traffic toward its intended destination based on the information in the router's routing and forwarding tables. You can configure routing policies that define the flows of routing information through the network, controlling which routes the routing protocols place in the routing tables and which routes they advertise from the tables. You can also use routing policies to change specific route characteristics, change the BGP route flap-damping values, perform per-packet load balancing, and enable class of service (CoS).

Attackers can send forged protocol packets to a router with the intent of changing or corrupting the contents of its routing table or other databases, which can degrade the functionality of the router. To prevent such attacks, you must ensure that routers form routing protocol peering or neighboring relationships with trusted peers. One way to do this is by authenticating routing protocol messages. The JUNOS BGP, IS-IS, OSPF, RIP, and RSVP protocols support HMAC-MD5 authentication, which uses a secret key combined with the data being protected to compute a hash. When the protocols send messages, the computed hash is transmitted with the data. The receiver uses the matching key to validate the message hash.

The JUNOS Software supports the IPsec security suite for the IPv4 and IPv6 network layers. The suite provides such functionality as authentication of origin, data integrity, confidentiality, replay protection, and nonrepudiation of source. The JUNOS Software also supports IKE, which defines mechanisms for key generation and exchange, and manages SAs.

JUNOS Software Support for Firewall Filters

Firewall filters allow you to control packets transiting the router to a network destination and packets destined for and sent by the router. You can configure firewall filters to control which data packets are accepted on and transmitted from the physical interfaces, and which local packets are transmitted from the physical interfaces and the Routing Engine. Firewall filters provide a means of protecting your router from excessive traffic. Firewall filters that control local packets can also protect your router from external aggressions, such as DoS attacks.

To protect the Routing Engine, you can configure a firewall filter only on the router's loopback interface. Adding or modifying filters for each interface on the router is not necessary. You can design firewall filters to protect against ICMP and Transmission Control Protocol (TCP) connection request (SYN) floods and to rate-limit traffic being sent to the Routing Engine.

JUNOS Software Auditing Support for Security

The JUNOS Software logs significant events that occur on the router and within the network. Although logging itself does not increase security, you can use the system logs to monitor the effectiveness of your security policies and router configurations. You can also use the logs when reacting to a continued and deliberate attack as a means of identifying the source address, router, or port of the attacker's traffic. You can configure the logging of different levels of events, from only critical events to all

events, including informational events. You can then inspect the contents of the system log files either in real time or later.

Debugging and troubleshooting are much easier when the timestamps in the system log files of all routers are synchronized, because events that span the network might be correlated with synchronous entries in multiple logs. The JUNOS Software supports the Network Time Protocol (NTP), which you can enable on the router to synchronize the system clocks of routers and other networking equipment. By default, NTP operates in an unauthenticated mode. You can configure various types of authentication, including an HMAC-MD5 scheme.

- Related Topics**
- Example: Configuring Firewall Filters on page 254
 - IPsec Overview on page 565
 - JUNOS Software System Log Configuration Overview on page 125

Part 2

System Management

This chapter covers the following topics:

- System Management Overview on page 39
- System Management Configuration Statements on page 47
- Configuring Basic System Management on page 55
- Configuring User Access on page 71
- Configuring System Authentication on page 89
- Configuring Time on page 113
- Configuring System Log Messages on page 125
- Configuring Miscellaneous System Management Features on page 171
- Security Configuration Example on page 241
- Summary of System Management Configuration Statements on page 269

Chapter 3

System Management Overview

The JUNOS Software provides a variety of parameters that allow you to configure system management functions, including the router's hostname, address, and domain name; the addresses of Domain Name System (DNS) servers; user login accounts, including user authentication and the root-level user account; time zones and Network Time Protocol (NTP) properties; and properties of the router's auxiliary and console ports.

This chapter provides you an overview of system management functions and features:

- Format for Specifying IP Addresses, Network Masks, and Prefixes in JUNOS Configuration Statements on page 39
- Format for Specifying Filenames and URLs in JUNOS CLI Commands on page 40
- Default Directories for JUNOS Software File Storage on the Router on page 41
- JUNOS Software Tracing and Logging Operations on page 42
- JUNOS Software Authentication Methods for Routing Protocols on page 44
- JUNOS Software User Authentication Methods on page 45

Format for Specifying IP Addresses, Network Masks, and Prefixes in JUNOS Configuration Statements

Many statements in the JUNOS Software configuration include an option to specify an IP address or route prefix. In this manual, this option is represented in one of the following ways:

- *network/prefix-length*—Network portion of the IP address, followed by a slash and the destination prefix length (previously called the subnet mask). For example, `10.0.0.1/8`.
- *network*—IP address. For example, `10.0.0.2`.
- *destination-prefix/prefix-length*—Route prefix, followed by a slash and the destination prefix length. For example, `192.168.1.10/32`.

You enter all IP addresses in classless mode. You can enter the IP address with or without a prefix length, in standard dotted notation (for example, `1.2.3.4`), or hexadecimal notation as a 32-bit number in network-byte order (for example, `0x01020304`). If you omit any octets, they are assumed to be zero. Specify the prefix length as a decimal number in the range from 1 through 32.

- Related Topics** ■ Format for Specifying Filenames and URLs in JUNOS CLI Commands on page 40

Format for Specifying Filenames and URLs in JUNOS CLI Commands

In some command-line interface (CLI) commands and configuration statements—including file copy, file archive, load, save, set system login user *username* authentication *load-key-file*, and request system software add—you can include a filename. On a routing matrix, you can include chassis information (for example, lcc0, lcc0-re0, or lcc0-re1) as part of the filename. A *routing matrix* is a multichassis architecture composed of either one TX Matrix router and from one to four T640 routers connected to the TX Matrix router, or one TX Matrix Plus router and from one to four T1600 routers connected to the TX Matrix Plus router. From the perspective of the user interface, the routing matrix appears as a single router. On a routing matrix composed of the TX Matrix router and T640 routers, the TX Matrix router controls all the T640 routers. On a routing matrix composed of a TX Matrix Plus router and T1600 routers, the TX Matrix Plus router controls all the T1600 routers.

You can specify a filename or URL in one of the following ways:

- *filename*—File in the user's current directory on the local CompactFlash card. You can use wildcards to specify multiple source files or a single destination file. Wildcards are not supported in Hypertext Transfer Protocol (HTTP) or FTP.



NOTE: Wildcards are supported only by the file (compare | copy | delete | list | rename | show) commands. When you issue the file show command with a wildcard, it must resolve to one filename.

- *path/filename*—File on the local flash disk.
- */var/filename* or */var/path/filename*—File on the local hard disk. You can also specify a file on a local Routing Engine for a specific T640 router or a T1600 router in a routing matrix:

```
user@host> file delete lcc0-re0:/var/tmp/junk
```

- *a:filename* or *a:path/filename*—File on the local removable media. The default path is / (the root-level directory). The removable media can be in MS-DOS or UNIX (UFS) format.
- *hostname:/path/filename*, *hostname:filename*, *hostname:path/filename*, or *"scp://hostname/path/filename"*—File on an scp/ssh client. This form is not available in the worldwide version of the JUNOS Software. The default path is the user's home directory on the remote system. You can also specify *hostname* as *username@hostname*.
- *ftp://hostname/path/filename*—File on an FTP server. You can also specify *hostname* as *username@hostname* or *username:password@hostname*. The default path is the user's home directory. To specify an absolute path, the path must start with %2F; for example, *ftp://hostname/%2Fpath/filename*. To have the

system prompt you for the password, specify **prompt** in place of the password. If a password is required, and you do not specify the password or **prompt**, an error message is displayed:

```
user@host> file copy ftp://username@ftp.hostname.net//filename

file copy ftp.hostname.net: Not logged in.

user@host> file copy ftp://username:prompt@ftp.hostname.net//filename

Password for username@ftp.hostname.net:
```

- **http://hostname/path/filename**—File on an HTTP server. You can also specify *hostname* as *username@hostname* or *username:password@hostname*. If a password is required and you omit it, you are prompted for it.
- **re0:/path/filename** or **re1:/path/filename**—File on a local Routing Engine. You can also specify a file on a local Routing Engine for a specific T640 router or a T1600 router in a routing matrix:

```
user@host> show log lcc0-re1:chassisd
```

A *routing matrix* is a multichassis architecture composed of either one TX Matrix router and from one to four T640 routers connected to the TX Matrix router, or one TX Matrix Plus router and from one to four T1600 routers. From the perspective of the user interface, the routing matrix appears as a single router. On a routing matrix composed of the TX Matrix router and T640 routers, the TX Matrix router controls all the T640 routers. On a routing matrix composed of a TX Matrix Plus router and T1600 routers, the TX Matrix Plus router controls all the T1600 routers.

Default Directories for JUNOS Software File Storage on the Router

JUNOS Software files are stored in the following directories on the router:

- **/altconfig**—When you back up the currently running and active file system partitions on the router to standby partitions using the **request system snapshot** command, the **/config** directory is backed up to **/altconfig**. Normally, the **/config** directory is on the CompactFlash card and **/altconfig** is on the hard disk.
- **/altroot**—When you back up the currently running and active file system partitions on the router to standby partitions using the **request system snapshot** command, the root file system (**/**) is backed up to **/altroot**. Normally, the root directory is on the CompactFlash card and **/altroot** is on the hard disk.
- **/config**—This directory is located on the primary boot device, that is, on the device from which the router booted (generally the CompactFlash card, device **wd0**). This directory contains the current operational router configuration and the last three committed configurations, in the files **juniper.conf**, **juniper.conf.1**, **juniper.conf.2**, and **juniper.conf.3**, respectively.
- **/var**—This directory is always located on the hard disk (device **wd2**). It contains the following subdirectories:

- **/var/home**—Contains users' home directories, which are created when you create user access accounts. For users using SSH authentication, their `.ssh` file, which contains their SSH key, is placed in their home directory. When a user saves or loads a configuration file, that file is loaded from the user's home directory unless the user specifies a full pathname.
- **/var/db/config**—Contains up to six additional previous versions of committed configurations, which are stored in the files `juniper.conf.4` through `juniper.conf.9`.
- **/var/log**—Contains system log and tracing files.
- **/var/tmp**—Contains core files. The software saves up to five core files, numbered from 0 through 4. File number 0 is the oldest core file and file number 4 is the newest core file. To preserve the oldest core files, the software overwrites the newest core file, number 4, with any subsequent core file.

Each router ships with removable media (device `wfd0`) that contains a backup copy of the JUNOS Software.

Directories on the Logical System

Beginning with JUNOS Release 9.5, logical systems have their individual directory structure created in the `/var/logical-system/logical-system-name` directory. It contains the following subdirectories:

- **/config**—Contains the current operational configuration specific to the logical system.
- **/log**—Contains system log and tracing files specific to the logical system.

To maintain backward compatibility for the log files with previous versions of JUNOS Software, a symbolic link (symlink) from the `/var/logs/logical-system-name` directory to the `/var/logical-systems/logical-system-name` directory is created when a logical system is configured.

- **/tmp**—Contains temporary files specific to the logical system.

The new file system for each logical system enables logical system users to view trace logs and modify logical system files. Logical system administrators have full access to view and modify all files specific to the logical system.

Logical system users and administrators can now save and load configuration files at the logical-system level using the `save` and `load` configuration mode commands. In addition, they can also issue the `show log`, `monitor`, and `file` operational mode commands at the logical-system level.

JUNOS Software Tracing and Logging Operations

Tracing and logging operations allow you to track events that occur in the router—both normal router operations and error conditions—and to track the packets that are

generated by or passed through the router. The results of tracing and logging operations are placed in files in the `/var/log` directory on the router.

The JUNOS Software provides an option to do remote tracing for specific processes, which greatly reduces use of the router's internal storage for tracing and is analogous to remote syslogging. You configure remote tracing system-wide using the `tracing` statement at the `[edit system]` hierarchy level. By default, remote tracing is not configured. You can disable remote tracing for specific processes using the `no-remote-trace` statement at the `[edit <process-name> traceoptions]` hierarchy level. This feature does not alter local tracing functionality in any way, and logging files are stored on the router.

The JUNOS Software supports remote tracing for the following processes:

- `chassisd`—chassis-control process
- `eventd`—event-processing process
- `cosd`—class-of-service process
- `spd`—adaptive-services process

Logging operations use a system logging mechanism similar to the UNIX `syslogd` utility to record systemwide, high-level operations, such as interfaces going up or down and users logging in to or out of the router. You configure these operations by using the `syslog` statement at the `[edit system]` hierarchy level, as described in “JUNOS Software System Log Configuration Overview” on page 125, and by using the `options` statement at the `[edit routing-options]` hierarchy level, as described in the *JUNOS Routing Protocols Configuration Guide*.

Tracing operations record more detailed messages about the operation of routing protocols, such as the various types of routing protocol packets sent and received, and routing policy actions. You configure tracing operations using the `traceoptions` statement. You can define tracing operations in different portions of the router configuration:

- Global tracing operations—Define tracing for all routing protocols. You define these tracing operations at the `[edit routing-options]` hierarchy level of the configuration.
- Protocol-specific tracing operations—Define tracing for a specific routing protocol. You define these tracing operations in the `[edit protocol]` hierarchy when configuring the individual routing protocol. 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.
- Tracing operations within individual routing protocol entities—Some protocols allow you to define more granular tracing operations. For example, in Border Gateway Protocol (BGP), you can configure peer-specific tracing operations. These operations override any equivalent BGP-wide operations or, if there are no equivalents, supplement them. If you do not specify any peer-specific tracing operations, the peers inherit, first, all the BGP-wide tracing operations and, second, the global tracing operations.

- Interface tracing operations—Define tracing for individual router interfaces and for the interface process itself. You define these tracing operations at the **[edit interfaces]** hierarchy level of the configuration as described in the *JUNOS Network Interfaces Configuration Guide*.
- Remote tracing—To enable system-wide remote tracing, include the **destination-override syslog host** statement at the **[edit system tracing]** hierarchy level. This specifies the remote host running the system log process (syslogd), which collects the traces. Traces are written to file(s) on the remote host per the syslogd configuration in `/etc/syslog.conf`. By default remote tracing is *not* configured.

To override the system-wide remote tracing configuration for a particular process, include the **no-remote-trace** statement at the **[edit <process-name> traceoptions]** hierarchy. When **no-remote-trace** is enabled, the process does local tracing.

To collect traces, use the *local0* facility as the selector in `/etc/syslog.conf` on the remote host. To separate traces from various processes into different files, include the process name or trace-file name if it is specified at the **[edit <process-name> traceoptions file]** hierarchy level, in the *program* field in `/etc/syslog.conf`. If your syslog server supports parsing hostname and program-name, then you can separate traces from the various processes.

JUNOS Software Authentication Methods for Routing Protocols

Some interior gateway protocols (IGPs)—Intermediate System-to-Intermediate System (IS-IS), Open Shortest Path First (OSPF), and Routing Information Protocol (RIP)—and Resource Reservation Protocol (RSVP) allow you to configure an authentication method and password. Neighboring routers use the password to verify the authenticity of packets sent by the protocol from the router or from a router interface. The following authentication methods are supported:

- Simple authentication (IS-IS, OSPF, and RIP)—Uses a simple text password. The receiving router uses an authentication key (password) to verify the packet. Because the password is included in the transmitted packet, this method of authentication is relatively insecure. We recommend that you not use this authentication method.
- MD5 and HMAC-MD5 (IS-IS, OSPF, RIP, and RSVP)—Message Digest 5 (MD5) creates an encoded checksum that is included in the transmitted packet. HMAC-MD5, which combines HMAC authentication with MD5, adds the use of an iterated cryptographic hash function. With both types of authentication, the receiving router uses an authentication key (password) to verify the packet. HMAC-MD5 authentication is defined in RFC 2104, *HMAC: Keyed-Hashing for Message Authentication*.

In general, authentication passwords are text strings consisting of a maximum of 16 or 255 letters and digits. Characters can include any ASCII strings. If you include spaces in a password, enclose all characters in quotation marks (“ ”).

JUNOS-FIPS has special password requirements. FIPS passwords must be between 10 and 20 characters in length. Passwords must use at least three of the five defined character sets (uppercase letters, lowercase letters, digits, punctuation marks, and

other special characters). If JUNOS-FIPS is installed on the router, you cannot configure passwords unless they meet this standard.

JUNOS Software User Authentication Methods

The JUNOS Software supports three methods of user authentication: local password authentication, Remote Authentication Dial-In User Service (RADIUS), and Terminal Access Controller Access Control System Plus (TACACS+).

With local password authentication, you configure a password for each user allowed to log in to the router.

RADIUS and TACACS+ are authentication methods for validating users who attempt to access the router using telnet. They are both distributed client-server systems—the RADIUS and TACACS+ clients run on the router, and the server runs on a remote network system.

You can configure the router to be both a RADIUS and TACACS+ client, and you can also configure authentication passwords in the JUNOS configuration file. You can prioritize the methods to configure the order in which the software tries the different authentication methods when verifying user access.

- Related Topics**
- Configuring RADIUS Authentication on page 89
 - Configuring TACACS+ Authentication on page 94
 - JUNOS Software Authentication Order for RADIUS, TACACS+, and Password Authentication on page 102

Chapter 4

System Management Configuration Statements

This chapter covers the following topics:

- System Management Complete Configuration Statements on page 47

System Management Complete Configuration Statements

This topic lists all the configuration statements that you can include at the [edit system] hierarchy level to configure system management features:

```
system {
  accounting {
    events [ login change-log interactive-commands ];
    destination {
      radius {
        server {
          server-address {
            accounting-port port-number;
            retry number;
            secret password;
            source-address address;
            timeout seconds;
          }
        }
      }
    }
    tacplus {
      server {
        server-address {
          port port-number;
          secret password;
          single-connection;
          timeout seconds;
        }
      }
    }
  }
  archival {
    configuration {
      archive-sites {
        ftp://<username>:<password>@<host>:<port>/<url-path>;
      }
    }
  }
}
```

```

        ftp://<username>:<password>@<host>:<port>/<url-path>;
    }
    transfer-interval interval;
    transfer-on-commit;
}
}
arp {
    passive-learning;
    aging-timer minutes;
}
authentication-order [ authentication-methods ];
backup-router address <destination destination-address>;
commit synchronize;
(compress-configuration-files | no-compress-configuration-files);
default-address-selection;
dump-device (compact-flash | remove-compact | usb);
diag-port-authentication (encrypted-password "password" | plain-text-password);
domain-name domain-name;
domain-search [ domain-list ];
host-name hostname;
inet6-backup-router address <destination destination-address>;
internet-options {
    tcp-mss mss-value;
    (gre-path-mtu-discovery | no-gre-path-mtu-discovery);
    icmpv4-rate-limit {
        bucket-size bucket-size;
        packet-rate packet-rate;
    }
    icmpv6-rate-limit {
        bucket-size bucket-size;
        packet-rate packet-rate;
    }
    (ipip-path-mtu-discovery | no-ipip-path-mtu-discovery);
    (ipv6-path-mtu-discovery | no-ipv6-path-mtu-discovery);
    ipv6-path-mtu-discovery-timeout;
    no-tcp-rfc1323;
    no-tcp-rfc1323-paws;
    (path-mtu-discovery | no-path-mtu-discovery);
    source-port upper-limit <upper-limit>;
    (source-quench | no-source-quench);
    tcp-drop-synfin-set;
}
location {
    altitude feet;
    building name;
    country-code code;
    floor number;
    hcoord horizontal-coordinate;
    lata service-area;
    latitude degrees;
    longitude degrees;
    npa-nxx number;
    postal-code postal-code;
    rack number;
    vcoord vertical-coordinate;
}

```

```

login {
    announcement text;
    class class-name {
        allow-commands "regular-expression";
        allow-configuration "regular-expression";
        deny-commands "regular-expression";
        deny-configuration "regular-expression";
        idle-timeout minutes;
        login-tip;
        permissions [ permissions ];
    }
    message text;
    password {
        change-type (set-transitions | character-set);
        format (md5 | sha1 | des);
        maximum-length length;
        minimum-changes number;
        minimum-length length;
    }
    retry-options {
        backoff-threshold number;
        backoff-factor seconds;
        minimum-time seconds;
        tries-before-disconnect number;
    }
    user username {
        full-name complete-name;
        uid uid-value;
        class class-name;
        authentication {
            (encrypted-password "password" | plain-text-password);
            ssh-rsa "public-key";
            ssh-dsa "public-key";
        }
    }
}
login-tip number;
mirror-flash-on-disk;
name-server {
    address;
}
no-multicast-echo;
no-redirects;
no-ping-record-route;
no-ping-time-stamp;
ntp {
    authentication-key key-number type type value password;
    boot-server address;
    broadcast <address> <key key-number> <version value> <ttl value>;
    broadcast-client;
    multicast-client <address>;
    peer address <key key-number> <version value> <prefer>;
    source-address source-address;
    server address <key key-number> <version value> <prefer>;
    trusted-key [ key-numbers ];
}

```

```

ports {
  auxiliary {
    type terminal-type;
  }
  pic-console-authentication {
    encrypted-password encrypted-password;
    plain-text-password;
    console {
      insecure;
      log-out-on-disconnect;
      type terminal-type;
      disable;
    }
  }
  processes {
    process-name (enable | disable) failover (alternate-media | other-routing-engine);
    timeout seconds;
  }
}
radius-server server-address {
  port port-number;
  retry number;
  secret password;
  source-address source-address;
  timeout seconds;
}
radius-options {
  password-protocol mschap-v2;
}
attributes {
  nas-ip-address ip-address;
}
root-authentication {
  (encrypted-password "password" | plain-text-password);
  ssh-rsa "public-key";
  ssh-dsa "public-key";
}
(saved-core-context | no-saved-core-context);
saved-core-files saved-core-files;
scripts {
  commit {
    allow-transients;
    file filename.xml {
      optional;
      refresh;
      refresh-from url;
      source url;
    }
  }
  traceoptions {
    file filename <files number> <size size> <match regular-expression>;
    flag flag;
  }
}
services {
  finger {
    <connection-limit limit>;
    <rate-limit limit>;
  }
}

```

```

}
flow-tap-dtcp {
  ssh {
    <connection-limit limit>;
    <rate-limit limit>;
  }
}
ftp {
  <connection-limit limit>;
  <rate-limit limit>;
}
service-deployment {
  servers server-address {
    port port-number;
  }
  source-address source-address;
}
ssh {
  root-login (allow | deny | deny-password);
  protocol-version [v1 v2];
  <connection-limit limit>;
  <rate-limit limit>;
}
telnet {
  <connection-limit limit>;
  <rate-limit limit>;
}
web-management {
  http {
    interfaces [ interface-names ];
    port port;
  }
  https {
    interfaces [ interface-names ];
    local-certificate name;
    port port;
  }
  limits {
    active-child-process [ process-limit ];
  }
  session {
    idle-timeout [ minutes ];
    session-limit [ session-limit ];
  }
}
xnm-clear-text {
  <connection-limit limit>;
  <rate-limit limit>;
}
xnm-ssl {
  <connection-limit limit>;
  local-certificate name;
  <rate-limit limit>;
}
}
static-host-mapping {

```

```

hostname {
    alias [ alias ];
    inet [ address ];
    sysid system-identifier;
}
}
syslog {
    archive {
        files number;
        size size;
        (world-readable | no-world-readable);
    }
    console {
        facility severity;
    }
    file filename {
        facility severity;
        explicit-priority;
        match "regular-expression";
        structured-data;
        archive {
            files number;
            size size;
            (world-readable | no-world-readable);
        }
    }
    host (hostname | other-routing-engine | scc-master) {
        facility severity;
        explicit-priority;
        facility-override facility;
        log-prefix string;
        match "regular-expression";
    }
    source-address source-address;
    time-format (year | millisecond | year millisecond);
    user (username | *) {
        facility severity;
        match "regular-expression";
    }
}
}
tacplus-options {
    service-name service-name;
    (no-cmd-attribute-value | exclude-cmd-attribute);
}
tacplus-server server-address {
    secret password;
    single-connection;
    source-address source-address;
    timeout seconds;
}
time-zone (GMThour-offset | time-zone);
}
tracing{
    destination-override {
        syslog host ;
    }
}

```

}

Chapter 5

Configuring Basic System Management

This chapter covers the following topics:

- Configuring the Basic Router Properties on page 56
- Configuring the Hostname of the Router on page 56
- Mapping the Name of the Router to IP Addresses on page 56
- Configuring an ISO System Identifier for the Router on page 57
- Example: Configuring the Name of the Router, IP Address, and System ID on page 57
- Configuring the Domain Name for the Router on page 58
- Example: Configuring the Domain Name for the Router on page 58
- Configuring the Domains to Search When a Router Is Included in Multiple Domains on page 59
- Configuring a DNS Name Server for Resolving a Hostname into Addresses on page 59
- Configuring a Backup Router on page 60
- Configuring Automatic Mirroring of the CompactFlash Card on the Hard Disk Drive on page 61
- Configuring the Physical Location of the Router on page 62
- Configuring the Root Password on page 63
- Example: Configuring the Root Password on page 64
- Example: Configuring a Plain-Text Password for Root Logins on page 64
- Example: Configuring SSH Authentication for Root Logins on page 65
- Special Requirements for JUNOS Software Plain-Text Passwords on page 65
- Changing the Requirements for JUNOS Software Plain-Text Passwords on page 67
- Example: Changing the Requirements for JUNOS Software Plain-Text Passwords on page 68
- Configuring Multiple Routing Engines to Synchronize Committed Configurations Automatically on page 68
- Compressing the Current Configuration File on page 68

Configuring the Basic Router Properties

When you configure the router initially, you must configure the basic properties of a router, such as the router's hostname, IP addresses, and the name the domain in which the router is located.

To configure basic router properties:

1. Configuring the router's hostname.

See "Configuring the Hostname of the Router" on page 56

2. Map the router's hostname to IP addresses.

See "Mapping the Name of the Router to IP Addresses" on page 56.

3. Configure an ISO system identifier for the router.

See "Configuring an ISO System Identifier for the Router" on page 57.

4. Configure the router's domain name.

See "Configuring the Domain Name for the Router" on page 58.

- Related Topics**
- Configuring the JUNOS Software the First Time on a Router with a Single Routing Engine on page 22
 - Configuring the JUNOS Software the First Time on a Router with Dual Routing Engines on page 27
 - Configuring the Physical Location of the Router on page 62

Configuring the Hostname of the Router

To configure the router's name, include the `host-name` statement at the `[edit system]` hierarchy level:

```
[edit system]
host-name hostname;
```

The router's name value must be less than 256 characters.

- Related Topics**
- Configuring the Basic Router Properties on page 56
 - Example: Configuring the Name of the Router, IP Address, and System ID on page 57

Mapping the Name of the Router to IP Addresses

To map a router's hostname to one or more IP addresses, include the `inet` statement at the `[edit system static-host-mapping hostname]` hierarchy level:

```
[edit system]
static-host-mapping {
  hostname {
    inet [ addresses ];
    alias [ aliases ];
  }
}
```

hostname is the name specified by the *host-name* statement at the [edit system] hierarchy level.

For each host, you can specify one or more aliases.

- Related Topics**
- Configuring the Basic Router Properties on page 56
 - Example: Configuring the Name of the Router, IP Address, and System ID on page 57

Configuring an ISO System Identifier for the Router

For IS-IS to operate on the router, you must configure a system identifier (system ID). The system identifier is commonly the media access control (MAC) address or the IP address expressed in binary-coded decimal (BCD).

To configure an International Organization for Standardization (ISO) system ID, include the *sysid* statement at the [edit system static-host-mapping *hostname*] hierarchy level:

```
[edit system]
static-host-mapping {
  hostname {
    sysid system-identifier;
  }
}
```

hostname is the name specified by the *host-name* statement at the [edit system] hierarchy level.

system-identifier is the ISO system identifier. It is the 6-byte system ID portion of the IS-IS network service access point (NSAP). We recommend that you use the host's IP address represented in BCD format. For example, the IP address 192.168.1.77 is 1921.6800.1077 in BCD.

- Related Topics**
- Configuring the Basic Router Properties on page 56
 - Example: Configuring the Name of the Router, IP Address, and System ID on page 57

Example: Configuring the Name of the Router, IP Address, and System ID

The following example shows how to configure the router's name, map the name to an IP address and alias, and configure a system identifier:

```

[edit]
user@host# set system host-name router-sj1
[edit]
user@host# set system static-host-mapping router-sj1 inet 192.168.1.77
[edit]
user@host# set system static-host-mapping router-sj1 alias sj1
[edit]
user@host# set system static-host-mapping router-sj1 sysid 1921.6800.1077
[edit]
user@host# show
system {
    host-name router-sj1;
    static-host-mapping {
        router-sj1 {
            inet 192.168.1.77;
            alias sj1;
            sysid 1921.6800.1077;
        }
    }
}

```

Related Topics ■ Configuring the Basic Router Properties on page 56

Configuring the Domain Name for the Router

For each router, you should configure the name of the domain in which the router is located. This is the default domain name that is appended to hostnames that are not fully qualified.

To configure the domain name, include the `domain-name` statement at the `[edit system]` hierarchy level:

```

[edit system]
domain-name domain-name;

```

The following example shows how to configure the router's domain name:

```

[edit]
user@host# set system domain-name company.net
[edit]
user@host# show
system {
    domain-name company.net;
}

```

Related Topics ■ Example: Configuring the Domain Name for the Router on page 58

Example: Configuring the Domain Name for the Router

The following example shows how to configure the router's domain name:

```

[edit]
user@host# set system domain-name company.net

```

```
[edit]
user@host# show
system {
    domain-name company.net;
}
```

Related Topics ■ Configuring the Domain Name for the Router on page 58

Configuring the Domains to Search When a Router Is Included in Multiple Domains

If your router is included in several different domains, you can configure those domain names to be searched.

To configure more than one domain to be searched, include the `domain-search` statement at the `[edit system]` hierarchy level:

```
[edit system]
domain-search [ domain-list ];
```

The domain list can contain up to 6 domain names, with a total of up to 256 characters.

The following example shows how to configure two domains to be searched:

```
[edit system]
domain-search [ domainone.net domainonealternate.com ]
```

Configuring a DNS Name Server for Resolving a Hostname into Addresses

To have the router resolve hostnames into addresses, you must configure one or more Domain Name System (DNS) name servers by including the `name-server` statement at the `[edit system]` hierarchy level:

```
[edit system]
name-server {
    address;
}
```

The following example shows how to configure two DNS name servers:

```
[edit]
user@host# set system name-server 192.168.1.253
[edit]
user@host# set system name-server 192.168.1.254
[edit]
user@host# show
system {
    name server {
        192.168.1.253;
        192.168.1.254;
    }
}
```

Configuring a Backup Router

When a router is booting, the routing protocol process (rpd) is not running; therefore, the router has no static or default routes. To allow the router to boot and to ensure that the router is reachable over the network if the routing protocol process fails to start properly, you configure a backup router (running IP version 4 [IPv4] or IP version 6 [IPv6]), which is a router that is directly connected to the local router (that is, on the same subnet).

To achieve network reachability while loading, configuring, and recovering the router, but without the risk of installing a default route in the forwarding table, include the **destination** option. Specify the address in the format *network/mask-length* so that the entire network is reachable through the backup router.

When the routing protocols start, the address of the backup router is removed from the local routing and forwarding tables. To have the address remain in these tables, configure a static route for that address by including the **static** statement at the [edit routing-options] hierarchy level.

The following topics describe how to configure a backup router running IPv4 and IPv6, respectively:

1. Configuring a Backup Router Running IPv4 on page 60
2. Configuring a Backup Router Running IPv6 on page 61

Configuring a Backup Router Running IPv4

To configure a backup router running IPv4, include the **backup-router** statement at the [edit system] hierarchy level:

```
[edit system]
backup-router address <destination destination-address>;
```

The following example shows how to configure a backup router running IPv4 and have its address remain in the routing and forwarding tables:

```
[edit]
system {
  backup-router 192.168.1.254 destination 208.197.1.0/24;
}
routing-options {
  static {
    route 208.197.1.0/24 {
      next-hop 192.168.1.254;
      retain;
    }
  }
}
```

Configuring a Backup Router Running IPv6

To configure a backup router running IPv6, include the `inet6-backup-router` statement at the `[edit system]` hierarchy level:

```
[edit system]
inet6-backup-router "address <destination destination-address>;"
```

The following example shows how to configure a backup router running IPv6 and have its address remain in the routing and forwarding tables:

```
[edit]
system {
  inet6-backup-router 8:3::1 destination abcd::/48;
}
routing-options {
  rib inet6.0 {
    static {
      route abcd::/48 {
        next-hop 8:3::1;
        retain;
      }
    }
  }
}
```

- Related Topics**
- Configuring the JUNOS Software the First Time on a Router with a Single Routing Engine on page 22
 - Configuring the JUNOS Software the First Time on a Router with Dual Routing Engines on page 27

Configuring Automatic Mirroring of the CompactFlash Card on the Hard Disk Drive

You can direct the hard disk to automatically mirror the contents of the CompactFlash card. When you include the `mirror-flash-on-disk` statement, the hard disk maintains a synchronized mirror copy of the CompactFlash card contents. Data written to the CompactFlash card is simultaneously updated in the mirrored copy of the hard disk. If the CompactFlash card fails to read data, the hard disk automatically retrieves its mirrored copy of the CompactFlash card. This feature is not available on the J Series routers.



CAUTION: We recommend that you disable flash-to-disk mirroring when you upgrade or downgrade the router.

You cannot issue the `request system snapshot` command while flash-to-disk mirroring is enabled.

To configure the mirroring of the CompactFlash card to the hard disk, include the `mirror-flash-on-disk` statement at the `[edit system]` hierarchy level:

```
[edit system]
mirror-flash-on-disk;
```



NOTE: After you have enabled or disabled the `mirror-flash-on-disk` statement, you must reboot the router for your changes to take effect. To reboot, issue the `request system reboot` command.

Configuring the Physical Location of the Router

To configure the physical location of the router, you can configure the following options for the `location` statement at the `[edit system]` hierarchy level:

- `altitude feet`—Number of feet above sea level.
- `building name`—Name of the building, 1 to 28 characters in length. If the string contains spaces, enclose it in quotation marks (" ").
- `country-code code`—Two-letter country code.
- `floor number`—Floor in the building.
- `hcoord horizontal-coordinate`—Bellcore Horizontal Coordinate.
- `lata service-area`—Long-distance service area.
- `latitude degrees`—Latitude in degree format.
- `longitude degrees`—Longitude in degree format.
- `npa-nxx number`—First six digits of the phone number (area code and exchange).
- `postal-code postal-code`—Postal code.
- `rack number`—Rack number.
- `vcoord vertical-coordinate`—Bellcore Vertical Coordinate.

The following example shows how to configure the physical location of the router:

```
[edit system]
location {
  altitude feet;
  building name;
  country-code code;
  floor number;
  hcoord horizontal-coordinate;
  lata service-area;
  latitude degrees;
  longitude degrees;
  npa-nxx number;
  postal-code postal-code;
  rack number;
  vcoord vertical-coordinate;
}
```


Configuring the Root Password

The JUNOS Software is preinstalled on the router. When the router is powered on, it is ready to be configured. Initially, you log in to the router as the user “root” with no password.



NOTE: If you configure a blank password using the `encrypted-password` statement at the `[edit system root-authentication]` hierarchy level for root authentication, you will be able to commit a configuration, but you will *not* be able to login as superuser and get root level access to the router.

After you log in, you should configure the root (superuser) password by including the `root-authentication` statement at the `[edit system]` hierarchy level:

```
[edit system]
root-authentication {
  (encrypted-password "password"| plain-text-password);
  ssh-dsa "public-key";
  ssh-rsa "public-key";
}
```

If you configure the `plain-text-password` option, you are prompted to enter and confirm the password:

```
[edit system]
user@host# set root-authentication plain-text-password
New password: type password here
Retype new password: retype password here
```

To load an SSH key file, enter the `load-key-file` command. This command loads RSA (SSH version 1 and SSH version 2) and DSA (SSH version 2) public keys.

You can also configure SSH RSA keys and SSH DSA keys to authenticate root logins. You can configure more than one public RSA or DSA key for SSH authentication of root logins as well as for user accounts. When a user logs in as root, the public keys are referenced to determine whether the private key matches any of them.

If you load the SSH keys file, the contents of the file are copied into the configuration immediately after you enter the `load-key-file` statement. To view the SSH keys entries, use the configuration mode `show` command. For example:

```
[edit system]
user@host# set root-authentication load-key-file my-host:.ssh/identity.pub
.file.19692 | 0 KB | 0.3 kB/s | ETA: 00:00:00 | 100%
[edit system]
user@host# show
root-authentication {
  ssh-rsa "1024 35 9727638204084251055468226757249864241630322
20740496252839038203869014158453496417001961060835872296
15634757491827360336127644187426594689320773910834481012
68312595772262546166799927831612350043866091586628382248
```

```

97467326056611921489539813965561563786211940327687806538
16960202749164163735913269396344008443 boojum@juniper.net"; #
SECRET-DATA
}

```

JUNOS-FIPS has special password requirements. FIPS passwords must be between 10 and 20 characters in length. Passwords must use at least three of the five defined character sets (uppercase letters, lowercase letters, digits, punctuation marks, and other special characters). If JUNOS-FIPS is installed on the router, you cannot configure passwords unless they meet this standard. If you use the `encrypted-password` option, then a null-password (empty) is not permitted.

You cannot configure a blank password for `encrypted-password` using blank quotation marks (" "). You must configure a password whose number of characters range from 1 through 128 characters and enclose the password in quotation marks.

- Related Topics**
- Example: Configuring the Root Password on page 64
 - Recovering the Root Password on page 109

Example: Configuring the Root Password

The following example shows how to configure the root password:

```

[edit]
user@host# set system root-authentication encrypted-password
"$1$14c5.$sBopasddsd0"
[edit]
user@host# show
system {
  root-authentication {
    encrypted-password "$1$14c5.$sBopasddsd0";
  }
}

```

- Related Topics**
- Configuring the Root Password on page 63

Example: Configuring a Plain-Text Password for Root Logins

The following example shows how to set a plain-text password for root logins:

```

[edit]
user@host# set system root-authentication plain-text-password
New password: type root password
Retype new password: retype root password
[edit]
user@host# show
system {
  root-authentication {
    encrypted-password "$1$14c5.$sBopasddsd0";
  }
}

```

Related Topics ■ Configuring the Root Password on page 63

Example: Configuring SSH Authentication for Root Logins

The following example shows how to configure two public DSA keys for SSH authentication of root logins:

```
[edit system]
root-authentication {
  encrypted-password "$1$1wp5tqMX$uy/u5H7OdXTwfWTmeJWXe/";
  ## SECRET-DATA;
  ssh-dsa "2354 95 9304@boojum.per";
  ssh-dsa "0483 02 8362@ecbatana.per";
}
```

- Related Topics** ■ Configuring the Root Password on page 63
- Special Requirements for JUNOS Software Plain-Text Passwords on page 65

Special Requirements for JUNOS Software Plain-Text Passwords

The JUNOS Software has special requirements when you create plain-text passwords on a router. Table 5 on page 65 shows the default requirements.

Table 5: Special Requirements for Plain-Text Passwords

JUNOS Software	JUNOS-FIPS
The password must be between 6 and 128 characters long.	FIPS passwords must be between 10 and 20 characters in length
You can include most character classes in a password (uppercase letters, lowercase letters, numbers, punctuation marks, and other special characters). Control characters are not recommended.	You can include most character classes in a password (uppercase letters, lowercase letters, numbers, punctuation marks, and other special characters). Control characters are not recommended.
Valid passwords must contain at least one change of case or character class.	Passwords must use at least three of the five defined character classes (uppercase letters, lowercase letters, numbers, punctuation marks, and other special characters).

You can change the requirements for plain-text passwords.

JUNOS Software supports the following five character classes for plain-text passwords:

- Lowercase letters
- Uppercase letters
- Numbers

- Punctuation
- Special characters: ! @ # \$ % ^ & * , + < > ; ;

Control characters are not recommended.

You can include the **plain-text-password** statement at the following hierarchy levels:

- [edit system diag-port-authentication]
- [edit system pic-console-authentication]
- [edit system root-authentication]
- [edit system login *username* authentication]

The **change-type** statement specifies whether the password is checked for the following:

- The total number of character sets used (**character-set**)
- The total number of character set changes (**set-transitions**)

For example, the following password:

MyPassWd@2

has four character sets (uppercase letters, lowercase letters, special characters, and numbers) and seven character set changes (M–y, y–P, P–a, s–W, W–d, d–@, and @–2).

The **change-type** statement is optional. If **change-type** is omitted, JUNOS-FIPS plain-text passwords are checked for character sets and JUNOS plain-text passwords are checked for character set changes.

The **minimum-changes** statement specifies how many character sets or character set changes are required for the password. This statement is optional. If **minimum-changes** is not specified, character sets are not checked for JUNOS Software. If the **change-type** statement is configured for **character-set**, then **minimum-changes** must be 5 or less, because the JUNOS Software only supports five character sets.

The **format** statement specifies the hash algorithm (**md5**, **sha1** or **des**) for authenticating plain-text passwords. This statement is optional. For JUNOS Software, the default format is **md5**. For JUNOS-FIPS, only **sha1** is supported.

The **maximum-length** statement specifies the maximum number of characters allowed in a password. This statement is optional. By default JUNOS passwords have no maximum; however, only the first 128 characters are significant. JUNOS-FIPS passwords must be 20 characters or less. The range for JUNOS Software maximum-length passwords is from 20 to 128 characters.

The **minimum-length** statement specifies the minimum number of characters required for a password. This statement is optional. By default JUNOS passwords must be at least 6 characters long, and JUNOS-FIPS passwords must be at least 10 characters long. The range is from 6 to 20 characters.

Changes to password requirements do not take effect until the configuration is committed. When requirements change, only newly created, plain-text passwords are checked; existing passwords are not checked against the new requirements.

The default configuration for JUNOS plain-text passwords is:

```
[edit system login]
passwords {
  change-type character-sets;
  format md5;
  minimum-changes 1;
  minimum-length 6;
}
```

The default configuration for JUNOS-FIPS plain-text passwords is:

```
[edit system login]
passwords {
  change-type set-transitions;
  format sha1;
  maximum-length 20;
  minimum-changes 3;
  minimum-length 10;
}
```

- Related Topics**
- Changing the Requirements for JUNOS Software Plain-Text Passwords on page 67
 - Configuring the Root Password on page 63

Changing the Requirements for JUNOS Software Plain-Text Passwords

To change the requirements for plain-text passwords, include the `password` statement at the `[edit system login]` hierarchy level:

```
[edit system login]
password {
  change-type (set-transitions | character-set);
  format (md5 | sha1 | des);
  maximum-length length;
  minimum-changes number;
  minimum-length length;
}
```



NOTE: These statements apply to plain-text passwords only, not encrypted passwords.

- Related Topics**
- Special Requirements for JUNOS Software Plain-Text Passwords on page 65
 - Configuring the Root Password on page 63

Example: Changing the Requirements for JUNOS Software Plain-Text Passwords

The following example shows how to set the minimum password length to 12 characters and the maximum length to 22 characters:

```
[edit system login]
passwords {
  minimum-length 12;
  maximum-length 22;
}
```

Related Topics ■ Changing the Requirements for JUNOS Software Plain-Text Passwords on page 67

Configuring Multiple Routing Engines to Synchronize Committed Configurations Automatically

If your router has multiple Routing Engines, you can manually direct one Routing Engine to synchronize its configuration with the others by issuing the **commit synchronize** command.

To make the Routing Engines synchronize automatically whenever a configuration is committed, include the **commit synchronize** statement at the **[edit system]** hierarchy level:

```
[edit system]
commit synchronize;
```

The Routing Engine on which you execute the **commit** command (requesting Routing Engine) copies and loads its candidate configuration to the other (responding) Routing Engines. All Routing Engines then perform a syntax check on the candidate configuration file being committed. If no errors are found, the configuration is activated and becomes the current operational configuration on all Routing Engines.

Related Topics ■ JUNOS Software Commit Model for Router Configuration on page 8

Compressing the Current Configuration File

By default, the current operational configuration file is compressed, and is stored in the file **juniper.conf.gz**, in the **/config** file system, along with the last three committed versions of the configuration. If you have large networks, the current configuration file might exceed the available space in the **/config** file system. Compressing the current configuration file enables the file to fit in the file system, typically reducing the size of the file by 90 percent. You might want to compress your current operation configuration files when they reach 3 megabytes (MB) in size.

When you compress the current configuration file, the names of the router's configuration files change. To determine the size of the files in the **/config** file system, issue the **file list /config detail** command.



NOTE: We recommend that you use the default setting (compress the router configuration files) to minimize the amount of disk space that they require.

To compress the current configuration file, include the `compress-configuration-files` statement at the `[edit system]` hierarchy level:

```
[edit system]
compress-configuration-files;
```

Commit the current configuration file to include the `compression-configuration-files` statement. Commit the configuration again to compress the current configuration file:

```
[edit system]
user@host# set compress-configuration-files
user@host# commit
commit complete
user@host# commit
commit complete
```

If you do not want to compress the current operational configuration file, include the `no-compress-configuration-files` statement at the `[edit system]` hierarchy level:

```
[edit system]
no-compress-configuration-files;
```

Commit the current configuration file to include the `no-compress-configuration-files` statement. Commit the configuration again to uncompress the current configuration file:

```
[edit system]
user@host#
user@host# commit
commit complete
user@host# commit
commit complete
```


Chapter 6

Configuring User Access

This chapter covers the following topics:

- JUNOS Software Login Classes Overview on page 72
- Defining JUNOS Software Login Classes on page 73
- JUNOS Software User Accounts Overview on page 73
- Configuring JUNOS Software User Accounts on page 75
- Example: Configuring User Accounts on page 75
- Limiting the Number of User Login Attempts for SSH and Telnet Sessions on page 76
- Example: Limiting the Number of Login Attempts for SSH and Telnet Sessions on page 77
- JUNOS-FIPS Crypto Officer and User Accounts Overview on page 78
- JUNOS Software Access Privilege Levels Overview on page 78
- Configuring Access Privilege Levels on page 81
- Example: Configuring Access Privilege Levels on page 82
- Specifying Access Privileges for JUNOS Software Operational Mode Commands on page 82
- Regular Expressions for Allowing and Denying JUNOS Software Operational Mode Commands on page 83
- Example: Configuring Access Privileges for Operational Mode Commands on page 84
- Specifying Access Privileges for JUNOS Software Configuration Mode Commands on page 84
- Regular Expressions for Allowing and Denying JUNOS Software Configuration Mode Commands on page 85
- Example 1: Defining Access Privileges for Configuration Mode Commands on page 86
- Example 2: Configuring Access Privileges for Individual Configuration Mode Commands on page 87
- Configuring the Timeout Value for Idle Login Sessions on page 87
- Configuring CLI Tips on page 88

JUNOS Software Login Classes Overview

All users who can log in to the router must be in a login class. With login classes, you define the following:

- Access privileges users have when they are logged in to the router
- Commands and statements that users can and cannot specify
- How long a login session can be idle before it times out and the user is logged out

You can define any number of login classes and then apply one login class to an individual user account

The JUNOS Software contains a few predefined login classes, which are listed in Table 6 on page 72. The predefined login classes cannot be modified.

Table 6: Default System Login Classes

Login Class	Permission Flag Set
operator	clear, network, reset, trace, view
read-only	view
super-user	all
unauthorized	None



NOTE: You cannot modify a predefined login class name. If you issue the **set** command on a predefined class name, the JUNOS Software will append **-local** to the login class name. The following message also appears:

warning: '<class-name>' is a predefined class name; changing to '<class-name>-local'



NOTE: You cannot issue the **rename** or **copy** command on a predefined login class. Doing so results in the following error message:

error: target '<class-name>' is a predefined class

Related Topics ■ Defining JUNOS Software Login Classes on page 73

Defining JUNOS Software Login Classes

To define a login class and its access privileges, include the `class` statement at the `[edit system login]` hierarchy level:

```
[edit system login]
class class-name {
  allow-commands "regular-expression";
  allow-configuration "regular-expression";
  deny-commands "regular-expression";
  deny-configuration "regular-expression";
  idle-timeout minutes;
  permissions [ permissions ];
}
```

Related Topics ■ JUNOS Software Login Classes Overview on page 72

JUNOS Software User Accounts Overview

User accounts provide one way for users to access the router. (Users can access the router without accounts if you configured RADIUS or TACACS+ servers, as described in “JUNOS Software User Authentication Methods” on page 45.) For each account, you define the login name for the user and, optionally, information that identifies the user. After you have created an account, the software creates a home directory for the user.

For each user account, you can define the following:

- Username—(Optional) Name that identifies the user. It must be unique within the router. Do not include spaces, colons, or commas in the username. The username can be up to 64 characters long.
- User’s full name—(Optional) If the full name contains spaces, enclose it in quotation marks. Do not include colons or commas.
- User identifier (UID)—(Optional) Numeric identifier that is associated with the user account name. The identifier must be in the range from 100 through 64,000 and must be unique within the router. If you do not assign a UID to a username, the software assigns one when you commit the configuration, preferring the lowest available number.

You must ensure that the UID is unique. However, it is possible to assign the same UID to different users. If you do this, the CLI displays a warning when you commit the configuration and then assigns the duplicate UID.

- User’s access privilege—(Required) One of the login classes you defined in the `class` statement at the `[edit system login]` hierarchy level, or one of the default classes listed in Table 9 on page 86.
- Authentication method or methods and passwords that the user can use to access the router—(Optional) You can use SSH or a Message Digest 5 (MD5) password,

or you can enter a plain-text password that the JUNOS Software encrypts using MD5-style encryption before entering it in the password database. For each method, you can specify the user's password. If you configure the **plain-text-password** option, you are prompted to enter and confirm the password:

```
[edit system login user router-name]
user@host# set authentication plain-text-password
New password: type password here
Retype new password: retype password here
```

The default requirements for plain-text passwords are:

- The password must be between 6 and 128 characters long
 - You can include most character classes in a password (uppercase letters, lowercase letters, numbers, punctuation marks, and other special characters). Control characters are not recommended.
 - Valid passwords must contain at least one change of case or character class.

For each user account and for root logins, you can configure more than one public RSA or DSA key for user authentication. When a user logs in using a user account or as root, the configured public keys are referenced to determine whether the private key matches any of them.

For SSH authentication, you can also copy the contents of an SSH keys file into the configuration.

To load an SSH key file, use the **load-key-file** command. This command loads RSA (SSH version 1 and SSH version 2) and DSA (SSH version 2) public keys.

If you load the SSH keys file, the contents of the file are copied into the configuration immediately after you enter the **load-key-file** statement. To view the SSH keys entries, use the configuration mode **show** command. For example:

```
[edit system login user boojum]
user@host# set authentication load-key-file my-host:.ssh/identity.pub
.file.19692 | 0 KB | 0.3 kB/s | ETA: 00:00:00 | 100%
[edit system]
user@host# show
root-authentication {
  ssh-rsa "1024 35 9727638204084251055468226757249864241630322
207404962528390382038690141584534964170019610608358722961563
475784918273603361276441874265946893207739108344813125957722
625461667999278316123500438660915866283822489746732605661192
181489539813862940327687806538169602027491641637359132693963
44008443 boojum@juniper.net"; # SECRET-DATA
}
```

An account for the user **root** is always present in the configuration. You configure the password for **root** using the **root-authentication** statement, as described in “Configuring the Root Password” on page 63.

JUNOS-FIPS and Common Criteria have special password requirements. FIPS and Common Criteria passwords must be between 10 and 20 characters in length. Passwords must use at least three of the five defined character sets (uppercase letters, lowercase letters, digits, punctuation marks, and other special characters). If JUNOS-FIPS is installed on the router, you cannot configure passwords unless they meet this standard.

- Related Topics**
- Configuring JUNOS Software User Accounts on page 75
 - JUNOS Software Login Classes Overview on page 72

Configuring JUNOS Software User Accounts

User accounts provide one way for users to access the router. For each account, you define the login name for the user and, optionally, information that identifies the user. After you have created an account, the software creates a home directory for the user.

To create user accounts, include the `user` statement at the `[edit system login]` hierarchy level:

```
[edit system login]
user username {
  full-name complete-name;
  uid uid-value;
  class class-name;
  authentication {
    (encrypted-password "password" | plain-text-password);
    ssh-rsa "public-key";
    ssh-dsa "public-key";
  }
}
```

- Related Topics**
- Example: Configuring User Accounts on page 75
 - JUNOS Software User Accounts Overview on page 73

Example: Configuring User Accounts

The following example shows how to create accounts for four router users, and create an account for the template user “remote.” All users use one of the default system login classes. User `alexander` also has two DSA public keys configured for SSH authentication.

```
[edit]
system {
  login {
    user philip {
      full-name "Philip of Macedonia";
      uid 1001;
      class super-user;
      authentication {
        encrypted-password "$1$poPPeY";
```

```

    }
  }
  user alexander {
    full-name "Alexander the Great";
    uid 1002;
    class view;
    authentication {
      encrypted-password "$1$14c5.$sBopasdFFdssdffFFdsdfs0";
      ssh-dsa "8924 37 5678 5678@gaugamela.per";
      ssh-dsa "6273 94 9283@boojum.per";
    }
  }
  user darius {
    full-name "Darius King of Persia";
    uid 1003;
    class operator;
    authentication {
      ssh-rsa "1024 37 12341234@ecbatana.per";
    }
  }
  user anonymous {
    class unauthorized;
  }
  user remote {
    full-name "All remote users";
    uid 9999;
    class read-only;
  }
}

```

Related Topics ■ Example: Configuring User Accounts on page 75

Limiting the Number of User Login Attempts for SSH and Telnet Sessions

Beginning with JUNOS Release 8.0, you can limit the number of times a user can attempt to enter a password while logging in through SSH or Telnet. The connection is terminated if a user fails to log in after the number of attempts specified. You can also specify a delay, in seconds, before a user can try to enter a password after a failed attempt. In addition, you can specify the threshold for the number of failed attempts before the user experiences a delay in being able to enter a password again.

To specify the number of times a user can attempt to enter a password while logging in, include the `retry-options` statement at the `[edit system login]` hierarchy level:

```

[edit system login]
retry-options {
  tries-before-disconnect number;
  backoff-threshold number;
  backoff-factor seconds;
  minimum-time seconds;
}
password {
}

```

You can configure the following options.

- **tries-before-disconnect**—Number of times a user can attempt to enter a password when logging in. The connection closes if a user fails to log in after the number specified. The range is from 1 through 10, and the default is 10.
- **backoff-threshold**—Threshold for the number of failed login attempts before the user experiences a delay in being able to enter a password again. Use the **backoff-factor** option to specify the length of the delay in seconds. The range is from 1 through 3, and the default is 2.
- **backoff-factor**—Length of time, in seconds, before a user can attempt to log in after a failed attempt. The delay increases by the value specified for each subsequent attempt after the threshold. The range is from 5 through 10, and the default is 5 seconds.
- **minimum-time**—Minimum length of time, in seconds, that a connection remains open while a user is attempting to enter a correct password. The range is from 20 through 60, and the default is 40.

- Related Topics**
- Example: Limiting the Number of Login Attempts for SSH and Telnet Sessions on page 77
 - Configuring JUNOS Software User Accounts on page 75

Example: Limiting the Number of Login Attempts for SSH and Telnet Sessions

The following example shows how to limit the user to four attempts when the user enters a password while logging in through SSH or Telnet. Set the **backoff-threshold** to 2, the **back-off-factor** to 5 seconds, and the **minimum-time** to 40 seconds. The user experiences a delay of 5 seconds after the second attempt to enter a correct password fails. After each subsequent failed attempt, the delay increases by 5 seconds. After the fourth and final failed attempt to enter a correct password, the user experiences an additional 10-second delay, and the connection closes after a total of 40 seconds.

```
[edit]
system {
  login {
    retry-options {
      tries-before-disconnect 4;
      backoff-threshold 2;
      backoff-factor 5;
      minimum-time 40;
    }
    password {
    }
  }
}
```

- Related Topics** ■ Limiting the Number of User Login Attempts for SSH and Telnet Sessions on page 76

JUNOS-FIPS Crypto Officer and User Accounts Overview

JUNOS-FIPS defines a restricted set of user roles. Unlike the JUNOS Software, which enables a wide range of capabilities to users, FIPS 140-2 defines specific types of users (Crypto Officer, User, and Maintenance). Crypto Officers and FIPS Users perform all FIPS-related configuration tasks and issue all FIPS-related commands. Crypto Officer and FIPS User configurations must follow FIPS 140-2 guidelines. Typically, no user besides a Crypto Officer can perform FIPS-related tasks.

Crypto Officer User Configuration

JUNOS-FIPS offers finer control of user permissions than those mandated by FIPS 140-2. For FIPS 140-2 conformance, any JUNOS-FIPS user with the **secret**, **security**, and **maintenance** permission bits set is a Crypto Officer. In most cases, the **super-user** class should be reserved for a Crypto Officer. A FIPS User can be defined as any JUNOS-FIPS user that does not have the **secret**, **security**, and **maintenance** bits set.

FIPS User Configuration

A Crypto Officer sets up FIPS Users. FIPS Users can be granted permissions normally reserved for a Crypto Officer; for example, permission to zeroize the system and individual AS-II FIPS PICs.

JUNOS Software Access Privilege Levels Overview

Each top-level command-line interface (CLI) command and each configuration statement have an access privilege level associated with it. Users can execute only those commands and configure and view only those statements for which they have access privileges. The access privileges for each login class are defined by one or more *permission flags*.

For each login class, you can explicitly deny or allow the use of operational and configuration mode commands that would otherwise be permitted or not allowed by a privilege level specified in the **permissions** statement.

The following sections provide additional information:

- JUNOS Software Login Class Permission Flags on page 78
- Allowing or Denying Individual Commands for JUNOS Software Login Classes on page 81

JUNOS Software Login Class Permission Flags

The **permissions** statement specifies one or more of the permission flags listed in Table 7 on page 79. Permission flags are not cumulative, so for each class you must list all the permission flags needed, including **view** to display information and **configure**

to enter configuration mode. Two forms for the permissions control the individual parts of the configuration:

- “Plain” form—Provides read-only capability for that permission type. An example is `interface`.
- Form that ends in `-control`—Provides read and write capability for that permission type. An example is `interface-control`.

Table 7 on page 79 lists the JUNOS Software login class permission flags that you can configure by including the `permissions` statement at the `[edit system login class class-name]` hierarchy level:

Table 7: Login Class Permission Flags

Permission Flag	Description
<code>access</code>	Can view the access configuration in configuration mode using the <code>show configuration</code> operational mode command.
<code>access-control</code>	Can view and configure access information at the <code>[edit access]</code> hierarchy level.
<code>admin</code>	Can view user account information in configuration mode and with the <code>show configuration</code> command.
<code>admin-control</code>	Can view user accounts and configure them at the <code>[edit system login]</code> hierarchy level.
<code>all</code>	Has all permissions.
<code>clear</code>	Can clear (delete) information learned from the network that is stored in various network databases using the <code>clear</code> commands.
<code>configure</code>	Can enter configuration mode using the <code>configure</code> command.
<code>control</code>	Can perform all control-level operations—all operations configured with the <code>-control</code> permission flags.
<code>field</code>	Reserved for field (debugging) support.
<code>firewall</code>	Can view the firewall filter configuration in configuration mode.
<code>firewall-control</code>	Can view and configure firewall filter information at the <code>[edit firewall]</code> hierarchy level.
<code>floppy</code>	Can read from and write to the removable media.
<code>flow-tap</code>	Can view the flow-tap configuration in configuration mode.
<code>flow-tap control</code>	Can view the flow-tap configuration in configuration mode and can configure flow-tap configuration information at the <code>[edit services flow-tap]</code> hierarchy level.
<code>flow-tap-operation</code>	Can make flow-tap requests to the router. For example, a Dynamic Tasking Control Protocol (DTCP) client must authenticate itself to JUNOS as an administrative user. That account must have <code>flow-tap-operation</code> permission.
NOTE: <code>flow-tap operation</code> is not included in the <code>all</code> permission.	

Table 7: Login Class Permission Flags (continued)

Permission Flag	Description
interface	Can view the interface configuration in configuration mode and with the show configuration operational mode command.
interface-control	Can view the interface configuration in configuration mode and with the show configuration operational mode command.
maintenance	Can perform system maintenance, including starting a local shell on the router and becoming the superuser in the shell using the su root command, and can halt and reboot the router using the request system commands.
network	Can access the network by entering the ping , SSH , telnet , and traceroute commands.
reset	Can restart software processes using the restart command and can configure whether software processes are enabled or disabled at the [edit system processes] hierarchy level.
rollback	Can use the rollback command to return to a previously committed configuration other than the most recently committed one.
routing	Can view general routing, routing protocol, and routing policy configuration information in configuration and operational modes.
routing-control	Can view general routing, routing protocol, and routing policy configuration information and configure general routing at the [edit routing-options] hierarchy level, routing protocols at the [edit protocols] hierarchy level, and routing policy at the [edit policy-options] hierarchy level.
secret	Can view passwords and other authentication keys in the configuration.
secret-control	Can view passwords and other authentication keys in the configuration and can modify them in configuration mode.
security	Can view security configuration in configuration mode and with the show configuration operational mode command.
security-control	Can view and configure security information at the [edit security] hierarchy level.
shell	Can start a local shell on the router by entering the start shell command.
snmp	Can view Simple Network Management Protocol (SNMP) configuration information in configuration and operational modes.
snmp-control	Can view SNMP configuration information and modify SNMP configuration at the [edit snmp] hierarchy level.
system	Can view system-level information in configuration and operational modes.
system-control	Can view system-level configuration information and configure it at the [edit system] hierarchy level.
trace	Can view trace file settings in configuration and operational modes.
trace-control	Can view trace file settings and configure trace file properties.
view	Can use various commands to display current systemwide, routing table, and protocol-specific values and statistics. Cannot view secret configuration.

Allowing or Denying Individual Commands for JUNOS Software Login Classes

By default, all top-level CLI commands have associated access privilege levels. Users can execute only those commands and view only those statements for which they have access privileges. For each login class, you can explicitly deny or allow the use of operational and configuration mode commands that would otherwise be permitted or not allowed by a privilege level specified in the **permissions** statement.



NOTE: The all login class permission bits take precedence over extended regular expressions when a user with **rollback** permission issues the **rollback** command.

Expressions used to allow and deny commands for users on RADIUS/TACACS+ servers have been simplified. Instead of a single, long expression with multiple commands (**allow-commands=cmd1 cmd2 cmdn**) you can specify each command as a separate expression. This new syntax is valid for **allow-configuration** and **deny-configuration**, **allow-command** and **deny-command**, and **user-permissions**.

Users cannot issue the **load override** command when specifying an extended regular expression. Users can only issue the **merge**, **replace**, and **patch** configuration commands.

Related Topics ■ Configuring Access Privilege Levels on page 81

Configuring Access Privilege Levels

Each top-level command-line interface (CLI) command and each configuration statement has an access privilege level associated with it. Users can execute only those commands and configure and view only those statements for which they have access privileges.

To configure access privilege levels, include the **permissions** statement at the [edit system login class *class-name*] hierarchy level:

```
[edit system login class class-name]
permissions [ permissions ];
```

Related Topics ■ Example: Configuring Access Privilege Levels on page 82

- JUNOS Software Access Privilege Levels Overview on page 78
- Specifying Access Privileges for JUNOS Software Operational Mode Commands on page 82
- Specifying Access Privileges for JUNOS Software Configuration Mode Commands on page 84

Example: Configuring Access Privilege Levels

Create two access privilege classes on the router, one for configuring and viewing user accounts only and the second for configuring and viewing SNMP parameters only:

```
[edit]
system {
  login {
    class user-accounts {
      permissions [ configure admin admin-control ];
    }
    class network-mgmt {
      permissions [ configure snmp snmp-control ];
    }
  }
}
```

Related Topics ■ Configuring Access Privilege Levels on page 81

Specifying Access Privileges for JUNOS Software Operational Mode Commands

You can specify extended regular expressions with the **allow-commands** and **deny-commands** statements to define a user's access privileges to individual operational commands. Doing so takes precedence over login class permission bits set for a user. You can include one **deny-commands** and one **allow-commands** statement in each login class.

To explicitly allow an individual operational mode command that would otherwise be denied, include the **allow-commands** statement at the **[edit system login class *class-name*]** hierarchy level:

```
[edit system login class class-name]
allow-commands "regular-expression";
```

To explicitly deny an individual operational mode command that would otherwise be allowed, include the **deny-commands** statement at the **[edit system login class *class-name*]** hierarchy level:

```
[edit system login class class-name]
deny-commands "regular-expression";
```

If the regular expression contains any spaces, operators, or wildcard characters, enclose it in quotation marks. Regular expressions are not case-sensitive.



NOTE: Modifiers are not supported within the regular expression string to be matched. If a modifier is used, then nothing is matched.

For example, the deny command `set protocols` does not match anything whereas `protocols` matches *protocols*.

- Related Topics**
- `allow-commands "show interfaces";`
 - Regular Expressions for Allowing and Denying JUNOS Software Operational Mode Commands on page 83
 - Example 1: Defining Access Privileges for Configuration Mode Commands on page 86
 - Example: Configuring Access Privileges for Operational Mode Commands on page 84

Regular Expressions for Allowing and Denying JUNOS Software Operational Mode Commands

Use extended regular expressions to specify which operational mode commands are denied or allowed. Table 8 on page 83 lists common regular expression operators that can be used in the operational mode commands. Command regular expressions implement the extended (modern) regular expressions as defined in POSIX 1003.2.

Table 8: Common Regular Expression Operators to Allow or Deny Operational Mode Commands

Operator	Match
	One of two or more terms separated by the pipe () symbol. Each term must be a complete standalone expression enclosed in parentheses (), with no spaces between the pipe and the adjacent parentheses. For example, (show system alarms) (show system software).
^	At the beginning of an expression, used to denote where the command begins, and where there might be some ambiguity.
\$	Character at the end of a command. Used to denote a command that must be matched exactly up to that point. For example, <code>allow-commands "show interfaces\$"</code> means that the user can issue the <code>show interfaces</code> command but cannot issue the <code>show interfaces detail</code> or <code>show interfaces extensive</code> command.
[]	Range of letters or digits. To separate the start and end of a range, use a hyphen (-).
()	A group of commands, indicating a complete, standalone expression to be evaluated; the result is then evaluated as part of the overall expression. Parentheses must always be used in conjunction with pipe operators as explained above.

If a regular expression contains a syntax error, it becomes invalid, and although the user can log in, the permission granted or denied by the regular expression does not take effect. When regular expressions configured on TACACS+ or RADIUS servers merge with regular expressions configured on the router, if the final expression has a syntax error, the overall result is an invalid regular expression. If a regular expression does not contain any operators, all varieties of the command are allowed. For example, if the following statement is included in the configuration, the user can issue the commands `show interfaces detail` and `show interfaces extensive` in addition to showing an individual interface:

```
allow-commands "show interfaces";
```

Related Topics ■ Specifying Access Privileges for JUNOS Software Operational Mode Commands on page 82

Example: Configuring Access Privileges for Operational Mode Commands

The following example shows how to configure access privileges for different login classes for individual operational mode commands:

```
[edit]
system {
  login {
    # This login class has operator privileges and the additional ability to reboot the
    # router.
    class operator-and-boot {
      permissions [ clear network reset trace view ];
      allow-commands "request system reboot";
    }
    # This login class has operator privileges but can't use any commands beginning
    # with "set" .
    class operator-no-set {
      permissions [ clear network reset trace view ];
      deny-commands "^set";
    }
    # This login class has operator privileges and can install software but not view
    # BGP information, and can issue the show route command, without specifying
    # commands or arguments under it.
    class operator-and-install-but-no-bgp {
      permissions [ clear network reset trace view ];
      allow-commands "(request system software add)|(show route$)";
      deny-commands "show bgp";
    }
  }
}
```

Related Topics ■ Specifying Access Privileges for JUNOS Software Operational Mode Commands on page 82

Specifying Access Privileges for JUNOS Software Configuration Mode Commands

You can specify extended regular expressions with the `allow-configuration` and `deny-configuration` attributes to define user access privileges to parts of the

configuration hierarchy or individual configuration mode commands. Doing so overrides login class permission bits set for a user. You can also use wildcards to restrict access. When you define access privileges to parts of the configuration hierarchy or individual configuration mode commands, do the following:

- Specify the full paths in the extended regular expressions with the `allow-configuration` and `deny-configuration` attributes.
- Enclose parentheses around an extended regular expression that connects two or more expressions with the pipe `|` symbol. For example:

```
[edit system login class class-name]
user@host# set deny-configuration "(system login class) | (system services)"
```



NOTE: Each expression separated by a pipe (`|`) symbol must be a complete standalone expression, and must be enclosed in parentheses (`()`). Do not use spaces between regular expressions separated with parentheses and connected with the pipe (`|`) symbol. You cannot define access to keywords such as `set`, `edit`, or `activate`.

To explicitly allow an individual configuration mode command that would otherwise be denied, include the `allow-configuration` statement at the `[edit system login class class-name]` hierarchy level:

```
[edit system login class class-name]
allow-configuration "regular-expression";
```

To explicitly deny an individual configuration mode command that would otherwise be allowed, include the `deny-configuration` statement at the `[edit system login class class-name]` hierarchy level:

```
[edit system login class class-name]
deny-configuration "regular-expression";
```

You can include one `deny-configuration` and one `allow-configuration` statement in each login class.

- Related Topics**
- Example 1: Defining Access Privileges for Configuration Mode Commands on page 86
 - Example 2: Configuring Access Privileges for Individual Configuration Mode Commands on page 87
 - Regular Expressions for Allowing and Denying JUNOS Software Configuration Mode Commands on page 85
 - Configuring Access Privilege Levels on page 81

Regular Expressions for Allowing and Denying JUNOS Software Configuration Mode Commands

Use extended regular expressions to specify which configuration mode commands are denied or allowed. You specify these regular expressions in the `allow-configuration`

and `deny-configuration` statements at the `[edit system login class]` hierarchy level, or by specifying Juniper Networks vendor-specific TACACS+ or RADIUS attributes in your authentication server's configuration. If regular expressions are received during TACACS+ or RADIUS authentication, they merge with any regular expressions configured on the local router.

Table 9 on page 86 lists common regular expression operators that you can use for allowing or denying commands for configuration mode commands.

Command regular expressions implement the extended (modern) regular expressions, as defined in POSIX 1003.2.

Table 9: Configuration Mode Commands—Common Regular Expression Operators

Operator	Match
	One of two or more terms separated by the pipe. Each term must be a complete standalone expression enclosed in parentheses (), with no spaces between the pipe and the adjacent parentheses. For example, <code>(show system alarms) (show system software)</code> .
^	At the beginning of an expression, used to denote where the command begins, where there might be some ambiguity.
\$	Character at the end of a command. Used to denote a command that must be matched exactly up to that point. For example, <code>allow-commands "show interfaces\$"</code> means that the user can issue the <code>show interfaces</code> command but cannot issue <code>show interfaces detail</code> or <code>show interfaces extensive</code> .
[]	Range of letters or digits. To separate the start and end of a range, use a hyphen (-).
()	A group of commands, indicating a complete, standalone expression to be evaluated; the result is then evaluated as part of the overall expression. Parentheses must always be used in conjunction with pipe operators as explained above.
*	Zero or more terms.
+	One or more terms.
.	Any character except for a space " ".

Related Topics ■ Specifying Access Privileges for JUNOS Software Configuration Mode Commands on page 84

Example 1: Defining Access Privileges for Configuration Mode Commands

The following examples show how to configure access privileges for individual configuration mode commands.

If the following statement is included in the configuration and the user's login class permission bit is set to `all`, the user cannot configure telnet parameters:

```
[edit system login class class-name]
```



```
user@host# set deny-configuration "system services telnet"
```

If the following statement is included in the configuration and the user's login class permission bit is set to **all**, the user cannot issue login class commands within any login class whose name begins with "m":

```
[edit system login class class-name]
user@host# set deny-configuration "system login class m.*"
```

If the following statement is included in the configuration and the user's login class permission bit is set to **all**, the user cannot issue configuration mode commands at the login class or system services hierarchy levels:

```
[edit system login class class-name]
user@host# set deny-configuration "(system login class) | (system services)"
```

Related Topics ■ Specifying Access Privileges for JUNOS Software Configuration Mode Commands on page 84

Example 2: Configuring Access Privileges for Individual Configuration Mode Commands

The following example shows how to configure permissions for individual configuration mode commands:

```
[edit]
system {
  login {
    # This login class has operator privileges and the additional ability to issue
    # commands at the system services hierarchy level.
    class only-system-services {
      permissions [ configure ];
      allow-configuration "system services";
    }
    # This login class has operator privileges but cannot issue any system
    # services commands.
    class all-except-system-services {
      permissions [ all ];
      deny-configuration "system services";
    }
  }
}
```

Related Topics ■ Specifying Access Privileges for JUNOS Software Configuration Mode Commands on page 84

Configuring the Timeout Value for Idle Login Sessions

An idle login session is one in which the CLI operational mode prompt is displayed but there is no input from the keyboard. By default, a login session remains established until a user logs out of the router, even if that session is idle. To close idle sessions automatically, you configure a time limit for each login class. If a session

established by a user in that class remains idle for the configured time limit, the session automatically closes.

To define the timeout value for idle login sessions, include the `idle-timeout` statement at the `[edit system login class class-name]` hierarchy level:

```
[edit system login class class-name]  
idle-timeout minutes;
```

Specify the number of minutes that a session can be idle before it is automatically closed.

If you have configured a timeout value, the CLI displays messages similar to the following when timing out an idle user. It starts displaying these messages 5 minutes before timing out the user.

```
user@host# Session will be closed in 5 minutes if there is no activity.  
Warning: session will be closed in 1 minute if there is no activity  
Warning: session will be closed in 10 seconds if there is no activity  
Idle timeout exceeded: closing session
```

If you configure a timeout value, the session closes after the specified time has elapsed except if the user is running telnet or monitoring interfaces using the `monitor interface` or `monitor traffic` command.

Related Topics ■ Defining JUNOS Software Login Classes on page 73

Configuring CLI Tips

The JUNOS CLI provides the option of configuring CLI tips for the user. By default, the `tip` command is not enabled when a user logs in. To enable tips, include the `login-tip` statement at the `[edit system login class class-name]` hierarchy level:

```
[edit system login class class-name]  
login-tip;
```

Adding this statement enables the `tip` command for the class specified, provided the user logs in using the CLI.

Related Topics ■ Defining JUNOS Software Login Classes on page 73

Chapter 7

Configuring System Authentication

This chapter covers the following topics:

- Configuring RADIUS Authentication on page 89
- Juniper Networks Vendor-Specific RADIUS Attributes on page 92
- Configuring TACACS+ Authentication on page 94
- Juniper Networks Vendor-Specific TACACS+ Attributes on page 96
- Overview of Template Accounts for RADIUS and TACACS+ Authentication on page 98
- Configuring Remote Template Accounts for User Authentication on page 98
- Configuring Local User Template Accounts for User Authentication on page 99
- Using Regular Expressions on a TACACS+ or RADIUS Server to Allow or Deny Access to Commands on page 101
- JUNOS Software Authentication Order for RADIUS, TACACS+, and Password Authentication on page 102
- Configuring the JUNOS Software Authentication Order for RADIUS, TACACS+, and Local Password Authentication on page 106
- Example: Configuring System Authentication for RADIUS, TACACS+, and Password Authentication on page 107
- Recovering the Root Password on page 109

Configuring RADIUS Authentication

RADIUS authentication is a method of authenticating users who attempt to access the router. Tasks to configure RADIUS authentication are:

- Configuring RADIUS Server Details on page 89
- Configuring MS-CHAPv2 for Password-Change Support on page 90
- Specifying a Source Address for the JUNOS Software to Access External RADIUS Servers on page 91

Configuring RADIUS Server Details

To use RADIUS authentication on the router, configure information about one or more RADIUS servers on the network by including one **radius-server** statement at the **[edit system]** hierarchy level for each RADIUS server:

```
[edit system]
radius-server server-address {
  accounting-port port-number;
  port port-number;
  retry number;
  secret password;
  source-address source-address;
  timeout seconds;
}
```

server-address is the address of the RADIUS server.

You can specify a port on which to contact the RADIUS server. By default, port number **1812** is used (as specified in RFC 2865). You can also specify an accounting port to send accounting packets. The default is **1813** (as specified in RFC 2866).

You must specify a password in the **secret password** statement. If the password contains spaces, enclose it in quotation marks. The secret used by the local router must match that used by the server.

Optionally, you can specify the amount of time that the local router waits to receive a response from a RADIUS server (in the **timeout** statement) and the number of times that the router attempts to contact a RADIUS authentication server (in the **retry** statement). By default, the router waits 3 seconds. You can configure this to be a value in the range from 1 through 90 seconds. By default, the router retries connecting to the server 3 times. You can configure this to be a value in the range from 1 through 10 times.

You can use the **source-address** statement to specify a logical address for individual or multiple RADIUS servers.

To configure multiple RADIUS servers, include multiple **radius-server** statements.

To configure a set of users that share a single account for authorization purposes, you create a template user. To do this, include the **user** statement at the **[edit system login]** hierarchy level, as described in “Overview of Template Accounts for RADIUS and TACACS+ Authentication” on page 98.

You can also configure RADIUS authentication at the **[edit access]** and **[edit access profile]** hierarchy level. The JUNOS Software uses the following search order to determine which set of servers are used for authentication:

1. **[edit access profile profile-name radius-server server-address]**
2. **[edit access radius-server server-address]**
3. **[edit system radius-server server-address]**

Configuring MS-CHAPv2 for Password-Change Support

The JUNOS Software enables you to configure the Microsoft implementation of the Challenge Handshake Authentication Protocol version 2 (MS-CHAPv2) on the router to support changing of passwords. This feature provides users accessing a router the

option of changing the password when the password expires, is reset, or is configured to be changed at next logon.

Before you configure MS-CHAPv2 for password-change support, ensure that you have done the following:

- Configured RADIUS server authentication parameters.
- Set the first tried option in the authentication order to RADIUS server.

To configure MS-CHAP-v2, include the following statements at the [edit system radius-options] hierarchy level:

```
[edit system radius-options]
password-protocol mschap-v2;
```

The following example shows statements for configuring the MS-CHAPv2 password protocol, password authentication order, and user accounts:

```
[edit]
system {
  authentication-order [ radius password ];
  radius-server {
    192.168.69.149 secret "$9$Gj.5Qz6tpBk.1hrIXxUjiq5Qn/C"; ## SECRET-DATA
  }
  radius-options {
    password-protocol mschap-v2;
  }
  login {
    user bob {
      class operator;
    }
  }
}
```

Specifying a Source Address for the JUNOS Software to Access External RADIUS Servers

You can specify which source address the JUNOS Software uses when accessing your network to contact an external RADIUS server for authentication. You can also specify which source address the JUNOS Software uses when contacting a RADIUS server for sending accounting information.

To specify a source address for a RADIUS server, include the **source-address** statement at the [edit system radius-server *server-address*] hierarchy level:

```
[edit system radius-server server-address]
source-address source-address;
```

source-address is a valid IP address configured on one of the router interfaces.



NOTE: You can configure the JUNOS Software to select a fixed address as the source address for locally generated IP packets.

- Related Topics**
- [Juniper Networks Vendor-Specific RADIUS Attributes on page 92](#)
 - [Overview of Template Accounts for RADIUS and TACACS+ Authentication on page 98](#)

Juniper Networks Vendor-Specific RADIUS Attributes

The JUNOS Software supports the configuration of Juniper Networks RADIUS vendor-specific attributes (VSAs). These VSAs are encapsulated in a RADIUS vendor-specific attribute with the vendor ID set to the Juniper Networks ID number, 2636. Table 10 on page 92 lists the Juniper Networks VSAs you can configure.

Table 10: Juniper Networks Vendor-Specific RADIUS Attributes

Name	Description	Type	Length	String
Juniper-Local-User-Name	Indicates the name of the user template used by this user when logging in to a device. This attribute is used only in Access-Accept packets.	1	≥3	One or more octets containing printable ASCII characters.
Juniper-Allow-Commands	Contains an extended regular expression that enables the user to run operational mode commands in addition to the commands authorized by the user's login class permission bits. This attribute is used only in Access-Accept packets.	2	≥3	One or more octets containing printable ASCII characters, in the form of an extended regular expression. See Table 8 on page 83.
Juniper-Deny-Commands	Contains an extended regular expression that denies the user permission to run operation mode commands authorized by the user's login class permission bits. This attribute is used only in Access-Accept packets.	3	≥3	One or more octets containing printable ASCII characters, in the form of an extended regular expression. See Table 8 on page 83.
Juniper-Allow-Configuration	Contains an extended regular expression that enables the user to run configuration mode commands in addition to the commands authorized by the user's login class permission bits. This attribute is used only in Access-Accept packets.	4	≥3	One or more octets containing printable ASCII characters, in the form of an extended regular expression. See "Regular Expressions for Allowing and Denying JUNOS Software Configuration Mode Commands" on page 85.

Table 10: Juniper Networks Vendor-Specific RADIUS Attributes (continued)

Name	Description	Type	Length	String
Juniper-Deny-Configuration	Contains an extended regular expression that denies the user permission to run configuration commands authorized by the user's login class permission bits. This attribute is used only in Access-Accept packets.	5	≥3	One or more octets containing printable ASCII characters, in the form of an extended regular expression. See "Regular Expressions for Allowing and Denying JUNOS Software Configuration Mode Commands" on page 85.
Juniper-Interactive-Command	Indicates the interactive command entered by the user. This attribute is used only in Accounting-Request packets.	8	≥3	One or more octets containing printable ASCII characters.
Juniper-Configuration-Change	Indicates the interactive command that results in a configuration (database) change. This attribute is used only in Accounting-Request packets.	9	≥3	One or more octets containing printable ASCII characters.
Juniper-User-Permissions	<p>Contains information the server uses to specify user permissions. This attribute is used only in Access-Accept packets.</p> <p>NOTE: When the <code>Juniper-User-Permissions</code> attribute is configured to grant the JUNOS <code>maintenance</code> or all permissions on a RADIUS server, the UNIX wheel group membership is not automatically added to a user's list of group memberships. Some operations such as running the <code>su root</code> command from a local shell require wheel group membership permissions. However, when a user is configured locally with permissions <code>maintenance</code> or <code>all</code>, the user is automatically granted membership to the UNIX wheel group. Therefore, we recommend that you create a template user account with the required permissions and associate individual user accounts with the template user account.</p>	10	≥3	<p>One or more octets containing printable ASCII characters.</p> <p>The string is a list of permission flags separated by a space. The exact name of each flag must be specified in its entirety. See Table 7 on page 79.</p>

For more information about the VSAs, see RFC 2138, *Remote Authentication Dial In User Service (RADIUS)*.

Related Topics ■ Configuring RADIUS Authentication on page 89

Configuring TACACS+ Authentication

TACACS+ authentication is a method of authenticating users who attempt to access the router. Tasks to configure TACACS+ configuration are:

- Configuring TACACS+ Server Details on page 94
- Specifying a Source Address for the JUNOS Software to Access External TACACS+ Servers on page 95
- Configuring the Same Authentication Service for Multiple TACACS+ Servers on page 95
- Configuring Juniper Networks Vendor-Specific TACACS+ Attributes on page 96

Configuring TACACS+ Server Details

To use TACACS+ authentication on the router, configure information about one or more TACACS+ servers on the network by including the **tacplus-server** statement at the [edit system] hierarchy level:

```
[edit system]
tacplus-server server-address {
  port port-number;
  secret password;
  single-connection;
  timeout seconds;
}
```

server-address is the address of the TACACS+ server.

port-number is the TACACS+ server port number.

You must specify a secret (password) that the local router passes to the TACACS+ client by including the **secret** statement. If the password included spaces, enclose the password in quotation marks. The secret used by the local router must match that used by the server.

Optionally, you can specify the length of time that the local router waits to receive a response from a TACACS+ server by including the **timeout** statement. By default, the router waits 3 seconds. You can configure this to be a value in the range from 1 through 90 seconds.

Optionally, you can have the software maintain one open Transmission Control Protocol (TCP) connection to the server for multiple requests, rather than opening a connection for each connection attempt by including the **single-connection** statement.



NOTE: Early versions of the TACACS + server do not support the `single-connection` option. If you specify this option and the server does not support it, the JUNOS Software will be unable to communicate with that TACACS + server.

To configure multiple TACACS + servers, include multiple `tacplus-server` statements.

On a TX Matrix router, TACACS + accounting should be configured only under the groups `re0` and `re1`.



NOTE: Accounting should not be configured at the `[edit system]` hierarchy level; on a TX Matrix router, control is done under the switch-card chassis only.

To configure a set of users that share a single account for authorization purposes, you create a template user. To do this, include the `user` statement at the `[edit system login]` hierarchy level, as described in “Overview of Template Accounts for RADIUS and TACACS + Authentication” on page 98.

Specifying a Source Address for the JUNOS Software to Access External TACACS+ Servers

You can specify which source address the JUNOS Software uses when accessing your network to contact an external TACACS + server for authentication. You can also specify which source address the JUNOS Software uses when contacting a TACACS + server for sending accounting information.

To specify a source address for a TACACS + server for authentication, include the `source-address` statement at the `[edit system tacplus-server server-address]` hierarchy level:

```
[edit system tacplus-server server-address]
source-address source-address;
```

source-address is a valid IP address configured on one of the router interfaces.

To specify a source address for a TACACS + server for system accounting, include the `source-address` statement at the `[edit system accounting destination tacplus server server-address]` hierarchy level:

```
[edit system accounting destination tacplus server server-address]
source-address source-address;
```

source-address is a valid IP address configured on one of the router interfaces.

Configuring the Same Authentication Service for Multiple TACACS+ Servers

To configure the same authentication service for multiple TACACS + servers, include statements at the `[edit system tacplus-server]` and `[edit system tacplus-options]` hierarchy levels. For information about how to configure a TACACS + server at the `[edit system tacplus-server]` hierarchy level, see “Configuring TACACS + Authentication” on page 94.

To assign the same authentication service to multiple TACACS+ servers, include the `service-name` statement at the `[edit system tacplus-options]` hierarchy level:

```
[edit system tacplus-options]
service-name service-name;
```

service-name is the name of the authentication service. By default, the service name is set to `junos-exec`.

The following example shows how to configure the same authentication service for multiple TACACS+ servers:

```
[edit system]
tacplus-server {
  10.2.2.2 secret "$9$2dgoJGDiqP5ZG9A"; ## SECRET-DATA
  10.3.3.3 secret "$9$2dgoJGDiqP5ZG9A"; ## SECRET-DATA
}
tacplus-options {
  service-name bob;
}
```

Configuring Juniper Networks Vendor-Specific TACACS+ Attributes

The Juniper Networks Vendor-Specific TACACS+ Attributes enable you to configure access privileges for users on a TACACS+ server. They are specified in the TACACS+ server configuration file on a per-user basis. The JUNOS Software retrieves these attributes through an authorization request of the TACACS+ server after authenticating a user. You do not need to configure these attributes to run the JUNOS Software with TACACS+.

To specify these attributes, include a `service` statement of the following form in the TACACS+ server configuration file:

```
service = junos-exec {
  local-user-name = <username-local-to-router>
  allow-commands = "<allow-commands-regex>"
  allow-configuration = "<allow-configuration-regex>"
  deny-commands = "<deny-commands-regex>"
  deny-configuration = "<deny-configuration-regex>"
}
```

This `service` statement can appear in a `user` or `group` statement.

- Related Topics**
- Juniper Networks Vendor-Specific TACACS+ Attributes on page 96
 - Overview of Template Accounts for RADIUS and TACACS+ Authentication on page 98

Juniper Networks Vendor-Specific TACACS+ Attributes

The JUNOS Software supports the configuration of Juniper Networks TACACS+ vendor-specific attributes (VSAs). These VSAs are encapsulated in a TACACS+

vendor-specific attribute with the vendor ID set to the Juniper Networks ID number, 2636. Table 11 on page 97 lists the Juniper Networks VSAs you can configure.

Table 11: Juniper Networks Vendor-Specific TACACS+ Attributes

Name	Description	Length	String
local-user-name	Indicates the name of the user template used by this user when logging in to a device.	≥3	One or more octets containing printable ASCII characters.
allow-commands	Contains an extended regular expression that enables the user to run operational mode commands in addition to those commands authorized by the user's login class permission bits.	≥3	One or more octets containing printable ASCII characters, in the form of an extended regular expression. See Table 8 on page 83.
allow-configuration	Contains an extended regular expression that enables the user to run configuration mode commands in addition to those commands authorized by the user's login class permission bits.	≥3	One or more octets containing printable ASCII characters, in the form of an extended regular expression. See "Regular Expressions for Allowing and Denying JUNOS Software Configuration Mode Commands" on page 85.
deny-commands	Contains an extended regular expression that denies the user permission to run operational mode commands authorized by the user's login class permission bits.	≥3	One or more octets containing printable ASCII characters, in the form of an extended regular expression. See Table 8 on page 83.
deny-configuration	Contains an extended regular expression that denies the user permission to run configuration mode commands authorized by the user's login class permission bits.	≥3	One or more octets containing printable ASCII characters, in the form of an extended regular expression. See Table 9 on page 86.

Table 11: Juniper Networks Vendor-Specific TACACS+ Attributes *(continued)*

Name	Description	Length	String
user-permissions	<p>Contains information the server uses to specify user permissions.</p> <p>NOTE: When the <code>user-permissions</code> attribute is configured to grant the JUNOS <code>maintenance</code> or <code>all</code> permissions on a TACACS+ server, the UNIX wheel group membership is not automatically added to a user's list of group memberships. Some operations such as running the <code>su root</code> command from a local shell require wheel group membership permissions. However, when a user is configured locally with permissions <code>maintenance</code> or <code>all</code>, the user is automatically granted membership to the UNIX wheel group. Therefore, we recommend that you create a template user account with the required permissions and associate individual user accounts with the template user account.</p>	≥3	One or more octets containing printable ASCII characters. See Table 7 on page 79.

Related Topics ■ Configuring Juniper Networks Vendor-Specific TACACS+ Attributes on page 96

Overview of Template Accounts for RADIUS and TACACS+ Authentication

When you use local password authentication, you must create a local user account for every user who wants to access the system. However, when you are using RADIUS or TACACS+ authentication, you can create single accounts (for authorization purposes) that are shared by a set of users. You create these accounts using the remote and local user template accounts. When a user is using a template account, the command-line interface (CLI) username is the login name; however, the privileges, file ownership, and effective user ID are inherited from the template account.

Related Topics ■ Configuring Remote Template Accounts for User Authentication on page 98
 ■ Configuring Local User Template Accounts for User Authentication on page 99

Configuring Remote Template Accounts for User Authentication

By default, the JUNOS Software uses the remote template accounts when:

- The authenticated user does not exist locally on the router
- The authenticated user's record in the authentication server specifies local user, or the specified local user does not exist locally on the router

To configure the remote template account, include the **user remote** statement at the **[edit system login]** hierarchy level and specify the privileges you want to grant to remote users:

```
[edit system login]
user remote {
  full-name "All remote users";
  uid uid-value;
  class class-name;
}
```

To configure different access privileges for users who share the remote template account, include the **allow-commands** and **deny-commands** commands in the authentication server configuration file.

Related Topics ■ Overview of Template Accounts for RADIUS and TACACS+ Authentication on page 98

Configuring Local User Template Accounts for User Authentication

You use local user template accounts when you need different types of templates. Each template can define a different set of permissions appropriate for the group of users who use that template. These templates are defined locally on the router and referenced by the TACACS+ and RADIUS authentication servers.

When you configure local user templates and a user logs in, the JUNOS Software issues a request to the authentication server to authenticate the user's login name. If a user is authenticated, the server returns the local username to the JUNOS Software, which then determines whether a local username is specified for that login name (**local-username** for TACACS+, **Juniper-Local-User** for RADIUS). If so, the JUNOS Software selects the appropriate local user template locally configured on the router. If a local user template does not exist for the authenticated user, the router defaults to the **remote** template.

To configure different access privileges for users who share the local user template account, include the **allow-commands** and **deny-commands** commands in the authentication server configuration file.

To configure a local user template, include the **user local-username** statement at the **[edit system login]** hierarchy level and specify the privileges you want to grant to the local users to whom the template applies:

```
[edit system login]
user local-username {
  full-name "Local user account";
  uid uid-value;
  class class-name;
}
```

This example configures the **sales** and **engineering** local user templates:

```
[edit]
system {
```

```

login {
  user sales {
    uid uid-value;
    class class-name;
  }
  user engineering {
    uid uid-value;
    class class-name;
  }
}

user = simon {
  ...
  service = junos-exec {
    local-user-name = sales
    allow-commands = "configure"
    deny-commands = "shutdown"
  }
}

user = rob {
  ...
  service = junos-exec {
    local-user-name = sales
    allow-commands = "(request system) | (show rip neighbor)"
    deny-commands = "<^clear"
  }
}

user = harold {
  ...
  service = junos-exec {
    local-user-name = engineering
    allow-commands = "monitor | help | show | ping | traceroute"
    deny-commands = "configure"
  }
}

user = jim {
  ...
  service = junos-exec {
    local-user-name = engineering
    allow-commands = "show bgp neighbor"
    deny-commands = "telnet | ssh"
  }
}

```

When the login users Simon and Rob are authenticated, they use the sales local user template. When login users Harold and Jim are authenticated, they use the engineering local user template.

Related Topics ■ Overview of Template Accounts for RADIUS and TACACS+ Authentication on page 98

Using Regular Expressions on a TACACS+ or RADIUS Server to Allow or Deny Access to Commands

Use regular expressions to specify which operational or configuration mode commands are allowed or denied when using a RADIUS or TACACS+ server for user authentication. You can specify the regular expressions using the appropriate Juniper Networks vendor-specific TACACS+ or RADIUS attributes in your authentication server configuration.

You can specify the **allow**, **deny** configuration or operational mode commands, or **user-permissions** in a single extended regular expression, enclosing the multiple commands in parentheses and separating them using the pipe symbol:
`allow-commands= (cmd1 | cmd2 | cmdn).`

On a TACACS+ or RADIUS server, you can also use a simplified version for regular expressions, where you specify each command as a separate expression. The simplified version is valid for the **Juniper-Allow-Commands**, **Juniper-Deny-Commands**, **Juniper-Allow-Configuration**, **Juniper-Deny-Configuration**, and **Juniper-User-Permissions** vendor-specific attributes:

```

Juniper-Allow-Commands = "cmd1"
Juniper-Allow-Commands = "cmd2"
Juniper-Allow-Commands = "cmd n"
Juniper-Deny-Commands = "cmd1"
Juniper-Deny-Commands = "cmd2"
Juniper-Deny-Commands = "cmd n"
Juniper-Allow-Configuration = "cmd1"
Juniper-Allow-Configuration = "cmd2"
Juniper-Allow-Configuration = "cmd n"
Juniper-Deny-Configuration = "cmd1"
Juniper-Deny-Configuration = "cmd2"
Juniper-Deny-Configuration = "cmd n"
Juniper-User-Permissions = "cmd1"
Juniper-User-Permissions = "cmd2"
Juniper-User-Permissions = "cmd n"

```

For more information about Juniper Networks vendor-specific RADIUS and TACACS+ attributes, see “Juniper Networks Vendor-Specific RADIUS Attributes” on page 92 and “Configuring Juniper Networks Vendor-Specific TACACS+ Attributes” on page 96.



NOTE: When TACACS+ or RADIUS authentication is configured for a router, regular expressions configured on the RADIUS or TACACS+ server merge with any regular expressions configured on the local router at the `[edit system login class]` hierarchy level for the **allow**, **deny**, or **permissions** commands. If the final expression has a syntax error, the overall result is an invalid regular expression.

- Related Topics**
- Using Regular Expressions on a TACACS+ or RADIUS Server to Allow or Deny Access to Commands on page 101
 - JUNOS Software Authentication Order for RADIUS, TACACS+, and Password Authentication on page 102

JUNOS Software Authentication Order for RADIUS, TACACS+, and Password Authentication

Using the `authentication-order` statement, you can prioritize the order in which the JUNOS Software tries the different authentication methods when verifying user access to a router.

For each login attempt, the JUNOS Software tries the configured authentication methods in order until the password is accepted. If the username and password are accepted, the login attempt succeeds and no other authentication methods are tried. The next method in the authentication order is consulted if the previous authentication method fails to respond or if the method returns a reject response to the login attempt because of an incorrect username or password.

If none of the configured authentication methods accept the login credentials and if a reject response is received, the login attempt fails. If no response is received from any configured authentication method, the JUNOS Software consults local password authentication as a last resort.

Using RADIUS or TACACS+ Authentication

You can configure the JUNOS Software to be both a RADIUS and TACACS+ authentication client.

If an authentication method included in the `[authentication-order]` statement is not available, or if the authentication is available but returns a reject response, the JUNOS Software tries the next authentication method included in the `authentication-order` statement.

The RADIUS or TACACS+ server authentication might fail because of the following reasons:

- The authentication method is configured, but the corresponding authentication servers are not configured. For instance, the RADIUS and TACACS+ authentication methods are included in the `authentication-order` statement, but the corresponding RADIUS or TACACS+ servers are not configured at the respective `[edit system radius-server]` and `[edit system tacplus-server]` hierarchy levels.
- The RADIUS or TACACS+ server does not respond within the timeout period configured at the `[edit system radius-server]` or `[edit system tacplus-server]` hierarchy levels.
- The RADIUS or TACACS+ server is not reachable because of a network problem.

The RADIUS or TACACS+ server authentication might return a reject response because of the following reasons:

- The user profiles of users accessing a router might not be configured on the RADIUS or TACACS+ server.
- The user enters incorrect logon credentials.

Using Local Password Authentication

You can explicitly configure the password authentication method or use this method as a fallback mechanism when remote authentication servers fail. The password authentication method consults the local user profiles configured at the [edit system login] hierarchy level. Users can log in to a router using their local username and password in the following scenarios:

- The password authentication method (password) is explicitly configured as one of the authentication methods in the [authentication-order authentication-methods] statement. In this case, the password authentication is consulted if no previous authentication accepts the logon credentials. This is true whether the previous authentication method fails to respond or returns a reject response because of an incorrect username or password.
- The password authentication method is not explicitly configured as one of the authentication methods in the authentication-order authentication-methods statement. In this case, the password authentication method is consulted only if all configured authentication methods fail to respond. It is not consulted if any configured authentication method returns a reject response because of an incorrect username or password.

Order of Authentication Attempts

Table 12 on page 103 describes how the authentication-order statement at the [edit system] hierarchy level determines the procedure that the JUNOS Software uses to authenticate users for access to a router:

Table 12: Order of Authentication Attempts

Syntax	Order of Authentication Attempts
authentication-order radius;	<ol style="list-style-type: none"> 1. Try configured RADIUS authentication servers. 2. If RADIUS server is available and authentication is accepted, grant access. 3. If RADIUS server is available but authentication is rejected, deny access. 4. If RADIUS servers are not available, try password authentication. <p>NOTE: If a RADIUS server is available, password authentication is not attempted, because it is not explicitly configured in the authentication order.</p>

Table 12: Order of Authentication Attempts *(continued)*

Syntax	Order of Authentication Attempts
authentication-order [radius password];	<ol style="list-style-type: none"> 1. Try configured RADIUS authentication servers. 2. If RADIUS servers fail to respond or return a reject response, try password authentication, because it is explicitly configured in the authentication order.
authentication-order [radius tacplus];	<ol style="list-style-type: none"> 1. Try configured RADIUS authentication servers. 2. If RADIUS server is available and authentication is accepted, grant access. 3. If RADIUS servers fail to respond or return a reject response, try configured TACACS+ servers. 4. If TACACS+ server is available and authentication is accepted, grant access. 5. If TACACS+ server is available but authentication is rejected, deny access. 6. If both RADIUS and TACACS+ servers are not available, try password authentication. <p>NOTE: If either RADIUS or TACACS+ servers are available, password authentication is not attempted, because it is not explicitly configured in the authentication order.</p>
authentication-order [radius tacplus password];	<ol style="list-style-type: none"> 1. Try configured RADIUS authentication servers. 2. If RADIUS server is available and authentication is accepted, grant access. 3. If RADIUS servers fail to respond or return a reject response, try configured TACACS+ servers. 4. If TACACS+ server is available and authentication is accepted, grant access. 5. If TACACS+ servers fail to respond or return a reject response, try password authentication, because it is explicitly configured in the authentication order.
authentication-order tacplus;	<ol style="list-style-type: none"> 1. Try configured TACACS+ authentication servers. 2. If TACACS+ server is available and authentication is accepted, grant access. 3. If TACACS+ server is available but authentication is rejected, deny access. 4. If TACACS+ servers are not available, try password authentication. <p>NOTE: If a TACACS+ server is available, password authentication is not attempted, because it is not explicitly configured in the authentication order.</p>

Table 12: Order of Authentication Attempts *(continued)*

Syntax	Order of Authentication Attempts
authentication-order [tacplus password];	<ol style="list-style-type: none"> 1. Try configured TACACS + authentication servers. 2. If TACACS + servers fail to respond or return a reject response, try password authentication, because it is explicitly configured in the authentication order.
authentication-order [tacplus radius];	<ol style="list-style-type: none"> 1. Try configured TACACS + authentication servers. 2. If TACACS + server is available and authentication is accepted, grant access. 3. If TACACS + servers fail to respond or return a reject response, try configured RADIUS servers. 4. If RADIUS server is available and authentication is accepted, grant access. 5. If RADIUS server is available but authentication is rejected, deny access. 6. If both TACACS + and RADIUS servers are not available, try password authentication. <p>NOTE: If either TACACS + or RADIUS servers are available, password authentication is not attempted, because it is not explicitly configured in the authentication order.</p>
authentication-order [tacplus radius password];	<ol style="list-style-type: none"> 1. Try configured TACACS + authentication servers. 2. If TACACS + server is available and authentication is accepted, grant access. 3. If TACACS + servers fail to respond or return a reject response, try configured RADIUS servers. 4. If RADIUS server is available and authentication is accepted, grant access. 5. If RADIUS servers fail to respond or return a reject response try password authentication, because it is explicitly configured in the authentication order.
authentication-order password;	<ol style="list-style-type: none"> 1. Try to authenticate the user, using the password configured at the [edit system login] hierarchy level. 2. If the authentication is accepted, grant access. 3. If the authentication is rejected, deny access.



NOTE: If SSH public keys are configured, SSH user authentication first tries to perform public key authentication before using the authentication methods configured in the authentication-order statement. If you want SSH logins to use the authentication methods configured in the authentication-order statement without first trying to perform public key authentication, do not configure SSH public keys.

- Related Topics**
- Configuring the JUNOS Software Authentication Order for RADIUS, TACACS + , and Local Password Authentication on page 106
 - Overview of Template Accounts for RADIUS and TACACS + Authentication on page 98

Configuring the JUNOS Software Authentication Order for RADIUS, TACACS+, and Local Password Authentication

Using the `authentication-order` statement, you can prioritize the order in which the JUNOS Software tries the different authentication methods when verifying user access to a router.

To configure the authentication order, include the `authentication-order` statement at the `[edit system]` hierarchy level:

```
[edit system]
authentication-order [authentication-methods ];
```

Specify one or more of the following authentication methods in the preferred order, from first tried to last tried:

- `radius`—Verify the user using RADIUS authentication services
- `tacplus`—Verify the user using TACACS + authentication services.
- `password`—Verify the user using the username and password configured locally by including the authentication statement at the `[edit system login user]` hierarchy level.

The CHAP authentication sequence cannot take more than 30 seconds. If it takes longer to authenticate a client, the authentication is abandoned and a new sequence is initiated.

For example, if you configure three RADIUS servers so that the router attempts to contact each server three times, and with each retry the server times out after 3 seconds, then the maximum time given to the RADIUS authentication method before CHAP considers it a failure is 27 seconds. If you add more RADIUS servers to this configuration, they might not be contacted because the authentication process might be abandoned before these servers are tried.

The JUNOS Software enforces a limit to the number of standing authentication server requests that the CHAP authentication can have at one time. Thus, an authentication server method—RADIUS, for example—may fail to authenticate a client when this limit is exceeded. In the above example, any authentication method following this method is tried. If it fails, the authentication sequence is reinitiated by the router until authentication succeeds and the link is brought up.

The following example shows how to configure `radius` and `password` authentication:

```
[edit system]
authentication-order [ radius password ];
```

The following example shows how to delete the `radius` statement from the authentication order:

```
[edit system]
user@host# delete authentication-order radius
```

The following example shows how to insert the `tacplus` statement after the `radius` statement:

```
[edit system]
user@host# insert authentication-order tacplus after radius
```



NOTE: You can also configure the authentication order by including the `authentication-order` statement at the `[edit access profile name]` hierarchy level:

- `[edit access profile profile-name]`
`authentication-order [authentication-methods];`
- For Layer 2 Tunneling Protocol (L2TP), RADIUS authentication servers are configured at the `[edit access radius-server]` hierarchy level.
- When you configure the authentication methods for L2TP, only the first configured authentication method is used.

-
- Related Topics**
- JUNOS Software Authentication Order for RADIUS, TACACS + , and Password Authentication on page 102
 - Example: Configuring System Authentication for RADIUS, TACACS + , and Password Authentication on page 107
 - Using Regular Expressions on a TACACS + or RADIUS Server to Allow or Deny Access to Commands on page 101
 - JUNOS Software Authentication Order for RADIUS, TACACS + , and Password Authentication on page 102

Example: Configuring System Authentication for RADIUS, TACACS+, and Password Authentication

The following example shows how to configure system authentication for RADIUS, TACACS, and password authentication.

The example permits logins only by the individual user Philip, and by users who have been authenticated by a remote RADIUS server. If a user logs in and is not authenticated by the RADIUS server, the user is denied access to the router. However, if the RADIUS server is not available, the user's login name has a local password, and the user enters that password, the user is authenticated (using the `password` authentication method) and allowed access to the router. For more information about the password authentication method, see "Using Local Password Authentication" on page 103.

When Philip tries to log in to the system, if the RADIUS server authenticates him, he is given access and privileges for the `super-user` class. Local accounts are not

configured for other users. When they log in to the system and the RADIUS server authenticates them, they are given access using the same user ID (UID) 9999 and the same privileges for the **operator** class.

```
[edit]
system {
  authentication-order radius;
  login {
    user philip {
      full-name "Philip";
      uid 1001;
      class super-user;
    }
    user remote {
      full-name "All remote users";
      uid 9999;
      class operator;
    }
  }
}
```



NOTE: For authorization purposes, you can use a template account to create a single account that can be shared by a set of users at the same time. For example, when you create a remote template account, a set of remote users can concurrently share a single UID. For more information about template accounts, see “Overview of Template Accounts for RADIUS and TACACS+ Authentication” on page 98.

Configuring a single remote user template account requires that all users without individual configuration entries share the same class and UID. When you are using RADIUS and telnet or RADIUS and SSH together, you can specify a different template user other than the remote user.

To configure an alternate template user, specify the **user-name** parameter returned in the RADIUS authentication response packet. Not all RADIUS servers allow you to change this parameter. The following shows a sample JUNOS configuration:

```
[edit]
system {
  authentication-order radius;
  login {
    user philip {
      full-name "Philip";
      uid 1001;
      class super-user;
    }
    user operator {
      full-name "All operators";
      uid 9990;
      class operator;
    }
    user remote {
      full-name "All remote users";
      uid 9999;
    }
  }
}
```

```

        class read-only;
    }
}

```

Assume your RADIUS server is configured with the following information:

- User Philip with password “olympia”
- User Alexander with password “bucephalus” and username “operator”
- User Darius with password “redhead” and username “operator”
- User Roxane with password “athena”

Philip would be given access as a superuser (super-user) because he has his own local user account. Alexander and Darius share UID 9990 and have access as operators. Roxane has no template-user override, so she shares access with all the other remote users, getting read-only access.

Related Topics ■ Configuring the JUNOS Software Authentication Order for RADIUS, TACACS + , and Local Password Authentication on page 106

Recovering the Root Password

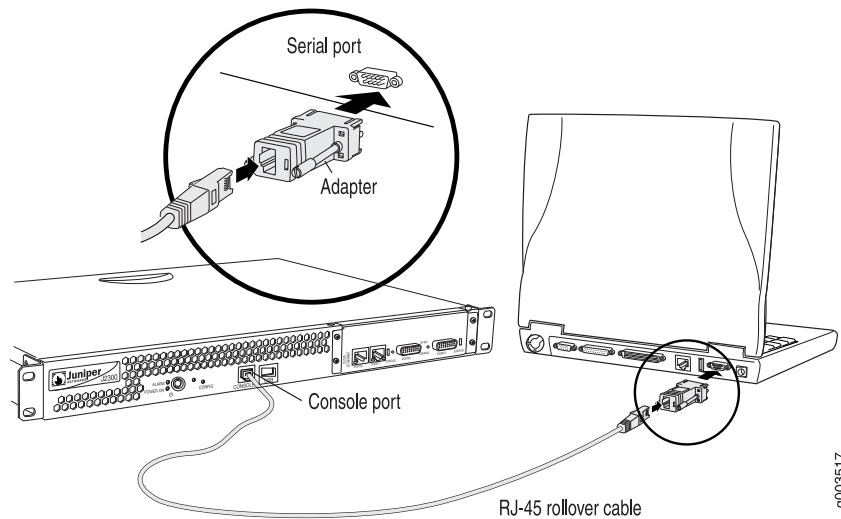
If you forget the root password for the router, you can use the password recovery procedure to reset the root password.



NOTE: You need console access to recover the root password.

To recover the root password:

1. Power off the router by pressing the power button on the front panel.
2. Turn off the power to the management device, such as a PC or laptop computer, that you want to use to access the CLI.
3. Plug one end of the Ethernet rollover cable supplied with the router into the RJ-45 to DB-9 serial port adapter supplied with the router (see Figure 2 on page 110.)
4. Plug the RJ-45 to DB-9 serial port adapter into the serial port on the management device (see Figure 2 on page 110).
5. Connect the other end of the Ethernet rollover cable to the console port on the router (see Figure 2 on page 110).

Figure 2: Connecting to the Console Port on the J2300 Router

NOTE: The J Series Services Router included in this figure is just an example. The physical location of the console port and serial port might vary on T Series or M Series routers.

6. Turn on the power to the management device.
7. On the management device, start your asynchronous terminal emulation application (such as Microsoft Windows Hyperterminal) and select the appropriate COM port to use (for example, COM1).
8. Configure the port settings as follows:
 - Bits per second: 9600
 - Data bits: 8
 - Parity: None
 - Stop bits: 1
 - Flow control: None
9. Power on the router by pressing the power button on the front panel. Verify that the **POWER** LED on the front panel turns green.

The terminal emulation screen on your management device displays the router's boot sequence.

10. When the following prompt appears, press the Spacebar to access the router's bootstrap loader command prompt:

```
Hit [Enter] to boot immediately, or space bar for command prompt.
Booting [kernel] in 9 seconds...
```

11. At the following prompt, enter **boot -s** to start up the system in single-user mode.


```
ok boot -s
```

12. At the following prompt, enter **recovery** to start the root password recovery procedure.

```
Enter full pathname of shell or 'recovery' for root password recovery or
RETURN for /bin/sh: recovery
```

13. Enter configuration mode in the CLI.
14. Set the root password. For example:

```
user@host# set system root-authentication plain-text-password
```

15. At the following prompt, enter the new root password. For example:

```
New password: juniper1
```

```
Retype new password:
```

16. At the second prompt, reenter the new root password.
17. After you have finished configuring the password, commit the configuration.

```
root@host# commit
```

```
commit complete
```

18. Exit configuration mode in the CLI.
19. Exit operational mode in the CLI.
20. At the prompt, enter **y** to reboot the router.

```
Reboot the system? [y/n] y
```

Related Topics ■ Configuring the Root Password on page 63

Chapter 8

Configuring Time

This chapter covers the following topics:

- Modifying the Default Time Zone for a Router Running JUNOS Software on page 113
- NTP Overview on page 114
- Synchronizing and Coordinating Time Distribution Using NTP on page 114
- NTP Time Server and Time Services Overview on page 116
- Configuring the NTP Time Server and Time Services on page 117
- Configuring NTP Authentication Keys on page 120
- Configuring the Router to Listen for Broadcast Messages Using NTP on page 120
- Configuring the Router to Listen for Multicast Messages Using NTP on page 121
- Setting a Custom Time Zone on Routers Running JUNOS Software on page 121

Modifying the Default Time Zone for a Router Running JUNOS Software

The default local time zone on the router is UTC (Coordinated Universal Time, formerly known as Greenwich Mean Time, or GMT). To modify the local time zone, include the `time-zone` statement at the `[edit system]` hierarchy level:

```
[edit system]
time-zone (GMThour-offset | time-zone);
```

You can use the GMT *hour-offset* option to set the time zone relative to UTC (GMT) time. By default, *hour-offset* is 0. You can configure this to be a value in the range from -14 to +12.

You can also specify *time-zone* as a string such as PDT (Pacific Daylight Time) or WET (Western European Time), or specify the continent and major city.

For the time zone change to take effect for all processes running on the router, you must reboot the router.

The following example shows how to change the current time zone to America/New_York:

```
[edit]
user@host# set system time-zone America/New_York
[edit]
```

```

user@host# show
system {
    time-zone America/New_York;
}

```

NTP Overview

The Network Time Protocol (NTP) provides the mechanisms to synchronize time and coordinate time distribution in a large, diverse network. NTP uses a returnable-time design in which a distributed subnet of time servers operating in a self-organizing, hierarchical primary-secondary configuration synchronizes local clocks within the subnet and to national time standards by means of wire or radio. The servers also can redistribute reference time using local routing algorithms and time daemons.

NTP is defined in RFC 1305, *Network Time Protocol (Version 3) Specification, Implementation and Analysis*.

For Common Criteria compliance, configure NTP to provide accurate timestamps for system log messages.



NOTE: NTP does not support VPN routing and forwarding (VRF) requests. The router cannot process these requests properly because NTP uses the `inet.0` route table for route resolution to the requestor and thus cannot propagate routes using the `routing-instance-name.inet.0` VRF table for the VPN.

When configuring NTP, you do not actively configure time servers. Rather, all clients also are servers. An NTP server is not believed unless it, in turn, is synchronized to another NTP server—which itself must be synchronized to something upstream, eventually terminating in a high-precision clock.

By default, if the time difference between the local router clock and the NTP server clock is more than 128 milliseconds, the clocks are slowly stepped into synchronization. However, if the difference is more than 1000 seconds, the clocks are not synchronized. On the local router, you set the date and time using the `set date` command. To set the time automatically, use the `boot-server` statement at the `[edit system ntp]` hierarchy level, specifying the address of an NTP server.

Related Topics ■ Synchronizing and Coordinating Time Distribution Using NTP on page 114

Synchronizing and Coordinating Time Distribution Using NTP

Using NTP to synchronize and coordinate time distribution in a large network involves these tasks:

1. Configuring NTP on page 115
2. Configuring the NTP Boot Server on page 115
3. Specifying a Source Address for an NTP Server on page 115

Configuring NTP

To configure NTP on the router, include the `ntp` statement at the `[edit system]` hierarchy level:

```
[edit system]
ntp {
  authentication-key number type type value password;
  boot-server address;
  broadcast <address> <key key-number> <version value> <ttl value>;
  broadcast-client;
  multicast-client <address>;
  peer address <key key-number> <version value> <prefer>;
  server address <key key-number> <version value> <prefer>;
  source-address source-address;
  trusted-key [ key-numbers ];
}
```

Configuring the NTP Boot Server

When you boot the router, it issues an `ntpdate` request, which polls a network server to determine the local date and time. You need to configure a server that the router uses to determine the time when the router boots. Otherwise, NTP will not be able to synchronize to a time server if the server's time appears to be very far off of the local router's time.

To configure the NTP boot server, include the `boot-server` statement at the `[edit system ntp]` hierarchy level:

```
[edit system ntp]
boot-server address;
```

Specify the address of the network server. You must specify an address, not a hostname.

Specifying a Source Address for an NTP Server

For IP version 4 (IPv4), you can specify that if the NTP server configured at the `[edit system ntp]` hierarchy level is contacted on one of the loopback interface addresses, the reply always uses a specific source address. This is useful for controlling which source address NTP will use to access your network when it is either responding to an NTP client request from your network or when it itself is sending NTP requests to your network.

To configure the specific source address that the reply will always use, and the source address that requests initiated by NTP server will use, include the `source-address` statement at the `[edit system ntp]` hierarchy level:

```
[edit system ntp]
source-address source-address;
```

source-address is a valid IP address configured on one of the router interfaces.



NOTE: If a firewall filter is applied on the loopback interface, ensure that the **source-address** specified for the NTP server at the [edit system ntp] hierarchy level is explicitly included as one of the match criteria in the firewall filter. This enables the JUNOS Software to accept traffic on the loopback interface from the specified source address.

The following example shows a firewall filter with the source address 10.0.10.100 specified in the **from** statement included at the [edit firewall filter *firewall-filter-name*] hierarchy:

```
[edit firewall filter Loopback-Interface-Firewall-Filter]
term Allow-NTP {
  from {
    source-address {
      172.17.27.46/32; // IP address of the NTP server
      10.0.10.100/32; // Source address specified for the NTP server
    }
  }
  then accept;
}
```

If no **source-address** is configured for the NTP server, include the primary address of the loopback interface in the firewall filter.

Related Topics ■ NTP Overview on page 114

NTP Time Server and Time Services Overview

When configuring the Network Time Protocol (NTP), you can specify which system on the network is the authoritative time source, or time server, and how time is synchronized between systems on the network. To do this, you configure the router to operate in one of the following modes:

- Client mode—In this mode, the local router can be synchronized with the remote system, but the remote system can never be synchronized with the local router.
- Symmetric active mode—In this mode, the local router and the remote system can synchronize with each other. You use this mode in a network in which either the local router or the remote system might be a better source of time.



NOTE: Symmetric active mode can be initiated by either the local or the remote system. Only one system needs to be configured to do so. This means that the local system can synchronize with any system that offers symmetric active mode without any configuration whatsoever. However, we strongly encourage you to configure authentication to ensure that the local system synchronizes only with known time servers.

- Broadcast mode—In this mode, the local router sends periodic broadcast messages to a client population at the specified broadcast or multicast **address**.

Normally, you include this statement only when the local router is operating as a transmitter.

- Server mode—In this mode, the local router operates as an NTP server.



NOTE: In NTP server mode, the JUNOS Software does not support authentication.

Related Topics ■ Configuring the NTP Time Server and Time Services on page 117

Configuring the NTP Time Server and Time Services

When you use NTP, configure the router to operate in one of the following modes:

- Client mode
- Symmetric active mode
- Broadcast mode
- Server mode

The following topics describe how to configure these modes of operation:

1. Configuring the Router to Operate in Client Mode on page 117
2. Configuring the Router to Operate in Symmetric Active Mode on page 118
3. Configuring the Router to Operate in Broadcast Mode on page 118
4. Configuring the Router to Operate in Server Mode on page 119

Configuring the Router to Operate in Client Mode

To configure the local router to operate in client mode, include the **server** statement and other optional statements at the [edit system ntp] hierarchy level:

```
[edit system ntp]
server address <key key-number> <version value> <prefer>;
authentication-key key-number type type value password;
boot-server address;
trusted-key [ key-numbers ];
```

Specify the address of the system acting as the time server. You must specify an address, not a hostname.

To include an authentication key in all messages sent to the time server, include the **key** option. The key corresponds to the key number you specify in the **authentication-key** statement, as described in “Configuring NTP Authentication Keys” on page 120.

By default, the router sends NTP version 4 packets to the time server. To set the NTP version level to 1, 2, or 3 include the **version** option.

If you configure more than one time server, you can mark one server preferred by including the **prefer** option.

For information about how to configure trusted keys, see “Configuring NTP Authentication Keys” on page 120. For information about how to configure an NTP boot server, see “Configuring the NTP Boot Server” on page 115. For information about how to configure the router to operate in server mode, see “Configuring the Router to Operate in Server Mode” on page 119.

The following example shows how to configure the router to operate in client mode:

```
[edit system ntp]
authentication-key 1 type md5 value "$9$EgfcvX7VY4ZEcwgoHjkP5Q3CuREyv87";
boot-server 10.1.1.1;
server 10.1.1.1 key 1 prefer;
trusted-key 1;
```

Configuring the Router to Operate in Symmetric Active Mode

To configure the local router to operate in symmetric active mode, include the **peer** statement at the [edit system ntp] hierarchy level:

```
[edit system ntp]
peer address <key key-number> <version value> <prefer>;
```

Specify the address of the remote system. You must specify an address, not a hostname.

To include an authentication key in all messages sent to the remote system, include the **key** option. The key corresponds to the key number you specify in the **authentication-key** statement, as described in “Configuring NTP Authentication Keys” on page 120.

By default, the router sends NTP version 4 packets to the remote system. To set the NTP version level to 1, 2 or 3, include the **version** option.

If you configure more than one remote system, you can mark one system preferred by including the **prefer** option:

```
peer address <key key-number> <version value> prefer;
```

Configuring the Router to Operate in Broadcast Mode

To configure the local router to operate in broadcast mode, include the **broadcast** statement at the [edit system ntp] hierarchy level:

```
[edit system ntp]
broadcast address <key key-number> <version value> <ttl value>;
```

Specify the broadcast address on one of the local networks or a multicast address assigned to NTP. You must specify an address, not a hostname. If the multicast address is used, it must be 224.0.1.1.

To include an authentication key in all messages sent to the remote system, include the **key** option. The key corresponds to the key number you specify in the **authentication-key** statement, as described in “Configuring NTP Authentication Keys” on page 120.

By default, the router sends NTP version 4 packets to the remote system. To set the NTP version level to 1, 2, or 3, include the **version** option.

Configuring the Router to Operate in Server Mode

In server mode, the router acts as an NTP server for clients when the clients are configured appropriately. The only prerequisite for “server mode” is that the router must be receiving time from another NTP peer or server. No other configuration is necessary on the router.

To configure the local router to operate as an NTP server, include the following statements at the **[edit system ntp]** hierarchy level:

```
[edit system ntp]
authentication-key key-number type type value password;
server address <key key-number> <version value> <prefer>;
trusted-key [ key-numbers ];
```

Specify the address of the system acting as the time server. You must specify an address, not a hostname.

To include an authentication key in all messages sent to the time server, include the **key** option. The key corresponds to the key number you specify in the **authentication-key** statement, as described in “Configuring NTP Authentication Keys” on page 120.

By default, the router sends NTP version 4 packets to the time server. To set the NTP version level to 1, or 2, or 3, include the **version** option.

If you configure more than one time server, you can mark one server preferred by including the **prefer** option.

For information about how to configure trusted keys, see “Configuring NTP Authentication Keys” on page 120. For information about how to configure the router to operate in client mode, see “Configuring the Router to Operate in Client Mode” on page 117.

The following example shows how to configure the router to operate in server mode:

```
[edit system ntp]
authentication-key 1 type md5 value "$9$tXERuBEreWx-wtuLNdboaUjH.T3AtOESe";
server 172.17.27.46 prefer;
trusted-key 1;
```

Related Topics ■ NTP Time Server and Time Services Overview on page 116

Configuring NTP Authentication Keys

Time synchronization can be authenticated to ensure that the local router obtains its time services only from known sources. By default, network time synchronization is unauthenticated. The system will synchronize to whatever system appears to have the most accurate time. We strongly encourage you to configure authentication of network time services.

To authenticate other time servers, include the **trusted-key** statement at the **[edit system ntp]** hierarchy level. Only time servers transmitting network time packets that contain one of the specified key numbers and whose key matches the value configured for that key number are eligible to be synchronized to. Other systems can synchronize to the local router without being authenticated.

```
[edit system ntp]
trusted-key [ key-numbers ];
```

Each key can be any 32-bit unsigned integer except 0. Include the **key** option in the **peer**, **server**, or **broadcast** statements to transmit the specified authentication key when transmitting packets. The key is necessary if the remote system has authentication enabled so that it can synchronize to the local system.

To define the authentication keys, include the **authentication-key** statement at the **[edit system ntp]** hierarchy level:

```
[edit system ntp]
authentication-key key-number type value password;
```

number is the key number, *type* is the authentication type (only Message Digest 5 [MD5] is supported), and *password* is the password for this key. The key number, type, and password must match on all systems using that particular key for authentication.

Configuring the Router to Listen for Broadcast Messages Using NTP

When you are using NTP, you can configure the local router to listen for broadcast messages on the local network to discover other servers on the same subnet by including the **broadcast-client** statement at the **[edit system ntp]** hierarchy level:

```
[edit system ntp]
broadcast-client;
```

When the router hears a broadcast message for the first time, it measures the nominal network delay using a brief client-server exchange with the remote server. It then enters *broadcast client* mode, in which it listens for, and synchronizes to, succeeding broadcast messages.

To avoid accidental or malicious disruption in this mode, both the local and remote systems must use authentication and the same trusted key and key identifier.

Related Topics ■ Configuring the Router to Listen for Multicast Messages Using NTP on page 121

Configuring the Router to Listen for Multicast Messages Using NTP

When you are using NTP, you can configure the local router to listen for multicast messages on the local network to discover other servers on the same subnet by including the `multicast-client` statement at the `[edit system ntp]` hierarchy level:

```
[edit system ntp]
multicast-client <address>;
```

When the router hears a multicast message for the first time, it measures the nominal network delay using a brief client-server exchange with the remote server. It then enters *multicast client* mode, in which it listens for, and synchronizes to, succeeding multicast messages.

You can specify one or more IP addresses. (You must specify an address, not a hostname.) If you do, the route joins those multicast groups. If you do not specify any addresses, the software uses 224.0.1.1.

To avoid accidental or malicious disruption in this mode, both the local and remote systems must use authentication and the same trusted key and key identifier.

Related Topics ■ Configuring the Router to Listen for Broadcast Messages Using NTP on page 120

Setting a Custom Time Zone on Routers Running JUNOS Software

You can update the time zone database information on routers running JUNOS Software. This feature simplifies time zone management in devices running JUNOS Software by allowing for future unforeseen time zone database adjustments. You can configure your router to use a custom time zone database file that you create to meet your requirements by editing an existing time zone database file.

Tasks for setting a custom time zone are:

1. Importing and Installing Time Zone Files on page 121
2. Configuring a Custom Time Zone on page 122

Importing and Installing Time Zone Files

To import and install time zone files, follow these steps:

1. Download the time zone files archive and untar them to a temporary directory such as `/var/tmp`:

```
# mkdir -p /var/tmp/tz && cd /var/tmp/tz && rm *
# wget 'ftp://elsie.nci.nih.gov/pub/tzdata*.tar.gz'
# tar xvzf tzdata*.gz
africa
antarctica
asia
```

```

australasia
europe
northamerica
southamerica
pacificnew
etcetera
factory
backward
systemv
solar87
solar88
solar89
iso3166.tab
zone.tab
leapseconds
yearistype.sh

```



NOTE: If needed, you can edit the above untarred files to create or modify time zones.

2. Select the names of time zone files to compile and feed them to the following script.
For example, to generate `northamerica` and `asia` tz files:

```
# /usr/libexec/ui/compile-tz northamerica asia
```

3. Enable the use of the generated tz files using the CLI:

```

[edit]
# set system use-imported-time-zones
[edit]
# set system time-zone ?

```

This should show the newly generated tz files in `/var/db/zoneinfo/`.

4. Set the time zone and commit:

```

[edit]
# set system time-zone <your-time-zone>
# commit

```

5. Verify that the time zone change has taken effect:

```

[edit]
# run show system uptime

```

Configuring a Custom Time Zone

To use a custom time zone, follow these steps:

1. Download a time zones archive (from a known or designated source) to the router. Compile the time zone archive using the `zic` time zone compiler, which generates `tz` files.

2. Using the CLI, configure the router to enable the use of the generated tz files as follows:

```
[edit]  
user@host# set system use-imported-time-zones
```

3. Display the imported time zones (saved in the directory `/var/db/zoneinfo/`):

```
[edit]  
user@host# set system time-zone ?
```

If you do not configure the router to use imported time zones, the JUNOS default time zones are shown (saved in the directory `/usr/share/zoneinfo/`).

Related Topics ■ [Modifying the Default Time Zone for a Router Running JUNOS Software on page 113](#)

Chapter 9

Configuring System Log Messages

This chapter covers the following topics:

- JUNOS Software System Log Configuration Overview on page 125
- JUNOS Software System Log Configuration Statements on page 125
- JUNOS Software Minimum and Default System Logging Configuration on page 126
- Single-Chassis System Logging Configuration on page 129
- System Logging Configuration for a TX Matrix Router on page 150
- System Logging Configuration for a TX Matrix Plus Router on page 160

JUNOS Software System Log Configuration Overview

The JUNOS Software generates system log messages (also called *syslog messages*) to record events that occur on the router, including the following:

- Routine operations, such as creation of an Open Shortest Path First (OSPF) protocol adjacency or a user login into the configuration database
- Failure and error conditions, such as failure to access a configuration file or unexpected closure of a connection to a peer process
- Emergency or critical conditions, such as router power-down due to excessive temperature

Each system log message identifies the JUNOS Software process that generated the message and briefly describes the operation or error that occurred. For detailed information about specific system log messages, see the *JUNOS System Log Messages Reference*.



NOTE: This topic describes system log messages for JUNOS Software processes and libraries and not the services on a Physical Interface Card (PIC) such as the Adaptive Services PIC. For information about configuring system logging for PIC services, see the *JUNOS Services Interfaces Configuration Guide*.

JUNOS Software System Log Configuration Statements

To configure the router to log system messages, include the `syslog` statement at the [edit system] hierarchy level:

```

[edit system]
syslog {
  archive {
    files number;
    size size;
    (world-readable | no-world-readable);
  }
  console {
    facility severity;
  }
  file filename {
    facility severity;
    explicit-priority;
    match "regular-expression";
    structured-data {
      brief;
    }
    archive {
      archive-sites {
        site-name;
      }
      files number;
      size size;
      start-time date.time;
      transfer-interval interval;
      (world-readable | no-world-readable);
    }
  }
  host (hostname | other-routing-engine | scc-master) {
    facility severity;
    explicit-priority;
    facility-override facility;
    log-prefix string
    match "regular-expression";
  }
  source-address source-address;
  time-format (year | millisecond | year millisecond);
  user (username | *) {
    facility severity;
    match "regular-expression";
  }
}

```

JUNOS Software Minimum and Default System Logging Configuration

For information about the minimum and default system log settings on routers that run the JUNOS Software, see the following topics:

- JUNOS Software Minimum System Logging Configuration on page 127
- JUNOS Software Default System Log Settings on page 127
- JUNOS Software Platform-Specific Default System Log Messages on page 129

JUNOS Software Minimum System Logging Configuration

To record or view system log messages, you must include the `syslog` statement at the `[edit system]` hierarchy level. Specify at least one destination for the messages, as described in Table 13 on page 127. For more information about the configuration statements, see “Single-Chassis System Logging Configuration Overview” on page 130.

Table 13: Minimum Configuration Statements for System Logging

Destination	Minimum Configuration Statements
File	<pre>[edit system syslog] file filename { facility severity; }</pre>
Terminal session of one, several, or all users	<pre>[edit system syslog] user (username *) { facility severity; }</pre>
Router console	<pre>[edit system syslog] console { facility severity; }</pre>
Remote machine or the other Routing Engine on the router	<pre>[edit system syslog] host (hostname other-routing-engine) { facility severity; }</pre>

JUNOS Software Default System Log Settings

Table 14 on page 128 summarizes the default system log settings that apply to all routers that run the JUNOS Software, and specifies which statement to include in the configuration to override the default value.

Table 14: Default System Logging Settings

Setting	Default	Overriding Statement	Instructions
Alternative facility for message forwarded to a remote machine	For change-log: local6 For conflict-log: local5 For dfc: local1 For firewall: local3 For interactive-commands: local7 For pfe: local4	[edit system syslog] host <i>hostname</i> { facility-override <i>facility</i> ; }	“Changing the Alternative Facility Name for Remote System Log Messages” on page 137
Format of messages logged to a file	Standard JUNOS format, based on UNIX format	[edit system syslog] file <i>filename</i> { structured-data; }	“Logging Messages in Structured-Data Format” on page 134
Maximum number of files in the archived set	10	[edit system syslog] archive { files <i>number</i> ; } file <i>filename</i> { archive { files <i>number</i> ; } }	“Specifying Log File Size, Number, and Archiving Properties” on page 141
Maximum size of the log file	J Series: 128 kilobytes (KB) M Series, MX Series, and T Series: 1 megabyte (MB) TX Matrix: 10 MB	[edit system syslog] archive { size <i>size</i> ; } file <i>filename</i> { archive { size <i>size</i> ; } }	“Specifying Log File Size, Number, and Archiving Properties” on page 141
Timestamp format	Month, date, hour, minute, second For example: Aug 21 12:36:30	[edit system syslog] time-format <i>format</i> ;	“Including the Year or Millisecond in Timestamps” on page 145
Users who can read log files	root user and users with the JUNOS maintenance permission	[edit system syslog] archive { world-readable; } file <i>filename</i> { archive { world-readable; } }	“Specifying Log File Size, Number, and Archiving Properties” on page 141

JUNOS Software Platform-Specific Default System Log Messages

The following messages are generated by default on specific routers. To view either type of message, you must configure at least one destination for messages as described in “JUNOS Software Minimum System Logging Configuration” on page 127.

- On J Series routers, a message is logged when a process running in the kernel consumes 500 or more consecutive milliseconds of CPU time.
- To log the kernel process message on an M Series, MX Series, or T Series router, include the `kernel info` statement at the appropriate hierarchy level:

```
[edit system syslog]
(console | file filename | host destination | user username) {
  kernel info;
}
```

- On a routing matrix composed of a TX Matrix router and T640 routers, the master Routing Engine on each T640 router forwards to the master Routing Engine on the TX Matrix router, all messages with a severity of `info` and higher. This is equivalent to the following configuration statement included on the TX Matrix router:

```
[edit system syslog]
host scc-master {
  any info;
}
```

- Likewise, on a routing matrix composed of a TX Matrix Plus router and T1600 routers, the master Routing Engine on each T1600 router forwards to the master Routing Engine on the TX Matrix Plus router all messages with a severity of `info` and higher. This is equivalent to the following configuration statement included on the TX Matrix Plus router:

```
[edit system syslog]
host sfc0-master {
  any info;
}
```

Single-Chassis System Logging Configuration

This section includes the following topics:

- Single-Chassis System Logging Configuration Overview on page 130
- Specifying the Facility and Severity of Messages to Include in the Log on page 131
- JUNOS System Logging Facilities and Message Severity Levels on page 132
- Directing System Log Messages to a Log File on page 133
- Logging Messages in Structured-Data Format on page 134
- Directing System Log Messages to a User Terminal on page 134

- Directing System Log Messages to the Console on page 135
- System Logging on a Remote Machine or the Other Routing Engine on page 135
- Specifying Log File Size, Number, and Archiving Properties on page 141
- Including Priority Information in System Log Messages on page 143
- System Log Facility Codes and Numerical Codes Reported in Priority Information on page 144
- Including the Year or Millisecond in Timestamps on page 145
- Using Regular Expressions to Refine the Set of Logged Messages on page 146
- JUNOS System Log Regular Expression Operators for the match Statement on page 147
- Disabling the System Logging of a Facility on page 148
- Examples: Configuring System Logging on page 149

Single-Chassis System Logging Configuration Overview

The JUNOS system logging utility is similar to the UNIX **syslogd** utility. This section describes how to configure system logging for a single-chassis system that runs the JUNOS Software.

System logging configuration for the JUNOS-FIPS software and for Juniper Networks routers in a Common Criteria environment is the same as for the JUNOS Software. For more information, see the *Secure Configuration Guide for Common Criteria and JUNOS-FIPS*.

For information about configuring system logging for a routing matrix composed of a TX Matrix router and T640 routers, see “Configuring System Logging for a TX Matrix Router” on page 151.

Each system log message belongs to a *facility*, which groups together related messages. Each message is also preassigned a *severity level*, which indicates how seriously the triggering event affects router functions. You always specify the facility and severity of the messages to include in the log. For more information, see “Specifying the Facility and Severity of Messages to Include in the Log” on page 131.

You direct messages to one or more destinations by including the appropriate statement at the **[edit system syslog]** hierarchy level:

- To a named file in a local file system, by including the **file** statement. See “Directing System Log Messages to a Log File” on page 133.
- To the terminal session of one or more specific users (or all users) when they are logged in to the router, by including the **user** statement. See “Directing System Log Messages to a User Terminal” on page 134.
- To the router console, by including the **console** statement. See “Directing System Log Messages to the Console” on page 135.
- To a remote machine that is running the **syslogd** utility or to the other Routing Engine on the router, by including the **host** statement. See “Directing System Log Messages to a Remote Machine or the Other Routing Engine” on page 135.

By default, messages are logged in a standard format, which is based on a UNIX system log format; for detailed information about message formatting, see the *JUNOS System Log Messages Reference*. You can alter the content and format of logged messages in the following ways:

- In JUNOS Release 8.3 and later, you can log messages to a file in structured-data format instead of the standard JUNOS format. Structured-data format provides more information without adding significant length, and makes it easier for automated applications to extract information from the message. For more information, see “Logging Messages in Structured-Data Format” on page 134.
- A message’s facility and severity level are together referred to as its *priority*. By default, the standard JUNOS format for messages does not include priority information (structured-data format includes a priority code by default.) To include priority information in standard-format messages directed to a file or a remote destination, include the **explicit-priority** statement. For more information, see “Including Priority Information in System Log Messages” on page 143.
- By default, the standard JUNOS format for messages specifies the month, date, hour, minute, and second when the message was logged. You can modify the timestamp on standard-format system log messages to include the year, the millisecond, or both. (Structured-data format specifies the year and millisecond by default.) For more information, see “Including the Year or Millisecond in Timestamps” on page 145.
- When directing messages to a remote machine, you can specify the IP address that is reported in messages as their source. You can also configure features that make it easier to separate messages generated by the JUNOS Software or messages generated on particular routers. For more information, see “Directing System Log Messages to a Remote Machine or the Other Routing Engine” on page 135.
- The predefined facilities group together related messages, but you can also use regular expressions to specify more exactly which messages from a facility are logged to a file, a user terminal, or a remote destination. For more information, see “Using Regular Expressions to Refine the Set of Logged Messages” on page 146.

Specifying the Facility and Severity of Messages to Include in the Log

Each system log message belongs 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). Each message is also preassigned a *severity level*, which indicates how seriously the triggering event affects router functions.

When you configure logging for a facility and destination, you specify a severity level for each facility. Messages from the facility that are rated at that level or higher are logged to the destination:

```
[edit system syslog]
(console | file filename | host destination | user username) {
    facility severity;
}
```

Related Topics ■ JUNOS System Logging Facilities and Message Severity Levels on page 132

JUNOS System Logging Facilities and Message Severity Levels

Table 15 on page 132 lists the JUNOS system logging facilities that you can specify in configuration statements at the `[edit system syslog]` hierarchy level.

Table 15: JUNOS System Logging Facilities

Facility	Type of Event or Error
any	All (messages from all facilities)
authorization	Authentication and authorization attempts
change-log	Changes to the JUNOS configuration
conflict-log	Specified configuration is invalid on the router type
daemon	Actions performed or errors encountered by system processes
dfc	Events related to dynamic flow capture
firewall	Packet filtering actions performed by a firewall filter
ftp	Actions performed or errors encountered by the FTP process
interactive-commands	Commands issued at the JUNOS command-line interface (CLI) prompt or by a client application such as a JUNOScript or NETCONF client
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 user-space processes

Table 16 on page 132 lists the severity levels that you can specify in configuration statements at the `[edit system syslog]` hierarchy level. The levels from **emergency** through **info** are in order from highest severity (greatest effect on functioning) to lowest.

Unlike the other severity levels, the **none** level disables logging of a facility instead of indicating how seriously a triggering event affects routing functions. For more information, see “Disabling the System Logging of a Facility” on page 148.

Table 16: System Log Message Severity Levels

Severity Level	Description
any	Includes all severity levels

Table 16: System Log Message Severity Levels (*continued*)

Severity Level	Description
none	Disables logging of the associated facility to a destination
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 errors
error	Error conditions that generally have less serious consequences than errors in 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

Directing System Log Messages to a Log File

To direct system log messages to a file in the `/var/log` directory of the local Routing Engine, include the `file` statement at the `[edit system syslog]` hierarchy level:

```
[edit system syslog]
file filename {
    facility severity;
    explicit-priority;
    match "regular-expression";
    structured-data {
        brief;
    }
    archive {
        files number;
        size size;
        (world-readable | no-world-readable);
    }
}
```

For the list of facilities and severity levels, see “Specifying the Facility and Severity of Messages to Include in the Log” on page 131.

To prevent log files from growing too large, the JUNOS system logging utility by default writes messages to a sequence of files of a defined size. By including the `archive` statement, you can configure the number of files, their maximum size, and who can read them, for either all log files or a certain log file. For more information, see “Specifying Log File Size, Number, and Archiving Properties” on page 141.

For information about the following statements, see the indicated sections:

- **explicit-priority**—See “Including Priority Information in System Log Messages” on page 143
- **match**—See “Using Regular Expressions to Refine the Set of Logged Messages” on page 146
- **structured-data**—See “Logging Messages in Structured-Data Format” on page 134

Logging Messages in Structured-Data Format

In JUNOS Release 8.3 and later, you can log messages to a file in structured-data format instead of the standard JUNOS format. Structured-data format provides more information without adding significant length, and makes it easier for automated applications to extract information from a message.

The structured-data format complies with Internet draft draft-ietf-syslog-protocol-23, *The syslog Protocol*, which at the time of this writing is accessible at <http://tools.ietf.org/html/draft-ietf-syslog-protocol-23>. The draft establishes a standard message format regardless of the source or transport protocol for logged messages.

To output messages to a file in structured-data format, include the **structured-data** statement at the [edit system syslog file *filename*] hierarchy level:

```
[edit system syslog file filename]
  facility severity;
  structured-data {
    brief;
  }
```

The optional **brief** statement suppresses the English-language text that appears by default at the end of a message to describe the error or event. For information about the fields in a structured-data format message, see the *JUNOS System Log Messages Reference*.

The structured format is used for all messages logged to the file that are generated by a JUNOS process or software library.



NOTE: If you include either or both of the **explicit-priority** and **time-format** statements along with the **structured-data** statement, they are ignored. These statements apply to the standard JUNOS system log format, not to structured-data format.

Directing System Log Messages to a User Terminal

To direct system log messages to the terminal session of one or more specific users (or all users) when they are logged in to the local Routing Engine, include the **user** statement at the [edit system syslog] hierarchy level:

```
[edit system syslog]
  user (username | *) {
    facility severity;
```



```
    match "regular-expression";
}
```

Specify one or more JUNOS usernames, separating multiple values with spaces, or use the asterisk (*) to indicate all users who are logged in to the local Routing Engine.

For the list of logging facilities and severity levels, see “Specifying the Facility and Severity of Messages to Include in the Log” on page 131. For information about the `match` statement, see “Using Regular Expressions to Refine the Set of Logged Messages” on page 146.

Directing System Log Messages to the Console

To direct system log messages to the console of the local Routing Engine, include the `console` statement at the `[edit system syslog]` hierarchy level:

```
[edit system syslog]
console {
    facility severity;
}
```

For the list of logging facilities and severity levels, see “Specifying the Facility and Severity of Messages to Include in the Log” on page 131.

System Logging on a Remote Machine or the Other Routing Engine

This section includes the following topics:

- Directing System Log Messages to a Remote Machine or the Other Routing Engine on page 135
- Specifying an Alternative Source Address for System Log Messages on page 136
- Changing the Alternative Facility Name for Remote System Log Messages on page 137
- System Log Default Facilities for Messages Directed to a Remote Destination on page 139
- JUNOS System Log Alternate Facilities for Remote Logging on page 139
- Examples: Assigning an Alternative Facility on page 140
- Adding a Text String to System Log Messages on page 141

Directing System Log Messages to a Remote Machine or the Other Routing Engine

To direct system log messages to a remote machine or to the other Routing Engine on the router, include the `host` statement at the `[edit system syslog]` hierarchy level:

```
[edit system syslog]
host (hostname | other-routing-engine) {
    facility severity;
    explicit-priority;
    facility-override facility;
```

```

    log-prefix string;
    match "regular-expression";
}
source-address source-address;

```

To direct system log messages to a remote machine, include the **host *hostname*** statement to specify the remote machine's IP version 4 (IPv4) address, IP version 6 (IPv6) address, or fully qualified hostname. The remote machine must be running the standard **syslogd** utility. We do not recommend directing messages to another Juniper Networks router. In each system log message directed to the remote machine, the hostname of the local Routing Engine appears after the timestamp to indicate that it is the source for the message.

To direct system log messages to the other Routing Engine on a router with two Routing Engines installed and operational, include the **host *other-routing-engine*** statement. The statement is not automatically reciprocal, so you must include it in each Routing Engine's configuration if you want them to direct messages to each other. In each message directed to the other Routing Engine, the string **re0** or **re1** appears after the timestamp to indicate the source for the message.

For the list of logging facilities and severity levels to configure under the **host** statement, see "Specifying the Facility and Severity of Messages to Include in the Log" on page 131.

To record facility and severity level information in each message, include the **explicit-priority** statement. For more information, see "Including Priority Information in System Log Messages" on page 143.

For information about the **match** statement, see "Using Regular Expressions to Refine the Set of Logged Messages" on page 146.

When directing messages to remote machines, you can include the **source-address** statement to specify the IP address of the router that is reported in the messages as their source. In each **host** statement, you can also include the **facility-override** statement to assign an alternative facility and the **log-prefix** statement to add a string to each message. For more information, see the following sections:

Specifying an Alternative Source Address for System Log Messages

To specify the router that is reported in system log messages as their source when they are directed to a remote machine, include the **source-address** statement at the **[edit system syslog]** hierarchy level:

```

[edit system syslog]
source-address source-address;

```

source-address is a valid IPv4 or IPv6 address configured on one of the router interfaces. The address is reported in the messages directed to all remote machines specified in **host *hostname*** statements at the **[edit system syslog]** hierarchy level, but not in messages directed to the other Routing Engine.

Changing the Alternative Facility Name for Remote System Log Messages

Some facilities assigned to messages logged on the local router have the JUNOS Software-specific names (see Table 15 on page 132). In the recommended configuration, a remote machine designated at the `[edit system syslog host hostname]` hierarchy level is not a Juniper Networks router, so its `syslogd` utility cannot interpret the JUNOS Software-specific names. To enable the standard `syslogd` utility to handle messages from these facilities when messages are directed to a remote machine, a standard `localX` facility name is used instead of the JUNOS Software-specific facility name.

Table 17 on page 139 lists the default alternative facility name next to the JUNOS Software-specific facility name it is used for.

The `syslogd` utility on a remote machine handles all messages that belong to a facility in the same way, regardless of the source of the message (the Juniper Networks router or the remote machine itself). For example, the following statements in the configuration of the router called `local-router` direct messages from the `authorization` facility to the remote machine `monitor.mycompany.com`:

```
[edit system syslog]
host monitor.mycompany.com {
  authorization info;
}
```

The default alternative facility for the local `authorization` facility is also `authorization`. If the `syslogd` utility on `monitor` is configured to write messages belonging to the `authorization` facility to the file `/var/log/auth-attempts`, the file contains both the messages generated when users log in to `local-router` and the messages generated when users log in to `monitor`. Although the name of the source machine appears in each system log message, the mixing of messages from multiple machines can make it more difficult to analyze the contents of the `auth-attempts` file.

To make it easier to separate the messages from each source, you can assign an alternative facility to all messages generated on `local-router` when they are directed to `monitor`. You can then configure the `syslogd` utility on `monitor` to write messages with the alternative facility to a different file from messages generated on `monitor` itself.

To change the facility used for all messages directed to a remote machine, include the `facility-override` statement at the `[edit system syslog host hostname]` hierarchy level:

```
[edit system syslog host hostname]
facility severity;
facility-override facility;
```

In general, it makes sense to specify an alternative facility that is not already in use on the remote machine, such as one of the `localX` facilities. On the remote machine, you must also configure the `syslogd` utility to handle the messages in the desired manner.

Table 18 on page 139 lists the facilities that you can specify in the **facility-override** statement.

We do not recommend including the **facility-override** statement at the **[edit system syslog host other-routing-engine]** hierarchy level. It is not necessary to use alternative facility names when directing messages to the other Routing Engine, because its JUNOS system logging utility can interpret the JUNOS Software–specific names.

The following example shows how to log all messages generated on the local router at the **error** level or higher to the **local0** facility on the remote machine called **monitor.mycompany.com**:

```
[edit system syslog]
host monitor.mycompany.com {
  any error;
  facility-override local0;
}
```

The following example shows how to configure routers located in California and routers located in New York to send messages to a single remote machine called **central-logger.mycompany.com**. The messages from California are assigned alternative facility **local0** and the messages from New York are assigned to alternative facility **local2**.

- Configure California routers to aggregate messages in the **local0** facility:

```
[edit system syslog]
host central-logger.mycompany.com {
  change-log info;
  facility-override local0;
}
```

- Configure New York routers to aggregate messages in the **local2** facility:

```
[edit system syslog]
host central-logger.mycompany.com {
  change-log info;
  facility-override local2;
}
```

On **central-logger**, you can then configure the system logging utility to write messages from the **local0** facility to the file **california-config** and the messages from the **local2** facility to the file **new-york-config**.

Related Topics

- Table 17 on page 139
- JUNOS System Log Alternate Facilities for Remote Logging on page 139

System Log Default Facilities for Messages Directed to a Remote Destination

Table 17 on page 139 lists the default alternative facility name next to the JUNOS Software-specific facility name it is used for. For facilities that are not listed, the default alternative name is the same as the local facility names.

Table 17: Default Facilities for Messages Directed to a Remote Destination

JUNOS Software-specific Local Facility	Default Facility When Directed to Remote Destination
change-log	local6
conflict-log	local5
dfc	local1
firewall	local3
interactive-commands	local7
pfe	local4

JUNOS System Log Alternate Facilities for Remote Logging

Table 18 on page 139 lists the facilities that you can specify in the facility-override statement.

Table 18: Facilities for the facility-override Statement

Facility	Description
authorization	Authentication and authorization attempts
daemon	Actions performed or errors encountered by system processes
ftp	Actions performed or errors encountered by the FTP process
kernel	Actions performed or errors encountered by the JUNOS kernel
local0	Local facility number 0
local1	Local facility number 1
local2	Local facility number 2
local3	Local facility number 3
local4	Local facility number 4
local5	Local facility number 5

Table 18: Facilities for the facility-override Statement *(continued)*

Facility	Description
local6	Local facility number 6
local7	Local facility number 7
user	Actions performed or errors encountered by user-space processes

We do not recommend including the `facility-override` statement at the `[edit system syslog host other-routing-engine]` hierarchy level. It is not necessary to use alternative facility names when directing messages to the other Routing Engine, because its JUNOS system logging utility can interpret the JUNOS Software-specific names.

Examples: Assigning an Alternative Facility

The following example shows how to configure the logging of all messages generated on the local router at the error level or higher to the `local0` facility on the remote machine called `monitor.mycompany.com`:

```
[edit system syslog]
host monitor.mycompany.com {
  any error;
  facility-override local0;
}
```

Configure routers located in and routers located in New York to send messages to a single remote machine called `central-logger.mycompany.com`. The messages from California are assigned alternative facility `local0` and the messages from New York are assigned to alternative facility `local2`.

- Configure California routers to aggregate messages in the `local0` facility:

```
[edit system syslog]
host central-logger.mycompany.com {
  change-log info;
  facility-override local0;
}
```

- Configure New York routers to aggregate messages in the `local2` facility:

```
[edit system syslog]
host central-logger.mycompany.com {
  change-log info;
  facility-override local2;
}
```

On `central-logger`, you can then configure the system logging utility to write messages from the `local0` facility to the file `california-config` and the messages from the `local2` facility to the file `new-york-config`.

Adding a Text String to System Log Messages

To add a text string to every system log message directed to a remote machine or to the other Routing Engine, include the `log-prefix` statement at the `[edit system syslog host]` hierarchy level:

```
[edit system syslog host (hostname | other-routing-engine)]
  facility severity;
  log-prefix string;
```

The string can contain any alphanumeric or special character except the equal sign (=) and the colon (:). It also cannot include the space character; do not enclose the string in quotation marks (" ") in an attempt to include spaces in it.

The JUNOS system logging utility automatically appends a colon and a space to the specified string when the system log messages are written to the log. The string is inserted after the identifier for the Routing Engine that generated the message.

The following example shows how to add the string **M120** to all messages to indicate that the router is an M120 router, and direct the messages to the remote machine `hardware-logger.mycompany.com`:

```
[edit system syslog]
  host hardware-logger.mycompany.com {
    any info;
    log-prefix M120;
  }
```

When these configuration statements are included on an M120 router called `origin1`, a message in the system log on `hardware-logger.mycompany.com` looks like the following:

```
Mar 9 17:33:23 origin1 M120: mgd[477]: UI_CMDLINE_READ_LINE: user 'root',
  command 'run show version'
```

Specifying Log File Size, Number, and Archiving Properties

To prevent log files from growing too large, the JUNOS system logging utility by default writes messages to a sequence of files of a defined size. The files in the sequence are referred to as *archive* files to distinguish them from the *active* file to which messages are currently being written. The default maximum size depends on the platform type:

- 128 kilobytes (KB) for J Series Services Routers
- 1 (MB) for M Series, MX Series, and T Series routers
- 10 MB for TX Matrix or TX Matrix Plus routers

When an active log file called *logfile* reaches the maximum size, the logging utility closes the file, compresses it, and names the compressed archive file *logfile.0.gz*. The logging utility then opens and writes to a new active file called *logfile*. When the new *logfile* reaches the configured maximum size, *logfile.0.gz* is renamed *logfile.1.gz*, and

the new *logfile* is closed, compressed, and renamed *logfile.0.gz*. By default, the logging utility creates up to 10 archive files in this manner. When the maximum number of archive files is reached, each time the active file reaches the maximum size the contents of the oldest archive file are overwritten by the next oldest file. The logging utility by default also limits the users who can read log files to the *root* user and users who have the JUNOS *maintenance* permission.

You can include the *archive* statement to change the maximum size of each file, how many archive files are created, and who can read log files.

To configure values that apply to all log files, include the *archive* statement at the *[edit system syslog]* hierarchy level:

```
archive size size files number (world-readable | no-world-readable);
```

To configure values that apply to a specific log file, include the *archive* statement at the *[edit system syslog file filename]* hierarchy level:

```
archive {
  archive-sites {
    site-name <password password>;
  }
  files number size size start-time date.time transfer-interval interval (world-readable
    | no-world-readable);
}
```

archive-sites site-name specifies a list of archive sites that you want to use for storing files. The *site-name* value is any valid FTP URL to a destination. If more than one site name is configured, a list of archive sites for the system log files is created. When a file is archived, the router attempts to transfer the file to the first URL in the list, moving to the next site only if the transfer does not succeed. The log file is stored at the archive site with the specified log file name. For information about how to specify valid FTP URLs, see “Format for Specifying Filenames and URLs in JUNOS CLI Commands” on page 40.

files number specifies the number of files to create before the oldest file is overwritten. The value can be from 1 through 1000.

size size specifies the maximum size of each file. The value can be from 64 KB (64k) through 1 gigabyte (1g); to represent megabytes, use the letter m after the integer. There is no space between the digits and the k, m, or g units letter.

start-time date.time defines the day and time at which you want the file transfer to occur. The format for *date.time* is *yyyy-mm-dd.hh:mm*. This is a one-time file transfer of the active log file to one of the specified archive sites.

transfer-interval interval defines the amount of time the current log file remains open (even if it has not reached the maximum possible size) and receives new statistics before it is closed and transferred to an archive site. This interval value can be from 5 through 2880 minutes.

world-readable enables all users to read log files. To restore the default permissions, include the *no-world-readable* statement.

Including Priority Information in System Log Messages

A message's facility and severity level are together referred to as its *priority*. By default, messages logged in the standard JUNOS format do not include information about priority. To include priority information in standard-format messages directed to a file, include the **explicit-priority** statement at the `[edit system syslog file filename]` hierarchy level:

```
[edit system syslog file filename]
  facility severity;
  explicit-priority;
```



NOTE: Messages logged in structured-data format include priority information by default (structured-data format is available in JUNOS Software Release 8.3 and later and for file destinations only). If you include the **structured-data** statement at the `[edit system syslog file filename]` hierarchy level along with the **explicit-priority** statement, the **explicit-priority** statement is ignored and messages are logged in structured-data format.

For information about the **structured-data** statement, see “Logging Messages in Structured-Data Format” on page 134. For information about the contents of a structured-data message, see the *JUNOS System Log Messages Reference*.

To include priority information in messages directed to a remote machine or the other Routing Engine, include the **explicit-priority** statement at the `[edit system syslog host (hostname | other-routing-engine)]` hierarchy level:

```
[edit system syslog host (hostname | other-routing-engine)]
  facility severity;
  explicit-priority;
```

The priority recorded in a message always indicates the original, local facility name. If the **facility-override** statement is included for messages directed to a remote destination, the JUNOS system logging utility still uses the alternative facility name for the messages themselves when directing them to the remote destination. For more information, see “Changing the Alternative Facility Name for Remote System Log Messages” on page 137.

When the **explicit-priority** statement is included, the JUNOS logging utility prepends codes for the facility name and severity level to the message tag name, if the message has one:

```
FACILITY-severity[-TAG]
```

(The tag is a unique identifier assigned to some JUNOS system log messages; for more information, see the *JUNOS System Log Messages Reference*.)

In the following example, the **CHASSISD_PARSE_COMPLETE** message belongs to the **daemon** facility and is assigned severity **info** (6):

```
Aug 21 12:36:30 router1 chassisd[522]: %DAEMON-6-CHASSISD_PARSE_COMPLETE:
Using new configuration
```

When the `explicit-priority` statement is not included, the priority does not appear in the message:

```
Aug 21 12:36:30 router1 chassisd[522]: CHASSISD_PARSE_COMPLETE: Using new
configuration
```

For more information about message formatting, see the *JUNOS System Log Messages Reference*.

System Log Facility Codes and Numerical Codes Reported in Priority Information

Table 19 on page 144 lists the facility codes that can appear in system log messages and maps them to facility names.



NOTE: If the second column in Table 19 on page 144 does not include the JUNOS facility name for a code, the facility cannot be included in a statement at the `[edit system syslog]` hierarchy level. The JUNOS Software might use the facilities in Table 19 on page 144—and others that are not listed—when reporting on internal operations.

Table 19: Facility Codes Reported in Priority Information

Code	JUNOS Facility Name	Type of Event or Error
AUTH	authorization	Authentication and authorization attempts
AUTHPRIV		Authentication and authorization attempts that can be viewed by superusers only
CHANGE	change-log	Changes to the JUNOS configuration
CONFLICT	conflict-log	Specified configuration is invalid on the router type
CONSOLE		Messages written to <code>/dev/console</code> by the kernel console output <code>r</code>
CRON		Actions performed or errors encountered by the cron process
DAEMON	daemon	Actions performed or errors encountered by system processes
DFC	dfc	Actions performed or errors encountered by the dynamic flow capture process
FIREWALL	firewall	Packet filtering actions performed by a firewall filter
FTP	ftp	Actions performed or errors encountered by the FTP process
INTERACT	interactive-commands	Commands issued at the JUNOS CLI prompt or invoked by a client application such as a JUNOScript or NETCONF client

Table 19: Facility Codes Reported in Priority Information (*continued*)

Code	JUNOS Facility Name	Type of Event or Error
KERN	kernel	Actions performed or errors encountered by the JUNOS kernel
NTP		Actions performed or errors encountered by the Network Time Protocol (NTP)
PFE	pfe	Actions performed or errors encountered by the Packet Forwarding Engine
SYSLOG		Actions performed or errors encountered by the JUNOS system logging utility
USER	user	Actions performed or errors encountered by user-space processes

Table 20 on page 145 lists the numerical severity codes that can appear in system log messages and maps them to severity levels.

Table 20: Numerical Codes for Severity Levels Reported in Priority Information

Numerical Code	Severity Level	Description
0	emergency	System panic or other condition that causes the router to stop functioning
1	alert	Conditions that require immediate correction, such as a corrupted system database
2	critical	Critical conditions, such as hard errors
3	error	Error conditions that generally have less serious consequences than errors in the emergency, alert, and critical levels
4	warning	Conditions that warrant monitoring
5	notice	Conditions that are not errors but might warrant special handling
6	info	Events or nonerror conditions of interest
7	debug	Software debugging messages (these appear only if a technical support representative has instructed you to configure this severity level)

Including the Year or Millisecond in Timestamps

By default, the timestamp recorded in a standard-format system log message specifies the month, date, hour, minute, and second when the message was logged, as in the following example:

Aug 21 12:36:30

To include the year, the millisecond, or both in the timestamp, include the **time-format** statement at the **[edit system syslog]** hierarchy level:

```
[edit system syslog]
time-format (year | millisecond | year millisecond);
```

The modified timestamp is used in messages directed to each destination configured by a **file**, **console**, or **user** statement at the **[edit system syslog]** hierarchy level, but not to destinations configured by a **host** statement.

The following example illustrates the format for a timestamp that includes both the millisecond (401) and the year (2006):

Aug 21 12:36:30.401 2006



NOTE: Messages logged in structured-data format (available in JUNOS Release 8.3 and later for file destinations) include the year and millisecond by default. If you include the structured-data statement at the **[edit system syslog file filename]** hierarchy level along with the **time-format** statement, the **time-format** statement is ignored and messages are logged in structured-data format.

For information about the **structured-data** statement, see “Logging Messages in Structured-Data Format” on page 134. For information about the contents of a structured-data message, see the *JUNOS System Log Messages Reference*.

Using Regular Expressions to Refine the Set of Logged Messages

The predefined facilities group together related messages, but you can also use regular expression matching to specify more exactly which messages from a facility are logged to a file, a user terminal, or a remote destination.

To specify the text string that must (or must not) appear in a message for the message to be logged to a destination, include the **match** statement and specify the regular expression which the text string must match:

```
match "regular-expression";
```

You can include this statement at the following hierarchy levels:

- **[edit system syslog file filename]** (for a file)
- **[edit system syslog user (username | *)]** (for the terminal session of one or all users)
- **[edit system syslog host (hostname | other-routing-engine)]** (for a remote destination)

In specifying the regular expression, use the notation defined in POSIX Standard 1003.2 for extended (modern) UNIX regular expressions. Explaining regular expression syntax is beyond the scope of this document, but POSIX standards are

available from the Institute of Electrical and Electronics Engineers (IEEE, <http://www.ieee.org>).

Table 21 on page 147 specifies which character or characters are matched by some of the regular expression operators that you can use in the **match** statement. In the descriptions, the term *term* refers to either a single alphanumeric character or a set of characters enclosed in square brackets, parentheses, or braces.



NOTE: The match statement is not case-sensitive.

The following example shows how to filter messages that belong to the **interactive-commands** facility, directing those that include the string **configure** to the terminal of the **root** user:

```
[edit system syslog]
user root {
  interactive-commands any;
  match ".*configure.*";
}
```

Messages like the following appear on the **root** user's terminal when a user issues a **configure** command to enter configuration mode:

```
timestamp router-name mgd[PID]: UI_CMDLINE_READ_LINE: User 'user', command
'configure private'
```

The following example shows how to filter messages that belong to the **daemon** facility and have severity **error** or higher, directing them to the file **/var/log/process-errors**. Omit messages generated by the SNMP process (**snmpd**), instead directing them to the file **/var/log/snmpd-errors**:

```
[edit system syslog]
file process-errors {
  daemon error;
  match "!(.*snmpd.*)";
}
file snmpd-errors {
  daemon error;
  match ".*snmpd.*";
}
```

Related Topics ■ JUNOS System Log Regular Expression Operators for the match Statement on page 147

JUNOS System Log Regular Expression Operators for the match Statement

Table 21: Regular Expression Operators for the match Statement

Operator	Matches
.	One instance of any character except the space.

Table 21: Regular Expression Operators for the match Statement (*continued*)

Operator	Matches
* (asterisk)	Zero or more instances of the immediately preceding term.
+ (plus sign)	One or more instances of the immediately preceding term.
? (question mark)	Zero or one instance of the immediately preceding term.
(pipe)	One of the terms that appear on either side of the pipe operator.
! (exclamation point)	Any string except the one specified by the expression, when the exclamation point appears at the start of the expression. Use of the exclamation point is JUNOS Software-specific.
^ (caret)	The start of a line, when the caret appears outside square brackets. One instance of any character that does not follow it within square brackets, when the caret is the first character inside square brackets.
\$ (dollar sign)	The end of a line.
[] (paired square brackets)	One instance of one of the enclosed alphanumeric characters. To indicate a range of characters, use a hyphen (-) to separate the beginning and ending characters of the range. For example, [a-z0-9] matches any letter or number.
() (paired parentheses)	One instance of the evaluated value of the enclosed term. Parentheses are used to indicate the order of evaluation in the regular expression.

Disabling the System Logging of a Facility

To disable the logging of messages that belong to a particular facility, include the **facility none** statement in the configuration. This statement is useful when, for example, you want to log messages that have the same severity level and belong to all but a few facilities. Instead of including a statement for each facility you want to log, you can include the **any severity** statement and then a **facility none** statement for each facility that you do not want to log. For example, the following logs all messages at the **error** level or higher to the console, except for messages from the **daemon** and **kernel** facilities. Messages from those facilities are logged to the file `>/var/log/internals` instead:

```
[edit system syslog]
console {
  any error;
  daemon none;
  kernel none;
}
file internals {
  daemon info;
  kernel info;
}
```

Examples: Configuring System Logging

The following example shows how to configure the logging of messages about all commands entered by users at the CLI prompt or invoked by client applications such as JUNOScript or NETCONF client applications, and all authentication or authorization attempts, both to the file `cli-commands` and to the terminal of any user who is logged in:

```
[edit system]
syslog {
  file cli-commands {
    interactive-commands info;
    authorization info;
  }
  user * {
    interactive-commands info;
    authorization info;
  }
}
```

The following example shows how to configure the logging of all changes in the state of alarms to the file `/var/log/alarms`:

```
[edit system]
syslog {
  file alarms {
    kernel warning;
  }
}
```

The following example shows how to configure the handling of messages of various types, as described in the comments. Information is logged to two files, to the terminal of user `alex`, to a remote machine, and to the console:

```
[edit system]
syslog {
  /* write all security-related messages to file /var/log/security */
  file security {
    authorization info;
    interactive-commands info;
  }
  /* write messages about potential problems to file /var/log/messages: */
  /* messages from "authorization" facility at level "notice" and above, */
  /* messages from all other facilities at level "warning" and above */
  file messages {
    authorization notice;
    any warning;
  }
  /* write all messages at level "critical" and above to terminal of user "alex" if */
  /* that user is logged in */
  user alex {
    any critical;
  }
  /* write all messages from the "daemon" facility at level "info" and above, and */
}
```

```

/* messages from all other facilities at level "warning" and above, to the */
/* machine monitor.mycompany.com */
host monitor.mycompany.com {
    daemon info;
    any warning;
}
/* write all messages at level "error" and above to the system console */
console {
    any error;
}
}

```

The following example shows how to configure the handling of messages generated when users issue JUNOS CLI commands, by specifying the `interactive-commands` facility at the following severity levels:

- **info**—Logs a message when users issue any command at the CLI operational or configuration mode prompt. The example writes the messages to the file `/var/log/user-actions`.
- **notice**—Logs a message when users issue the configuration mode commands `rollback` and `commit`. The example writes the messages to the terminal of user `philip`.
- **warning**—Logs a message when users issue a command that restarts a software process. The example writes the messages to the console.

```

[edit system]
syslog {
    file user-actions {
        interactive-commands info;
    }
    user philip {
        interactive-commands notice;
    }
    console {
        interactive-commands warning;
    }
}

```

System Logging Configuration for a TX Matrix Router

This section explains how to configure system logging for a TX Matrix router and the T640 routers in a routing matrix. It assumes you are familiar with system logging for single-chassis systems, as described in “Single-Chassis System Logging Configuration Overview” on page 130. For more information about a TX Matrix router and routing matrix, see the *TX Matrix Router Hardware Guide*.

- Configuring System Logging for a TX Matrix Router on page 151
- Configuring Message Forwarding to the TX Matrix Router on page 153
- Impact of Different Local and Forwarded Severity Levels on System Log Messages on a TX Matrix Router on page 154

- Configuring Optional Features for Forwarded Messages on a TX Matrix Router on page 156
- Directing Messages to a Remote Destination from the Routing Matrix Based on the TX Matrix Router on page 157
- Configuring System Logging Differently on Each T640 Router in a Routing Matrix on page 158

Configuring System Logging for a TX Matrix Router

To configure system logging for all routers in a routing matrix composed of a TX Matrix router and T640 routers, include the `syslog` statement at the `[edit system]` hierarchy level on the TX Matrix router. The `syslog` statement applies to every router in the routing matrix.

```
[edit system]
syslog {
  archive-sites {
    files number;
    size size;
    (world-readable | no-world-readable);
  }
  console {
    facility severity;
  }
  file filename {
    facility severity;
    explicit-priority;
    match "regular-expression";
    structured-data {
      brief;
    }
    archive-sites {
      files number;
      size size;
      (world-readable | no-world-readable);
    }
  }
  host (hostname | other-routing-engine | scc-master) {
    facility severity;
    explicit-priority;
    facility-override facility;
    log-prefix string;
    match "regular-expression";
  }
  source-address source-address;
  time-format (year | millisecond | year millisecond);
  (username | *) {
    facility severity;
    match "regular-expression";
  }
}
```

When included in the configuration on the TX Matrix router, the following configuration statements have the same effect as on a single-chassis system, except that they apply to every router in the routing matrix:

- **archive**—Sets the size and number of log files on each platform in the routing matrix. See “Specifying Log File Size, Number, and Archiving Properties” on page 141.
- **console**—Directs the specified messages to the console of each platform in the routing matrix. See “Directing System Log Messages to the Console” on page 135.
- **file**—Directs the specified messages to a file of the same name on each platform in the routing matrix. See “Directing System Log Messages to a Log File” on page 133.
- **match**—Limits the set of messages logged to a destination to those that contain (or do not contain) a text string matching a regular expression. See “Using Regular Expressions to Refine the Set of Logged Messages” on page 146.

The separate **match** statement at the `[edit system syslog host scc-master]` hierarchy level applies to messages forwarded from the T640 routers to the TX Matrix router. See “Configuring Optional Features for Forwarded Messages on a TX Matrix Router” on page 156.

- **source-address**—Sets the IP address of the router to report in system log messages as the message source, when the messages are directed to the remote machines specified in all `host hostname` statements at the `[edit system syslog]` hierarchy level, for each platform in the routing matrix. On a routing matrix composed of a TX Matrix router and T640 routers, the address is not reported by the T640 routers in messages directed to the other Routing Engine on each router or to the TX Matrix router. See “Specifying an Alternative Source Address for System Log Messages” on page 136.
- **structured-data**—Writes messages to a file in structured-data format. See “Logging Messages in Structured-Data Format” on page 134.
- **time-format**—Adds the millisecond, year, or both to the timestamp in each standard-format message. See “Including the Year or Millisecond in Timestamps” on page 145.
- **user**—Directs the specified messages to the terminal session of one or more specified users on each platform in the routing matrix that they are logged in to. See “Directing System Log Messages to a User Terminal” on page 134.

The effect of the other statements differs somewhat for a routing matrix than for a single-chassis system.

Related Topics

- Configuring Message Forwarding to the TX Matrix Router on page 153
- Impact of Different Local and Forwarded Severity Levels on System Log Messages on a TX Matrix Router on page 154
- Configuring Optional Features for Forwarded Messages on a TX Matrix Router on page 156

- Directing Messages to a Remote Destination from the Routing Matrix Based on the TX Matrix Router on page 157
- Configuring System Logging Differently on Each T640 Router in a Routing Matrix on page 158

Configuring Message Forwarding to the TX Matrix Router

By default, the master Routing Engine on each T640 router forwards to the master Routing Engine on the TX Matrix router all messages from all facilities with severity level of `info` and higher. To change the facility, the severity level, or both, include the `host scc-master` statement at the `[edit system syslog]` hierarchy level on the TX Matrix router:

```
[edit system syslog]
host scc-master {
    facility severity;
}
```

To disable message forwarding, set the facility to `any` and the severity level to `none`:

```
[edit system syslog]
host scc-master {
    any none;
}
```

In either case, the setting applies to all T640 routers in the routing matrix.

To capture the messages forwarded by the T640 routers (as well as messages generated on the TX Matrix router itself), you must also configure system logging on the TX Matrix router. Direct the messages to one or more destinations by including the appropriate statements at the `[edit system syslog]` hierarchy level on the TX Matrix router:

- To a file, as described in “Directing System Log Messages to a Log File” on page 133.
- To the terminal session of one or more specific users (or all users), as described in “Directing System Log Messages to a User Terminal” on page 134.
- To the console, as described in “Directing System Log Messages to the Console” on page 135.
- To a remote machine that is running the `syslogd` utility or to the other Routing Engine. For more information, see “Directing Messages to a Remote Destination from the Routing Matrix Based on the TX Matrix Router” on page 157.

As previously noted, the configuration statements included on the TX Matrix router also configure the same destinations on each T640 router in the routing matrix.

When specifying the severity level for local messages (at the `[edit system syslog (file | host | console | user)]` hierarchy level) and forwarded messages (at the `[edit system syslog host scc-master]` hierarchy level), you can set the same severity level for both, set a lower severity level for local messages, or set a higher severity

level for local messages. The following examples describe the consequence of each configuration. (For simplicity, the examples use the `any` facility in every case. You can also specify different severities for different facilities, with more complex consequences.)

Related Topics ■ Configuring System Logging for a TX Matrix Router on page 151

Impact of Different Local and Forwarded Severity Levels on System Log Messages on a TX Matrix Router

This topic describes the impact of different local and forwarded severity levels configured for system log messages on a TX Matrix router:

- Messages Logged When the Local and Forwarded Severity Levels Are the Same on page 154
- Messages Logged When the Local Severity Level Is Lower on page 154
- Messages Logged When the Local Severity Level Is Higher on page 155

Messages Logged When the Local and Forwarded Severity Levels Are the Same

When the severity level is the same for local and forwarded messages, the log on the TX Matrix router contains all messages from the logs on the T640 routers. For example, you can specify severity `info` for the `/var/log/messages` file, which is the default severity level for messages forwarded by T640 routers:

```
[edit system syslog]
file messages {
  any info;
}
```

Table 22 on page 154 specifies which messages are included in the logs on the T640 routers and the TX Matrix router.

Table 22: Example: Local and Forwarded Severity Level Are Both `info`

Log Location	Source of Messages	Lowest Severity Included
T640 router	Local	<code>info</code>
TX Matrix router	Local	<code>info</code>
	Forwarded from T640 routers	<code>info</code>

Messages Logged When the Local Severity Level Is Lower

When the severity level is lower for local messages than for forwarded messages, the log on the TX Matrix router includes fewer forwarded messages than when the severities are the same. Locally generated messages are still logged at the lower

severity level, so their number in each log is the same as when the severities are the same.

For example, on a TX Matrix router, you can specify severity **notice** for the `/var/log/messages` file and severity **critical** for forwarded messages:

```
[edit system syslog]
file messages {
    any notice;
}
host scc-master {
    any critical;
}
```

Table 23 on page 155 specifies which messages in a routing matrix are included in the logs on the T640 routers and the TX Matrix router. The T640 routers forward only those messages with severity **critical** and higher, so the log on the TX Matrix router does not include the messages with severity **error**, **warning**, or **notice** that the T640 routers log locally.

Table 23: Example: Local Severity Is notice, Forwarded Severity Is critical

Log Location	Source of Messages	Lowest Severity Included
T640 router	Local	notice
TX Matrix router	Local	notice
	Forwarded from T640 routers	critical

Messages Logged When the Local Severity Level Is Higher

When the severity level is higher for local messages than for forwarded messages, the log on the TX Matrix router includes fewer forwarded messages than when the severities are the same, and all local logs contain fewer messages overall.

For example, you can specify severity **critical** for the `/var/log/messages` file and severity **notice** for forwarded messages:

```
[edit system syslog]
file messages {
    any critical;
}
host scc-master {
    any notice;
}
```

Table 24 on page 156 specifies which messages are included in the logs on the T640 routers and the TX Matrix router. Although the T640 routers forward messages with severity **notice** and higher, the TX Matrix router discards any of those messages with severity **critical** or lower (does not log forwarded messages with severity **error**, **warning**, or **notice**). None of the logs include messages with severity **error** or lower.

Table 24: Example: Local Severity Is critical, Forwarded Severity Is notice

Log Location	Source of Messages	Lowest Severity Included
T640 router	Local	critical
TX Matrix router	Local	critical
	Forwarded from T640 routers	critical

Related Topics ■ Configuring System Logging for a TX Matrix Router on page 151

Configuring Optional Features for Forwarded Messages on a TX Matrix Router

To configure additional optional features when specifying how the T640 routers forward messages to the TX Matrix router, include statements at the [edit system syslog host scc-master] hierarchy level. To include priority information (facility and severity level) in each forwarded message, include the **explicit-priority** statement. To insert a text string in each forwarded message, include the **log-prefix** statement. To use regular expression matching to specify more exactly which messages from a facility are forwarded, include the **match** statement.

```
[edit system syslog]
host scc-master {
    facility severity;
    explicit-priority;
    log-prefix string;
    match "regular-expression;
}
```

You can also include the **facility-override** statement at the [edit system syslog host scc-master] hierarchy level, but we do not recommend doing so. It is not necessary to use alternative facilities for messages forwarded to the TX Matrix router, because it runs the JUNOS system logging utility and can interpret the JUNOS Software-specific facilities. For more information about alternative facilities, see “Changing the Alternative Facility Name for Remote System Log Messages” on page 137.

- Including Priority Information in Forwarded Messages on page 156
- Adding a Text String to Forwarded Messages on page 157
- Using Regular Expressions to Refine the Set of Forwarded Messages on page 157

Including Priority Information in Forwarded Messages

When you include the **explicit-priority** statement at the [edit system syslog host scc-master] hierarchy level, messages forwarded to the TX Matrix router include priority information. For the information to appear in a log file on the TX Matrix router, you must also include the **explicit-priority** statement at the [edit system syslog file *filename*] hierarchy level for the file on the TX Matrix router. As a consequence, the log file with the same name on each platform in the routing matrix also includes priority information for locally generated messages.

To include priority information in messages directed to a remote machine from all routers in the routing matrix, also include the `explicit-priority` statement at the `[edit system syslog host hostname]` hierarchy level for the remote machine. For more information, see “Directing Messages to a Remote Destination from the Routing Matrix Based on the TX Matrix Router” on page 157.

In the following example, the `/var/log/messages` file on all routers includes priority information for messages with severity `notice` and higher from all facilities. The log on the TX Matrix router also includes messages with those characteristics forwarded from the T640 routers.

```
[edit system syslog]
host scc-master {
  any notice;
  explicit-priority;
}
file messages {
  any notice;
  explicit-priority;
}
```

Adding a Text String to Forwarded Messages

When you include the `log-prefix` statement at the `[edit system syslog host scc-master]` hierarchy level, the string that you define appears in every message forwarded to the TX Matrix router. For more information, see “Adding a Text String to System Log Messages” on page 141.

Using Regular Expressions to Refine the Set of Forwarded Messages

When you include the `match` statement at the `[edit system syslog host scc-master]` hierarchy level, the regular expression that you specify controls which messages from the T640 routers are forwarded to the TX Matrix router. The regular expression is not applied to messages from the T640 router that are directed to destinations other than the TX Matrix router. For more information about regular expression matching, see “Using Regular Expressions to Refine the Set of Logged Messages” on page 146.

Directing Messages to a Remote Destination from the Routing Matrix Based on the TX Matrix Router

You can configure a routing matrix composed of a TX Matrix router and T640 routers to direct system logging messages to a remote machine or the other Routing Engine on each router, just as on a single-chassis system. Include the `host` statement at the `[edit system syslog]` hierarchy level on the TX Matrix router:

```
[edit system syslog]
host (hostname | other-routing-engine) {
  facility severity;
  explicit-priority;
  facility-override facility;
  log-prefix string;
  match "regular-expression";
```

```

}
source-address source-address;

```

The TX Matrix router directs messages to a remote machine or the other Routing Engine in the same way as a single-chassis system, and the optional statements (**explicit-priority**, **facility-override**, **log-prefix**, **match**, and **source-address**) also have the same effect as on a single-chassis system. For more information, see “Directing System Log Messages to a Remote Machine or the Other Routing Engine” on page 135.

For the TX Matrix router to include priority information when it directs messages that originated on a T640 router to the remote destination, you must also include the **explicit-priority** statement at the **[edit system syslog host scc-master]** hierarchy level.

The **other-routing-engine** statement does not interact with message forwarding from the T640 routers to the TX Matrix router. For example, if you include the statement in the configuration for the Routing Engine in slot 0 (**re0**), the **re0** Routing Engine on each T640 router sends messages to the **re1** Routing Engine on its platform only. It does not also send messages directly to the **re1** Routing Engine on the TX Matrix router.

Because the configuration on the TX Matrix router applies to the T640 routers, any T640 router that has interfaces for direct access to the Internet also directs messages to the remote machine. The consequences include the following:

- If the T640 routers are configured to forward messages to the TX Matrix router (as in the default configuration), the remote machine receives two copies of some messages: one directly from the T640 router and the other from the TX Matrix router. Which messages are duplicated depends on whether the severities are the same for local logging and for forwarded messages. For more information, see “Configuring Message Forwarding to the TX Matrix Router” on page 153.
- If the **source-address** statement is configured at the **[edit system syslog]** hierarchy level, all routers in the routing matrix report the same source address in messages directed to the remote machine. This is appropriate, because the routing matrix functions as a single router.
- If the **log-prefix** statement is included, the messages from all routers in the routing matrix include the same text string. You cannot use the string to distinguish between the routers in the routing matrix.

Related Topics ■ Configuring System Logging for a TX Matrix Router on page 151

Configuring System Logging Differently on Each T640 Router in a Routing Matrix

We recommend that all routers in a routing matrix composed of a TX Matrix router and T640 routers use the same configuration, which implies that you include system logging configuration statements on the TX Matrix router only. In rare circumstances, however, you might choose to log different messages on different routers. For example, if one router in the routing matrix is experiencing problems with authentication, a Juniper Networks support representative might instruct you to log messages from the **authorization** facility with severity **debug** on that router.

To configure routers separately, include configuration statements in the appropriate groups at the `[edit groups]` hierarchy level on the TX Matrix router:

- To configure settings that apply to the TX Matrix router but not the T640 routers, include them in the `re0` and `re1` configuration groups.
- To configure settings that apply to particular T640 routers, include them in the `lccn-re0` and `lccn-re1` configuration groups, where *n* is the line-card chassis (LCC) index number of the router.

When you use configuration groups, do not issue CLI configuration-mode commands to change statements at the `[edit system syslog]` hierarchy level on the TX Matrix router. If you do, the resulting statements overwrite the statements defined in configuration groups and apply to the T640 routers also. (We further recommend that you do not issue CLI configuration-mode commands on the T640 routers at any time.)

For more information about the configuration groups for a routing matrix, see the chapter about configuration groups in the *JUNOS CLI User Guide*.

The following example shows how to configure the `/var/log/messages` files on three routers to include different sets of messages:

- On the TX Matrix router, local messages with severity `info` and higher from all facilities. The file does not include messages from the T640 routers, because the `host scc-master` statement disables message forwarding.
- On the T640 router designated `LCC0`, messages from the `authorization` facility with severity `info` and higher.
- On the T640 router designated `LCC1`, messages with severity `notice` from all facilities.

```
[edit groups]
re0 {
  system {
    syslog {
      file messages {
        any info;
      }
      host scc-master {
        any none;
      }
    }
  }
}
re1 {
  ... same statements as for re0 ...
}
lcc0-re0 {
  system {
    syslog {
      file messages {
        authorization info;
      }
    }
  }
}
```

```

    }
  }
  lcc0-re1 {
    ... same statements as for lcc0-re0 ...
  }
  lcc1-re0 {
    system {
      syslog {
        file messages {
          any notice;
        }
      }
    }
  }
  lcc0-re1 {
    ... same statements as for lcc1-re0 ...
  }
}

```

Related Topics ■ Configuring System Logging for a TX Matrix Router on page 151

System Logging Configuration for a TX Matrix Plus Router

This section explains how to configure system logging for a TX Matrix Plus router and the T1600 routers in a routing matrix. It assumes you are familiar with system logging for single-chassis systems, as described in “Single-Chassis System Logging Configuration Overview” on page 130. For more information about a TX Matrix Plus router and routing matrix, see the *TX Matrix Router Hardware Guide*.

- Configuring System Logging for a TX Matrix Plus Router on page 160
- Configuring Message Forwarding to the TX Matrix Plus Router on page 162
- Impact of Different Local and Forwarded Severity Levels on System Log Messages on a TX Matrix Plus Router on page 163
- Configuring Optional Features for Forwarded Messages on a TX Matrix Plus Router on page 166
- Directing Messages to a Remote Destination from the Routing Matrix Based on a TX Matrix Plus Router on page 167
- Configuring System Logging Differently on Each T1600 Router in a Routing Matrix on page 168

Configuring System Logging for a TX Matrix Plus Router

To configure system logging for all routers in a routing matrix composed of a TX Matrix Plus router and T1600 routers, include the **syslog** statement at the **[edit system]** hierarchy level on the TX Matrix Plus router. The **syslog** statement applies to every router in the routing matrix.

```

[edit system]
syslog {
  archive-sites {
    files number;
  }
}

```

```

        size size;
        (world-readable | no-world-readable);
    }
    console {
        facility severity;
    }
    file filename {
        facility severity;
        explicit-priority;
        match "regular-expression";
        structured-data {
            brief;
        }
        archive-sites {
            files number;
            size size;
            (world-readable | no-world-readable);
        }
    }
    host (hostname | other-routing-engine | sfc0-master) {
        facility severity;
        explicit-priority;
        facility-override facility;
        log-prefix string;
        match "regular-expression";
    }
    source-address source-address;
    time-format (year | millisecond | year millisecond);
    (username | *) {
        facility severity;
        match "regular-expression";
    }
}

```

When included in the configuration on the TX Matrix Plus router, the following configuration statements have the same effect as on a single-chassis system, except that they apply to every router in the routing matrix composed of the TX Matrix Plus router and T1600 routers:

- **archive**—Sets the size and number of log files on each router in the routing matrix. See “Specifying Log File Size, Number, and Archiving Properties” on page 141.
- **console**—Directs the specified messages to the console of each router in the routing matrix. See “Directing System Log Messages to the Console” on page 135.
- **file**—Directs the specified messages to a file of the same name on each router in the routing matrix. See “Directing System Log Messages to a Log File” on page 133.
- **match**—Limits the set of messages logged to a destination to those that contain (or do not contain) a text string matching a regular expression. See “Using Regular Expressions to Refine the Set of Logged Messages” on page 146.

The separate **match** statement at the [edit system syslog host sfc0-master] hierarchy level applies to messages forwarded from the T1600 routers to the TX

Matrix Plus router. See “Configuring Optional Features for Forwarded Messages on a TX Matrix Plus Router” on page 166.

- **source-address**—Sets the IP address of the router as the message source in system log messages when the messages are directed to the remote machines specified in all **host** *hostname* statements at the [edit system syslog] hierarchy level, for each router in the routing matrix. On a routing matrix composed of a TX Matrix Plus router and T1600 routers, the address is not reported by the T1600 routers in messages directed to the other Routing Engine on each router or to the TX Matrix Plus router. See “Specifying an Alternative Source Address for System Log Messages” on page 136.
- **structured-data**—Writes messages to a file in structured-data format. See “Logging Messages in Structured-Data Format” on page 134.
- **time-format**—Adds the millisecond, year, or both to the timestamp in each standard-format message. See “Including the Year or Millisecond in Timestamps” on page 145.
- **user**—Directs the specified messages to the terminal session of one or more specified users on each router in the routing matrix that they are logged in to. See “Directing System Log Messages to a User Terminal” on page 134.

The effect of the other statements differs somewhat for a routing matrix than for a single-chassis system.

- Related Topics**
- Configuring Message Forwarding to the TX Matrix Plus Router on page 162
 - Impact of Different Local and Forwarded Severity Levels on System Log Messages on a TX Matrix Plus Router on page 163
 - Configuring Optional Features for Forwarded Messages on a TX Matrix Plus Router on page 166
 - Directing Messages to a Remote Destination from the Routing Matrix Based on a TX Matrix Plus Router on page 167
 - Configuring System Logging Differently on Each T1600 Router in a Routing Matrix on page 168

Configuring Message Forwarding to the TX Matrix Plus Router

By default, the master Routing Engine on each T1600 router forwards to the master Routing Engine on the TX Matrix Plus router all messages from all facilities with severity level of **info** and higher. To change the facility, the severity level, or both, include the **host sfc0-master** statement at the [edit system syslog] hierarchy level on the TX Matrix Plus router:

```
[edit system syslog]
host sfc0-master {
    facility severity;
}
```

To disable message forwarding, set the facility to **any** and the severity level to **none**:

```
[edit system syslog]
```

```
host sfc0-master {
    any none;
}
```

In either case, the setting applies to all T1600 routers in the routing matrix.

To capture the messages forwarded by the T1600 routers (as well as messages generated on the TX Matrix Plus router itself), you must also configure system logging on the TX Matrix Plus router. Direct the messages to one or more destinations by including the appropriate statements at the [edit system syslog] hierarchy level on the TX Matrix Plus router:

- To a file, as described in “Directing System Log Messages to a Log File” on page 133.
- To the terminal session of one or more specific users (or all users), as described in “Directing System Log Messages to a User Terminal” on page 134.
- To the console, as described in “Directing System Log Messages to the Console” on page 135.
- To a remote machine that is running the **syslogd** utility or to the other Routing Engine. For more information, see “Directing Messages to a Remote Destination from the Routing Matrix Based on a TX Matrix Plus Router” on page 167.

As previously noted, the configuration statements included on the TX Matrix Plus router also configure the same destinations on each T1600 router.

When specifying the severity level for local messages (at the [edit system syslog (file | host | console | user)] hierarchy level) and forwarded messages (at the [edit system syslog host sfc0-master] hierarchy level), you can set the same severity level for both, set a lower severity level for local messages, or set a higher severity level for local messages. The following examples describe the consequence of each configuration. (For simplicity, the examples use the **any** facility in every case. You can also specify different severities for different facilities, with more complex consequences.)

Related Topics ■ Configuring System Logging for a TX Matrix Plus Router on page 160

Impact of Different Local and Forwarded Severity Levels on System Log Messages on a TX Matrix Plus Router

This topic describes the impact of different local and forwarded severity levels configured for the system log messages on a TX Matrix Plus router:

- Messages Logged When the Local and Forwarded Severity Levels Are the Same on page 164
- Messages Logged When the Local Severity Level Is Lower on page 164
- Messages Logged When the Local Severity Level Is Higher on page 165

Messages Logged When the Local and Forwarded Severity Levels Are the Same

When the severity level is the same for local and forwarded messages, the log on the TX Matrix Plus router contains all messages from the logs on the T1600 routers in the routing matrix. For example, you can specify severity **info** for the `/var/log/messages` file, which is the default severity level for messages forwarded by T1600 routers:

```
[edit system syslog]
file messages {
  any info;
}
```

Table 25 on page 164 specifies which messages in a routing matrix based on a TX Matrix Plus router are included in the logs on the T1600 routers and the TX Matrix Plus router:

Table 25: Example: Local and Forwarded Severity Level Are Both info

Log Location	Source of Messages	Lowest Severity Included
T1600 router	Local	info
TX Matrix Plus router	Local	info
	Forwarded from T1600 routers	info

Messages Logged When the Local Severity Level Is Lower

When the severity level is lower for local messages than for forwarded messages, the log on the TX Matrix Plus router includes fewer forwarded messages than when the severities are the same. Locally generated messages are still logged at the lower severity level, so their number in each log is the same as when the severities are the same.

For example, on a TX Matrix Plus router, you can specify severity **notice** for the `/var/log/messages` file and severity **critical** for forwarded messages:

```
[edit system syslog]
file messages {
  any notice;
}
host sfc0-master {
  any critical;
}
```

Table 26 on page 165 specifies which messages in a routing matrix are included in the logs on the T1600 routers and the TX Matrix Plus router. The T1600 routers forward only those messages with severity **critical** and higher, so the log on the TX

Matrix Plus router does not include the messages with severity **error**, **warning**, or **notice** that the T1600 routers log locally.

Table 26: Example: Local Severity Is notice, Forwarded Severity Is critical

Log Location	Source of Messages	Lowest Severity Included
T1600 router	Local	notice
TX Matrix Plus router	Local	notice
	Forwarded from T1600 routers	critical

Messages Logged When the Local Severity Level Is Higher

When the severity level is higher for local messages than for forwarded messages, the log on the TX Matrix Plus router includes fewer forwarded messages than when the severities are the same, and all local logs contain fewer messages overall.

For example, you can specify severity **critical** for the `/var/log/messages` file and severity **notice** for forwarded messages:

```
[edit system syslog]
file messages {
    any critical;
}
host sfc0-master {
    any notice;
}
```

Table 27 on page 165 specifies which messages are included in the logs on the T1600 routers and the TX Matrix Plus router. Although the T1600 routers forward messages with severity **notice** and higher, the TX Matrix Plus router discards any of those messages with severity **critical** or lower (does not log forwarded messages with severity **error**, **warning**, or **notice**). None of the logs include messages with severity **error** or lower.

Table 27: Example: Local Severity Is critical, Forwarded Severity Is notice

Log Location	Source of Messages	Lowest Severity Included
T1600 router	Local	critical
TX Matrix Plus router	Local	critical
	Forwarded from T1600 routers	critical

Related Topics ■ Configuring System Logging for a TX Matrix Plus Router on page 160

Configuring Optional Features for Forwarded Messages on a TX Matrix Plus Router

To configure additional optional features when specifying how the T1600 routers forward messages to the TX Matrix Plus router, include statements at the [edit system syslog host sfc0-master] hierarchy level. To include priority information (facility and severity level) in each forwarded message, include the **explicit-priority** statement. To insert a text string in each forwarded message, include the **log-prefix** statement. To use regular expression matching to specify more exactly which messages from a facility are forwarded, include the **match** statement.

```
[edit system syslog]
host sfc0-master {
    facility severity;
    explicit-priority;
    log-prefix string;
    match "regular-expression;
}
```

You can also include the **facility-override** statement at the [edit system syslog host sfc0-master] hierarchy level, but we do not recommend doing so. It is not necessary to use alternative facilities for messages forwarded to the TX Matrix Plus router, because it runs the JUNOS system logging utility and can interpret the JUNOS Software-specific facilities. For more information about alternative facilities, see “Changing the Alternative Facility Name for Remote System Log Messages” on page 137.

1. Including Priority Information in Forwarded Messages on page 166
2. Adding a Text String to Forwarded Messages on page 167
3. Using Regular Expressions to Refine the Set of Forwarded Messages on page 167

Including Priority Information in Forwarded Messages

When you include the **explicit-priority** statement at the [edit system syslog host sfc0-master] hierarchy level, messages forwarded to the TX Matrix Plus router include priority information. For the information to appear in a log file on the TX Matrix Plus router, you must also include the **explicit-priority** statement at the [edit system syslog file filename] hierarchy level for the file on the TX Matrix Plus router. As a consequence, the log file with the same name on each platform in the routing matrix also includes priority information for locally generated messages.

To include priority information in messages directed to a remote machine from all routers in the routing matrix, also include the **explicit-priority** statement at the [edit system syslog host hostname] hierarchy level for the remote machine. For more information, see “Directing Messages to a Remote Destination from the Routing Matrix Based on a TX Matrix Plus Router” on page 167.

In the following example, the `/var/log/messages` file on all routers includes priority information for messages with severity **notice** and higher from all facilities. The log

on the TX Matrix Plus router also includes messages with those characteristics forwarded from the T1600 routers.

```
[edit system syslog]
host sfc0-master {
    any notice;
    explicit-priority;
}
file messages {
    any notice;
    explicit-priority;
}
```

Adding a Text String to Forwarded Messages

When you include the `log-prefix` statement at the `[edit system syslog host sfc0-master]` hierarchy level, the string that you define appears in every message forwarded to the TX Matrix Plus router. For more information, see “Adding a Text String to System Log Messages” on page 141.

Using Regular Expressions to Refine the Set of Forwarded Messages

When you include the `match` statement at the `[edit system syslog host sfc0-master]` hierarchy level, the regular expression that you specify controls which messages from the T1600 routers are forwarded to the TX Matrix Plus router. The regular expression is not applied to messages from the T1600 routers that are directed to destinations other than the TX Matrix Plus router. For more information about regular expression matching, see “Using Regular Expressions to Refine the Set of Logged Messages” on page 146.

Directing Messages to a Remote Destination from the Routing Matrix Based on a TX Matrix Plus Router

You can configure a routing matrix composed of a TX Matrix Plus router and T1600 routers to direct system logging messages to a remote machine or the other Routing Engine on each routing router, just as on a single-chassis system. Include the `host` statement at the `[edit system syslog]` hierarchy level on the TX Matrix Plus router:

```
[edit system syslog]
host (hostname | other-routing-engine) {
    facility severity;
    explicit-priority;
    facility-override facility;
    log-prefix string;
    match "regular-expression";
}
source-address source-address;
```

The TX Matrix Plus router directs messages to a remote machine or the other Routing Engine in the same way as a single-chassis system, and the optional statements (`explicit-priority`, `facility-override`, `log-prefix`, `match`, and `source-address`) also have the same effect as on a single-chassis system. For more information, see “Directing

System Log Messages to a Remote Machine or the Other Routing Engine” on page 135.

For the TX Matrix Plus router to include priority information when it directs messages that originated on a T1600 router to the remote destination, you must also include the **explicit-priority** statement at the **[edit system syslog host sfc0-master]** hierarchy level.

The **other-routing-engine** statement does not interact with message forwarding from the T1600 routers to the TX Matrix Plus router. For example, if you include the statement in the configuration for the Routing Engine in slot 0 (**re0**), the **re0** Routing Engine on each T1600 router sends messages to the **re1** Routing Engine on its router only. It does not also send messages directly to the **re1** Routing Engine on the TX Matrix Plus router.

Because the configuration on the TX Matrix Plus router applies to the T1600 routers, any T1600 router that has interfaces for direct access to the Internet also directs messages to the remote machine. The consequences include the following:

- If the T1600 routers are configured to forward messages to the TX Matrix Plus router (as in the default configuration), the remote machine receives two copies of some messages: one directly from the T1600 router and the other from the TX Matrix Plus router. Which messages are duplicated depends on whether the severities are the same for local logging and for forwarded messages. For more information, see “Configuring Message Forwarding to the TX Matrix Plus Router” on page 162.
- If the **source-address** statement is configured at the **[edit system syslog]** hierarchy level, all routers in the routing matrix report the same source address in messages directed to the remote machine. This is appropriate, because the routing matrix functions as a single routing router.
- If the **log-prefix** statement is included, the messages from all routers in the routing matrix include the same text string. You cannot use the string to distinguish between the routers in the routing matrix.

Related Topics ■ Configuring System Logging for a TX Matrix Plus Router on page 160

Configuring System Logging Differently on Each T1600 Router in a Routing Matrix

We recommend that all routers in a routing matrix composed of a TX Matrix router and T1600 routers use the same configuration, which implies that you include system logging configuration statements on the TX Matrix Plus router only. In rare circumstances, however, you might choose to log different messages on different routers. For example, if one router in the routing matrix is experiencing problems with authentication, a Juniper Networks support representative might instruct you to log messages from the **authorization** facility with severity **debug** on that router.

To configure routers separately, include configuration statements in the appropriate groups at the **[edit groups]** hierarchy level on the TX Matrix Plus router:

- To configure settings that apply to the TX Matrix Plus router but not the T1600 routers, include them in the **re0** and **re1** configuration groups.

- To configure settings that apply to particular T1600 routers, include them in the `lccn-re0` and `lccn-re1` configuration groups, where *n* is the line-card chassis (LCC) index number of the router.

When you use configuration groups, do not issue CLI configuration-mode commands to change statements at the `[edit system syslog]` hierarchy level on the TX Matrix Plus router. If you do, the resulting statements overwrite the statements defined in configuration groups and apply to the T1600 routers also. (We further recommend that you do not issue CLI configuration-mode commands on the T1600 routers at any time.)

For more information about the configuration groups for a routing matrix, see the chapter about configuration groups in the *JUNOS CLI User Guide*.

The following example shows how to configure the `/var/log/messages` files on three routers to include different sets of messages:

- On the TX Matrix Plus router, local messages with severity `info` and higher from all facilities. The file does not include messages from the T1600 routers, because the `host sfc0-master` statement disables message forwarding.
- On the T1600 router designated `LCC0`, messages from the `authorization` facility with severity `info` and higher.
- On the T1600 router designated `LCC1`, messages with severity `notice` from all facilities.

```
[edit groups]
re0 {
  system {
    syslog {
      file messages {
        any info;
      }
      host sfc0-master {
        any none;
      }
    }
  }
}
re1 {
  ... same statements as for re0 ...
}
lcc0-re0 {
  system {
    syslog {
      file messages {
        authorization info;
      }
    }
  }
}
lcc0-re1 {
  ... same statements as for lcc0-re0 ...
}
lcc1-re0 {
```

```
system {  
  syslog {  
    file messages {  
      any notice;  
    }  
  }  
}  
lcc0-re1 {  
  ... same statements as for lcc1-re0 ...  
}
```

Related Topics ■ [Configuring System Logging for a TX Matrix Plus Router on page 160](#)

Chapter 10

Configuring Miscellaneous System Management Features

This chapter covers the following topics:

- Configuring the JUNOS Software to Set Console and Auxiliary Port Properties on a Router Craft Interface on page 172
- Configuring the JUNOS Software to Disable Protocol Redirect Messages on the Router on page 173
- Configuring the JUNOS Software to Select a Fixed Source Address for Locally Generated TCP/IP Packets on page 174
- Configuring the JUNOS Software to Make the Router or Interface Act as a DHCP or BOOTP Relay Agent on page 174
- Configuring the JUNOS Software to Disable the Routing Engine Response to Multicast Ping Packets on page 175
- Configuring the JUNOS Software to Disable the Reporting of IP Address and Timestamps in Ping Responses on page 175
- Configuring System Services for Remote Router Access on page 176
- Configuring Password Authentication for Console Access to PICs on page 219
- Configuring the JUNOS Software to Display a System Login Message on page 220
- Configuring the JUNOS Software to Display a System Login Announcement on page 221
- Disabling JUNOS Software Processes on page 221
- Configuring Failover to Backup Media if a JUNOS Software Process Fails on page 222
- Configuring Password Authentication for the Diagnostics Port on page 222
- Viewing Core Files from JUNOS Software Processes on page 223
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- Using JUNOS Software to Configure Logical System Administrators on page 223
- Using JUNOS Software to Configure a Router to Transfer Its Configuration to an Archive Site on page 225
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- Configuring RADIUS System Accounting on page 227

- Example: Configuring RADIUS System Accounting on page 229
- Configuring TACACS+ System Accounting on page 230
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- Configuring the JUNOS Software to Work with SRC Software on page 232
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- Configuring the JUNOS Software for IP-IP Path MTU Discovery on IP-IP Tunnel Connections on page 233
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- Configuring the JUNOS Software for Path MTU Discovery on Outgoing TCP Connections on page 236
- Configuring the JUNOS Software to Ignore ICMP Source Quench Messages on page 236
- Configuring the JUNOS Software to Enable the Router to Drop Packets with the SYN and FIN Bits Set on page 237
- Configuring the JUNOS Software to Disable TCP RFC 1323 Extensions on page 237
- Configuring the JUNOS Software to Disable the TCP RFC 1323 PAWS Extension on page 237
- Configuring the JUNOS Software to Extend the Default Port Address Range on page 237
- Configuring the JUNOS Software ARP Learning and Aging Options for Mapping IPv4 Network Addresses to MAC Addresses on page 238
- Using JUNOS Software to Configure System Alarms to Appear Automatically on J Series Routers on page 239
- System Alarms on J Series Routers on page 239

Configuring the JUNOS Software to Set Console and Auxiliary Port Properties on a Router Craft Interface

The router's craft interface has two ports—a console port and an auxiliary port—for connecting terminals to the router. The console port is enabled by default, and its speed is 9600 baud. The auxiliary port is disabled by default.

To configure the properties for the console and auxiliary ports, include the **ports** statement at the **[edit system]** hierarchy level:

```
[edit system]
ports {
  auxiliary {
    type terminal-type;
  }
  console {
    insecure;
    log-out-on-disconnect;
    type terminal-type;
    disable;
  }
}
```

By default, the terminal type is unknown, and the terminal speed is 9600 baud for both the console and auxiliary ports. To change the terminal type, include the **type** statement, specifying a *terminal-type* of **ansi**, **vt100**, **small-xterm**, or **xterm**. The first three terminal types set a screen size of 80 columns by 24 lines. The last type, **xterm**, sets the size to 80 columns by 65 rows.

By default, the console session is not logged out when the data carrier is lost on the console modem control lines. To log out the session when the data carrier on the console port is lost, include the **log-out-on-disconnect** statement.

By default, terminal connections to the console and auxiliary ports are secure. When you configure the console as insecure, root logins are not allowed to establish terminal connections. In addition, superusers and anyone with a user identifier (UID) of 0 are not allowed to establish terminal connections in multiuser mode when you configure the console as insecure. To disable root login connections to the console and auxiliary ports, include the **insecure** statement.

To disable console login, include the **disable** statement. By default, console login is enabled.

For Common Criteria compliance, the console port must be disabled.

Configuring the JUNOS Software to Disable Protocol Redirect Messages on the Router

By default, the router sends protocol redirect messages. To disable the sending of redirect messages by the router, include the **no-redirects** statement at the **[edit system]** hierarchy level:

```
[edit system]
no-redirects;
```

To reenable the sending of redirect messages on the router, delete the **no-redirects** statement from the configuration.

To disable the sending of redirect messages on a per-interface basis, include the **no-redirects** statement at the **[edit interfaces *interface-name* unit *logical-unit-number* family *family*]** hierarchy level, as described in the *JUNOS Network Interfaces Configuration Guide*.

Configuring the JUNOS Software to Select a Fixed Source Address for Locally Generated TCP/IP Packets

By default, the source address included in locally generated Transmission Control Protocol/IP (TCP/IP) packets, such as FTP traffic, and in User Datagram Protocol (UDP) and IP packets, such as Network Time Protocol (NTP) requests, is chosen as the local address for the interface on which the traffic is transmitted. This means that the local address chosen for packets to a particular destination might change from connection to connection based on the interface that the routing protocol has chosen to reach the destination when the connection is established. If multiple equal-cost next hops are present for a destination, locally generated packets use the lo0 address as a source.

To configure the software to select a fixed address to use as the source for locally generated IP packets, include the **default-address-selection** statement at the [edit system] hierarchy level:

```
[edit system]
default-address-selection;
```

If you include the **default-address-selection** statement in the configuration, the JUNOS Software chooses the system default address as the source for most locally generated IP packets. The default address is usually an address configured on the lo0 loopback interface. For example, if you specified that SSH and telnet use a particular address, but you also have **default-address selection** configured, the system default address is used.

For IP packets sent by IP routing protocols—including Open Shortest Path First (OSPF), Routing Information Protocol (RIP), Resource Reservation Protocol (RSVP), and the multicast protocols, but not including Intermediate System-to-Intermediate System (IS-IS)—the local address selection is often constrained by the protocol specification so that the protocol operates correctly. When this constraint exists in the routing protocol, the packet's source address is unaffected by the presence of the **default-address-selection** statement in the configuration. For protocols in which the local address is unconstrained by the protocol specification, for example, internal Border Gateway Protocol (IBGP) and multihop external BGP (EBGP), if you do not configure a specific local address when configuring the protocol, the local address is chosen using the same method as other locally generated IP packets.

Configuring the JUNOS Software to Make the Router or Interface Act as a DHCP or BOOTP Relay Agent

To configure a router or interface to act as a bootstrap protocol (DHCP or BOOTP) relay agent, you include statements at the [edit forwarding-options helpers] hierarchy level.

For J Series Services Routers, you can configure a router or interface as a DHCP server by including statements at the [edit system services] hierarchy level.



NOTE: You cannot configure a router or interface as a DHCP server and a BOOTP relay agent at the same time.

Configuring the JUNOS Software to Disable the Routing Engine Response to Multicast Ping Packets

By default, the Routing Engine responds to Internet Control Message Protocol (ICMP) echo requests sent to multicast group addresses. To disable the Routing Engine from responding to ICMP echo requests sent to multicast group addresses, include the `no-multicast-echo` statement at the `[edit system]` hierarchy level:

```
[edit system]
no-multicast-echo;
```

By configuring the Routing Engine to ignore multicast ping packets, you can prevent unauthorized persons from discovering the list of provider edge (PE) routers in the network.

Configuring the JUNOS Software to Disable the Reporting of IP Address and Timestamps in Ping Responses

By default, the Routing Engine displays the path of the ICMP echo request packets and timestamps in the ICMP echo responses when the `ping` command is issued with the `record-route` option.

You can configure the Routing Engine to disable the setting of the `record-route` option in the IP header of the ping request packets. Disabling the `record-route` option prevents the Routing Engine from recording and displaying the path of the ICMP echo request packets in the response.

To configure the Routing Engine to disable the setting of the `record route` option, include the `no-ping-record-route` statement at the `[edit system]` hierarchy level:

```
[edit system]
no-ping-record-route;
```

To disable the reporting of timestamps in the ICMP echo responses, include the `no-ping-time-stamp` option at the `[edit system]` hierarchy level:

```
[edit system]
no-ping-time-stamp;
```

By configuring the `no-ping-record-route` and `no-ping-timestamp` options, you can prevent unauthorized persons from discovering information about the provider edge (PE) router and its loopback address.

Configuring System Services for Remote Router Access

- System Services Overview on page 177
- Configuring clear-text or SSL Service for JUNOScript Client Applications on page 177
- Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers on page 178
- DHCP Access Service Overview on page 180
- DHCP Statement Hierarchy and Inheritance on page 183
- Configuring Address Pools for DHCP Dynamic Bindings on page 185
- Configuring Manual (Static) DHCP Bindings Between a Fixed IP Address and a Client's MAC Address on page 186
- Specifying DHCP Lease Times for IP Address Assignments on page 187
- Configuring a DHCP Boot File and DHCP Boot Server on page 188
- Configuring a Static IP Address as DHCP Server Identifier on page 189
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- Configuring Routers Available to the DHCP Client on page 190
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- Interaction Among the DHCP Client, Extended DHCP Local Server, and Address-Assignment Pools on page 200
- Extended DHCP Local Server and Address-Assignment Pools on page 200
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System Services Overview

For security reasons, remote access to the router is disabled by default. You must configure the router explicitly so that users on remote systems can access it. The router can be accessed from a remote system by means of the DHCP, finger, FTP, rlogin, SSH, and Telnet services. In addition, JUNOScript client applications can use Secure Sockets Layer (SSL) or the JUNOScript-specific clear-text service, among other services.



NOTE: To protect system resources, you can limit the number of simultaneous connections that a service accepts and the number of processes owned by a single user. If either limit is exceeded, connection attempts fail.

Configuring clear-text or SSL Service for JUNOScript Client Applications

A JUNOScript client application can use one of four protocols to connect to the JUNOScript server on a router: clear-text (a JUNOScript-specific protocol for sending unencrypted text over a TCP connection), SSH, SSL, or Telnet. For clients to use the clear-text or SSL protocol, you must include JUNOScript-specific statements in the router configuration.

For more information, see the following topics:

1. Configuring clear-text Service for JUNOScript Client Applications on page 177
2. Configuring SSL Service for JUNOScript Client Applications on page 178

Configuring clear-text Service for JUNOScript Client Applications

To configure the router to accept clear-text connections from JUNOScript client applications on port 3221, include the `xnm-clear-text` statement at the `[edit system services]` hierarchy level:

```
[edit system services]
xnm-clear-text {
  <connection-limit limit>;
```

```

    <rate-limit limit>;
}

```

By default, the JUNOScript server supports a limited number of simultaneous clear-text sessions and connection attempts per minute. Optionally, you can include either or both of the following statements to change the defaults:

- **connection-limit *limit***—Maximum number of simultaneous connections (a value from 1 through 250). The default is 75.
- **rate-limit *limit***—Maximum number of connection attempts accepted per minute (a value from 1 through 250). The default is 150.

You cannot include the **xnm-clear-text** statement on routers that run the JUNOS-FIPS software. We recommend that you do not use the clear-text protocol in a Common Criteria environment.

Configuring SSL Service for JUNOScript Client Applications

To configure the router to accept SSL connections from JUNOScript client applications on port 3220, include the **xnm-ssl** statement at the **[edit system services]** hierarchy level:

```

[edit system services]
xnm-ssl {
    local-certificate name;
    <connection-limit limit>;
    <rate-limit limit>;
}

```

local-certificate is the name of the X.509 authentication certificate used to establish an SSL connection. You must obtain the certificate and copy it to the router before referencing it.

By default, the JUNOScript server supports a limited number of simultaneous SSL sessions and connection attempts per minute. Optionally, you can include either or both of the following statements to change the defaults:

- **connection-limit *limit***—Maximum number of simultaneous connections (a value from 1 through 250). The default is 75.
- **rate-limit *limit***—Maximum number of connection attempts accepted per minute (a value from 1 through 250). The default is 150.

Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers

The Dynamic Host Configuration Protocol (DHCP) server provides a framework for passing configuration information to client hosts (such as PCs) on a TCP/IP network. A router or interface that acts as a DHCP server can allocate network IP addresses and deliver configuration settings to client hosts without user intervention. DHCP access service minimizes the overhead required to add clients to the network by providing a centralized, server-based setup. You do not have to manually create and maintain IP address assignments for clients. DHCP is defined in RFC 2131, *Dynamic Host Configuration Protocol*.



NOTE: The DHCP server is supported in J Series routers and is compatible with the autoinstallation feature.

To configure a J Series router to accept DHCP as an access service, include the **dhcp** statement at the **[edit system services]** hierarchy level:

```
[edit system services]
dhcp {
  boot-file filename;
  boot-server (address | hostname);
  domain-name domain-name;
  domain-search [domain-list];
  default-lease-time;
  maximum-lease-time;
  name-server {
    address;
  }
  option {
    [ (id-number option-type option-value) | (id-number array option-type option-value) ];
  }
  pool address/prefix-length {
    address-range {
      low address;
      high address;
    }
    exclude-address {
      address;
    }
  }
  router {
    address;
  }
  static-binding mac-address {
    fixed-address {
      address;
    }
    host hostname;
    client-identifier (ascii client-id | hexadecimal client-id);
  }
  server-identifier address;
  wins-server {
    address;
  }
}
```

DHCP Access Service Overview

DHCP access service consists of two components: a protocol for delivering host-specific configuration information from a server to a client host and a method for allocating network addresses to a client host. The client sends a message to request configuration information. A DHCP server sends the configuration information back to the client.

With DHCP, clients can be assigned a network address for a fixed *lease*, enabling serial reassignment of network addresses to different clients. A DHCP server leases IP addresses for specific times to various clients. If a client does not use its assigned address for some period of time, the DHCP server can assign that IP address to another host. When assignments are made or changed, the DHCP server updates information in the DNS server. The DHCP server provides clients with their previous lease assignments whenever possible.

A DHCP server provides persistent storage of network parameters for clients. Because DHCP is an extension of BOOTP, DHCP servers can handle BOOTP requests.

The DHCP server includes IPv4 address assignment and commonly used DHCP options. The server is compatible with DHCP servers from other vendors on the network. The server does not support IPv6 address assignment, user class-specific configuration, DHCP failover protocol, dynamic DNS updates, or VPN connections. The JUNOS-FIPS software does not support the DHCP server.



NOTE: You cannot configure a router as a DHCP server and a BOOTP relay agent at the same time.

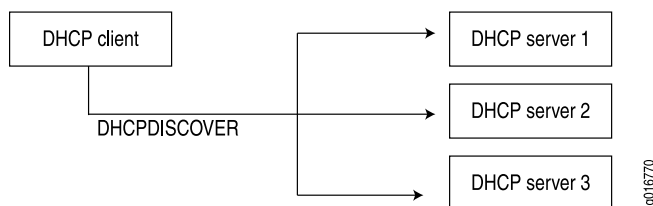
The following topics describe these concepts in detail:

- Network Address Assignments (Allocating a New Address) on page 180
- Network Address Assignments (Reusing a Previously Assigned Address) on page 182
- Static and Dynamic Bindings on page 182
- Compatibility with Autoinstallation on page 183
- Conflict Detection and Resolution on page 183

Network Address Assignments (Allocating a New Address)

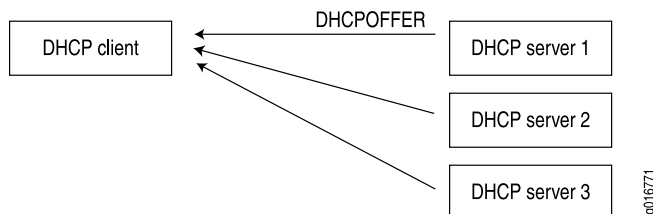
To receive configuration information and a network address assignment, a DHCP client negotiates with DHCP servers in a series of messages. The following steps show the messages exchanged between a DHCP client and servers to allocate a new network address. When allocating a new network address, the DHCP process can involve more than one server, but only one server is selected by the client.

1. When a client computer is started, it broadcasts a **DHCPDISCOVER** message on the local subnet, requesting a DHCP server. This request includes the hardware address of the requesting client.

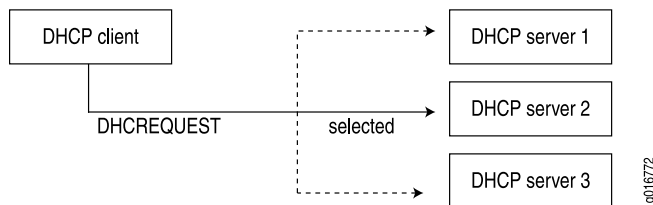
Figure 3: DHCP Discover

NOTE: For improved operation with DHCP clients that do not strictly conform to RFC 2131, the DHCP server accepts and processes **DHCPDISCOVER** messages even if the overload options in the messages are not properly terminated with an end statement.

2. Each DHCP server receiving the broadcast sends a **DHCPOFFER** message to the client, offering an IP address for a set period of time, known as the lease period.

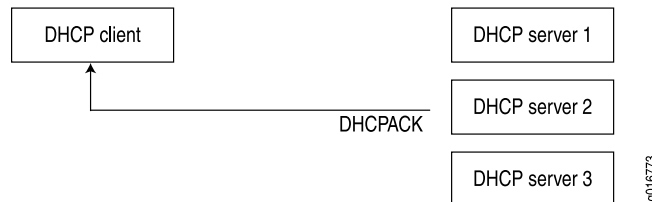
Figure 4: DHCP Offer

3. The client receives one or more **DHCPOFFER** messages from one or more servers and selects one of the offers received. Normally, a client looks for the longest lease period.
4. The client broadcasts a **DHCPREQUEST** message indicating the client has selected an offered leased IP address and identifies the selected server.

Figure 5: DHCP Request

5. Those servers not selected by the **DHCPREQUEST** message return the unselected IP addresses to the pool of available addresses.

6. The selected DHCP server sends a **DHCPACK** acknowledgment that includes configuration information such as the IP address, subnet mask, default gateway, and the lease period.

Figure 6: DHCP ACK

The information offered by the server is configurable.

7. The client receives the **DHCPACK** message with configuration information. The process is complete. The client is configured and has access to the network.
 - If the client receives a **DHCPNAK** message (for example, if the client has moved to a new subnet), the client restarts the negotiation process.
 - The client can relinquish its lease on a network address by sending a **DHCPRELEASE** message to the server (for example, when the client is restarted). When the server receives the **DHCPRELEASE** message, it marks the lease as free and the IP address becomes available again.

Figure 7: DHCP Release

Network Address Assignments (Reusing a Previously Assigned Address)

To enable reuse of a previously allocated network address, the following events occur:

1. A client that previously had a lease broadcasts a **DHCPREQUEST** message on the local subnet.
2. The server with knowledge of the client's configuration responds with a **DHCPACK** message.
3. The client verifies the DHCP configuration information sent by the server and uses this information to reestablish the lease.

Static and Dynamic Bindings

DHCP supports both dynamic and static bindings. For dynamic bindings, IP addresses are assigned to clients from a pool of addresses. Static bindings provide configuration

information for a specific client and can include one or more fixed IP addresses for the client. You can configure a DHCP server to include both address pools and static bindings. For any individual client, static bindings take priority over address pools.

Compatibility with Autoinstallation

The DHCP server is compatible with the autoinstallation feature on J Series Services Routers. The server automatically checks autoinstallation settings for conflicts and gives autoinstallation settings priority over corresponding DHCP settings. For example, an IP address set by autoinstallation takes priority over an IP address set by the DHCP server.



NOTE: The autoinstallation feature includes a fixed address pool and a fixed lease time. With DHCP, you can create address pools and modify lease times.

Conflict Detection and Resolution

When a client receives an IP address from the DHCP server, the client performs a series of ARP tests to verify that the IP address is available and no conflicts exist. If the client detects an address conflict, the client notifies the DHCP server about the conflict and may request another IP address from the DHCP server.

The DHCP server keeps a log of all conflicts and removes addresses with conflicts from the pool. These addresses remain excluded until you manually clear the conflicts list with the `clear system services dhcp conflict` command.

DHCP Statement Hierarchy and Inheritance

DHCP configuration statements are organized hierarchically. Statements at the top of the hierarchy apply to the DHCP server and network, branches contain statements that apply to address pools in a subnetwork, and leaves contain statements that apply to static bindings for individual clients. See Table 28 on page 184.

The `pool` and `static-binding` statements appear at the `[edit system services dhcp]` hierarchy level. You can include the remaining statements at the following hierarchy levels:

```
[edit system services dhcp]
[edit system services dhcp pool]
[edit system services dhcp static-binding]
```

Table 28: Pool and Binding Statements

Statement	Description	Hierarchy Level
<code>pool</code>	Configure a pool of IP addresses for DHCP clients on a subnet. When a client joins the network, the DHCP server dynamically allocates an IP address from this pool.	<code>[edit system services dhcp]</code>
<code>static-binding</code>	Set static bindings for DHCP clients. A static binding is a mapping between a fixed IP address and the client's MAC address.	

To minimize configuration changes, include common configuration statements shown in Table 29 on page 185 (for example, the `domain-name` statement) at the highest applicable level of the hierarchy (network or subnetwork). Configuration statements at lower levels of the hierarchy override statements inherited from a higher level. For example, if a statement appears at both the `[edit system services dhcp]` and `[edit system services dhcp pool]` hierarchy levels, the value assigned to the statement at the `[edit system services dhcp pool]` level takes priority.

Table 29: Common Configuration Statements

Statement	Description	Hierarchy Level
boot-file	Set the boot filename advertised to clients. The client uses the boot image stored in the boot file to complete configuration.	[edit system services dhcp] [edit system services dhcp pool] [edit system services dhcp static-binding]
boot-server	Set the server that contains the boot file.	
default-lease-time	Set the default lease time assigned to any client that does not request a specific lease time.	
domain-name	Configure the name of the domain in which clients will search for a DHCP server host. This is the default domain name that is appended to hostnames that are not fully qualified.	
domain-search	Define a domain search list.	
maximum-lease-time	Set the maximum lease time allowed by the server.	
name-server	Specify the DNS server that maintains the database of client name to IP address mappings.	
option	Configure user-defined DHCP options.	
router	Specify IP address for routers on the client's subnetwork. Routers are listed in order of preference.	
server-identifier	Set the IP address of the DHCP server.	

Configuring Address Pools for DHCP Dynamic Bindings

For dynamic bindings, set aside a pool of IP addresses that can be assigned to clients. Addresses in a pool must be available to clients on the same subnet.

To configure an address pool, include the following statements at the [edit system services dhcp] hierarchy level:

```
[edit system services dhcp]
pool address</prefix-length> {
  address-range {
    low address;
    high address;
  }
}
```

```

        exclude-address {
            address;
        }
    }

```

The pool definition must include the client subnet number and prefix length (in bits). Optionally, the definition can include an address range and a list of excluded addresses.

The **address-range** statement defines the lowest and highest IP addresses in the pool that are available for dynamic address assignment. This statement is optional. If no range is specified, the pool will use all available addresses within the subnet specified. (Broadcast addresses, interface addresses, and excluded addresses are not available.)

The **exclude-address** statement specifies addresses within the range that are not used for dynamic address assignment. You can exclude one or more addresses within the range. This statement is optional.

The following is an example of a pool configuration.

```

[edit system services dhcp]
pool 10.3.3.0/24 {
    address-range low 10.3.3.2 high 10.3.3.254;
    exclude-address {
        10.3.3.33;
    }
}

```

For dynamic address assignment, configure an address pool for each client subnet the DHCP server supports. You can configure multiple address pools for a DHCP server, but only one address range per pool is supported.

DHCP maintains the state information for all pools configured. Clients are assigned addresses from pools with subnets that match the interface on which the DHCPDISCOVER packet is received. When more than one pool exists on the same interface, addresses are assigned on a rotating basis from all available pools.

Configuring Manual (Static) DHCP Bindings Between a Fixed IP Address and a Client's MAC Address

Static bindings provide configuration information for specific clients. This information can include one or more fixed Internet addresses, the client hostname, and a client identifier.

To configure static bindings, include the following statements at the `[edit system services dhcp]` hierarchy level:

```

[edit system services dhcp]
static-binding mac-address {
    fixed-address {
        address;
    }
    host client-hostname;
    client-identifier (ascii client-id | hexadecimal client-id);
}

```

```
}
```

A static binding defines a mapping between a fixed IP address and the client's MAC address.

The *mac-address* variable specifies the MAC address of the client. This is a hardware address that uniquely identifies each client on the network.

The *fixed-address* statement specifies the fixed IP address assigned to the client. Typically a client has one address assigned, but you can assign more.

The *host* statement specifies the hostname of the client requesting the DHCP server. The name can include the local domain name. Otherwise, the name is resolved based on the *domain-name* statement.

The *client-identifier* statement is used by the DHCP server to index the database of address bindings. The client identifier is either an ASCII string or hexadecimal digits. It can include a type-value pair as specified in RFC 1700, *Assigned Numbers*. Either a client identifier or the client's MAC address must be configured to uniquely identify the client on the network.



NOTE: For each unique client-identifier *client-id* value, the DHCP server issues a unique lease and IP address from the pool. Previously, when the client provided an incorrect client-identifier *client-id* value, the DHCP server did not issue a lease.

The following is an example of a static binding configuration:

```
[edit system services dhcp]
static-binding 00:0d:56:f4:01:ab {
  fixed-address {
    10.5.5.5;
    10.6.6.6;
  }
  host-name "another-host.domain.tld";
  client-identifier hexadecimal 01001122aabbcc;
}
```

Specifying DHCP Lease Times for IP Address Assignments

For clients that do not request a specific lease time, the default lease time is one day. You can configure a maximum lease time for IP address assignments or change the default lease time.

To configure lease times, include the *maximum-lease-time* and *default-lease-time* statements:

```
maximum-lease-time;
default-lease-time;
```

You can include these statements at the following hierarchy levels:

```
[edit system services dhcp]
```

```
[edit system services dhcp pool]
[edit system services dhcp static-binding]
```

Lease times defined for static bindings and address pools take priority over lease times defined at the [edit system services **dhcp**] hierarchy level.

The **maximum-lease-time** statement configures the maximum length of time in seconds for which a client can request and hold a lease. If a client requests a lease longer than the maximum specified, the lease is granted only for the maximum time configured on the server. After a lease expires, the client must request a new lease.



NOTE: Maximum lease times do not apply to dynamic BOOTP leases. These leases are not specified by the client and can exceed the maximum lease time configured.

The following example shows a configuration for maximum and default lease times:

```
[edit system services dhcp]
maximum-lease-time 7200;
default-lease-time 3600;
```

Configuring a DHCP Boot File and DHCP Boot Server

When a DHCP client starts, it contacts a boot server to download the boot file.

To configure a boot file and boot server, include the **boot-file** and **boot-server** statements:

```
boot-file filename;
boot-server address;
```

You can include these statements at the following hierarchy levels:

```
[edit system services dhcp]
[edit system services dhcp pool]
[edit system services dhcp static-binding]
```

After a client receives a DHCP`OFFER` response from a DHCP server, the client can communicate directly with the boot server (instead of the DHCP server) to download the boot file. This minimizes network traffic and enables you to specify separate boot server/file pairs for each client pool or subnetwork.

The **boot-file** statement configures the name and location of the initial boot file that the DHCP client loads and executes. This file stores the boot image for the client. In most cases, the boot image is the operating system the client uses to load.

The **boot-server** statement configures the IP address of the TFTP server that contains the client's initial boot file. You must configure an IP address (not a hostname) for the server.

You must configure at least one boot file and boot server. Optionally, you can configure multiple boot files and boot servers. For example, you might configure two separate boot servers and files: one for static binding and one for address pools. Boot

file configurations for pools or static bindings take precedence over boot file configurations at the `[edit system services dhcp]` hierarchy level.

The following example specifies a boot file and server for an address pool:

```
[edit system services dhcp]
pool 10.4.4.0/24 {
  boot-file "boot.client";
  boot-server 10.4.4.1;
}
```

Configuring a Static IP Address as DHCP Server Identifier

The host running the DHCP server must itself use a manually assigned, static IP address. It cannot send a request and receive an IP address from itself or another DHCP server.

To configure a DHCP server identifier, include the `server-identifier` statement:

```
server-identifier address;
```

You can include this statement at the following hierarchy levels:

```
[edit system services dhcp]
[edit system services dhcp pool]
[edit system services dhcp static-binding]
```

The `server-identifier` statement specifies the IP address of the DHCP server. The host must be a TFTP server that is accessible by all clients served within a range of IP addresses (based on either an address pool or static binding).

The following example shows a DHCP server identifier configured for an address pool:

```
[edit system services dhcp]
pool 10.3.3.0/24 {
  address-range low 10.3.3.2 high 10.3.3.254;
  exclude-address {
    10.3.3.33;
  }
  router {
    10.3.3.1;
  }
  server-identifier 10.3.3.1;
}
```

Configuring a Domain Name and Domain Search List for a DHCP Server Host

To configure the name of the domain in which clients search for a DHCP server host, include the `domain-name` statement:

```
domain-name domain;
```

You can include this statement at the following hierarchy levels:

```
[edit system services dhcp]
[edit system services dhcp pool]
[edit system services dhcp static-binding]
```

The `domain-name` statement sets the domain name that is appended to hostnames that are not fully qualified. This statement is optional. If you do not configure a domain name, the default is the client's current domain.

To configure a domain search list, include the `domain-search` statement:

```
domain-search [ domain-list ];
```

You can include this statement at the following hierarchy levels:

```
[edit system services dhcp]
[edit system services dhcp pool]
[edit system services dhcp static-binding]
```

The `domain-search` statement sets the order in which clients append domain names when searching for the IP address of a host. You can include one or more domain names in the list. For more information, see RFC 3397, *Dynamic Host Configuration Protocol (DHCP) Domain Search Option*.

The `domain-search` statement is optional, if you do not configure a domain search list, the default is the client's current domain.

Configuring Routers Available to the DHCP Client

After a DHCP client loads the boot image and has booted, the client sends packets to a router.

To configure routers available to the DHCP client, include the `router` statement:

```
router {
    address;
}
```

You can include this statement at the following hierarchy levels:

```
[edit system services dhcp]
[edit system services dhcp pool]
[edit system services dhcp static-binding]
```

The `router` statement specifies a list of IP addresses for routers on the client's subnet. List routers in order of preference. You must configure at least one router for each client subnet.

The following example shows routers configured at the `[edit system services dhcp]` hierarchy level:

```
[edit system services dhcp]
router {
    10.6.6.1;
    10.7.7.1;
```



```
}
```

Creating User-Defined DHCP Options Not Included in the Default JUNOS Implementation of the DHCP Server

You can configure one or more user-defined options that are not included in the JUNOS default implementation of the DHCP server. For example, if a client requests a DHCP option that is not included in the DHCP server, you can create a user-defined option that enables the server to respond to the client's request.

To configure a user-defined DHCP option, include the `option` statement:

```
option {
  [ (id-number option-type option-value) | (id-number array option-typeoption-value) ] ;
}
```

The `option` statement specifies the following values:

- *id-number*—Any whole number. The ID number is used to index the option and must be unique across a DHCP server.
- *option-type*—Any of the following types: `flag`, `byte`, `string`, `short`, `unsigned-short`, `integer`, `unsigned-integer`, `ip-address`.
- *array*—An option can include an array of values.
- *option-value*—Value associated with an option. The option value must be compatible with the option type (for example, an `On` or `Off` value for a `flag` type).

You can include this statement at the following hierarchy levels:

```
[edit system services dhcp]
[edit system services dhcp pool]
[edit system services dhcp static-binding]
```

The following example shows user-defined DHCP options:

```
[edit system services dhcp]
option 19 flag off; # 19: "IP Forwarding" option
option 40 string "domain.tld"; # 40: "NIS Domain" option
option 16 ip-address 10.3.3.33; # 16: "Swap Server" option
```

User-defined options that conflict with DHCP configuration statements are ignored by the server. For example, in the following configuration, the DHCP server ignores the user-defined `option 3 router` statement and uses the `edit system services dhcp router` statement instead:

```
[edit system services dhcp]
option 3 router 10.7.7.2; # 3: "Default Router" option
router {
  10.7.7.1;
}
```

Example: Complete DHCP Server Configuration

This topic shows a complete DHCP server configuration with address pools, static bindings, and user-defined options.

The following example shows statements at the [edit interfaces] hierarchy level. The interface's primary address (10.3.3.1/24) has a corresponding address pool (10.3.3.0/24) defined at the [edit system services] hierarchy level.

```
[edit interfaces]
fe-0/0/1 {
  unit 0 {
    family inet {
      address 10.3.3.1/24;
    }
  }
}
```



NOTE: You can configure a DHCP server only on an interface's primary IP address.

Statements at the [edit system services] hierarchy level include the following:

```
[edit system services]
dhcp {
  domain-name "domain.tld";
  maximum-lease-time 7200;
  default-lease-time 3600;
  name-server {
    10.6.6.6;
    10.6.6.7;
  }
  domain-search [ subnet1.domain.tld subnet2.domain.tld ];
  wins-server {
    10.7.7.7;
    10.7.7.9;
  }
  router {
    10.6.6.1;
    10.7.7.1;
  }
  option 19 flag off; # 19: "IP Forwarding" option
  option 40 string "domain.tld"; # 40: "NIS Domain" option
  option 16 ip-address 10.3.3.33; # 16: "Swap Server" option
  pool 10.3.3.0/24 {
    address-range low 10.3.3.2 high 10.3.3.254;
    exclude-address {
      10.3.3.33;
    }
    router {
      10.3.3.1;
    }
  }
  server-identifier 10.3.3.1;
```

```

}
pool 10.4.4.0/24 {
    boot-file "boot.client";
    boot-server 10.4.4.1;
}
static-binding 00:0d:56:f4:20:01 {
    fixed-address 10.4.4.4;
    host-name "host.domain.tld";
}
static-binding 00:0d:56:f4:01:ab {
    fixed-address {
        10.5.5.5;
        10.6.6.6;
    }
    host-name "another-host.domain.tld";
    client-identifier "01aa.001a.bc65.3e";
}
}

```

Example: Viewing DHCP Bindings

Use the CLI command `show system services dhcp binding` to view information about DHCP address bindings, lease times, and address conflicts.

The following example shows the binding type and lease expiration times for IP addresses configured on a router that supports a DHCP server:

```

user@host> show system services dhcp binding
IP Address      Hardware Address  Type    Lease expires at
192.168.1.2     00:a0:12:00:12:ab static        never
192.168.1.3     00:a0:12:00:13:02 dynamic    2004-05-03 13:01:42 PDT

```

Enter an IP address to show binding for a specific IP address:

```

user@host> show system services dhcp binding 192.168.1.3
DHCP binding information:
IP address      192.168.1.3
Hardware address 00:a0:12:00:12:ab
Client identifier
61 63 65 64 2d 30 30 3a 61 30 3a 31 32 3a 30 30 aced-00:a0:12:00
3a 31 33 3a 30 32
Lease information:
Type            dynamic
Obtained at     2004-05-02 13:01:42 PDT
Expires at      2004-05-03 13:01:42 PDT

```

Use the `detail` option to show detailed binding information:

```

user@host> show system services dhcp binding detail
DHCP binding information:
IP address      192.168.1.3
Hardware address 00:a0:12:00:12:ab
Pool            192.168.1.0/24
Interface       fe-0/0/0, relayed by 192.168.4.254
Lease information:

```

```

Type                dynamic
Obtained at         2004-05-02 13:01:42 PDT
Expires at          2004-05-03 13:01:42 PDT
DHCP options:
name-server foo.mydomain.tld
domain-name mydomain.tld
option 19 flag off

```

Example: Viewing DHCP Address Pools

Use the CLI `show system services dhcp pool` command to view information about DHCP address pools.

The following example shows address pools configured on a DHCP server:

```

user@ host> show system services dhcp pool
Pool name      Low address    High address    Excluded addresses
10.40.1.0/24    10.40.1.1      10.40.1.254     10.40.1.254

```

Example: Viewing and Clearing DHCP Conflicts

When the DHCP server provides an IP address, the client performs an ARP check to make sure the address is not being used by another client and reports any conflicts back to the server. The server keeps track of addresses with conflicts and removes them from the address pool. Use the CLI command `show system services dhcp conflict` to show conflicts.

```

user@host> show system services dhcp conflict
Detection time      Detection method    Address
2004-08-03 19:04:00 PDT    client      192.168.1.5
2004-08-04 04:23:12 PDT    ping        192.168.1.8

```

Use the `clear system services dhcp conflicts` command to clear the conflicts list and return IP addresses to the pool. The following command shows how to clear an address on the server that has a conflict:

```

user@host> clear system services dhcp conflict 192.168.1.5

```

For more information about CLI commands you can use with the DHCP server, see the *JUNOS System Basics and Services Command Reference*.

Configuring Tracing Operations for DHCP Processes

DHCP tracing operations track all DHCP operations and record them to a log file.

By default, no DHCP processes are traced. If you include the `traceoptions` statement at the `[edit system services dhcp]` hierarchy level, the default tracing behavior is the following:

- Important events are logged in a file called `dhcpd` located in the `/var/log` directory.
- When the file `dhcpd` reaches 128 kilobytes (KB), it is renamed `dhcpd.0`, then `dhcpd.1`, and so on, until there are 3 trace files. Then the oldest trace file (`dhcpd.2`)

is overwritten). For more information about how log files are created, see the *JUNOS System Log Messages Reference*.

- Log files can be accessed only by the user who configures the tracing operation.

You cannot change the directory in which trace files are located. However, you can customize the other trace file settings by including the following statements at the [edit system services dhcp traceoptions] hierarchy level.:

```
[edit system services dhcp traceoptions]
file filename <files number> <match regex> <size size> <world-readable |
no-world-readable>;
flag {
  all;
}
```

Tasks for configuring DHCP tracing operations are:

1. Configuring the DHCP Processes Log Filename on page 195
2. Configuring the Number and Size of DHCP Processes Log Files on page 195
3. Configuring Access to the DHCP Log File on page 196
4. Configuring a Regular Expression for Refining the Output of DHCP Logged Events on page 196
5. Configuring DHCP Trace Operation Events on page 196

Configuring the DHCP Processes Log Filename

By default, the name of the file that records trace output is `dhcpd`. You can specify a different name by including the file statement at the [edit system services dhcp traceoptions] hierarchy level:

```
[edit system services dhcp traceoptions]
file filename;
```

Configuring the Number and Size of DHCP Processes Log Files

By default, when the trace file reaches 128 kilobytes (KB) in size, it is renamed `filename.0`, then `filename.1`, and so on, until there are 3 trace files. Then the oldest trace file (`filename.2`) is overwritten.

You can configure the limits on the number and size of trace files by including the following statements at the [edit system services dhcp traceoptions] hierarchy level:

```
[edit system services dhcp traceoptions]
file files number size size;
```

For example, set the maximum file size to 2 MB, and the maximum number of files to 20. When the file that receives the output of the tracking operation (`filename`) reaches 2 MB, `filename` is renamed `filename.0`, and a new file called `filename` is created. When the new `filename` reaches 2 MB, `filename.0` is renamed `filename.1` and `filename` is renamed `filename.0`. This process repeats until there are 20 trace files. Then the oldest file (`filename.19`) is overwritten by the newest file (`filename.0`).

The number of files can be from 2 through 1000 files. The file size of each file can be from 10KB through 1 gigabyte (GB).

Configuring Access to the DHCP Log File

By default, log files can be accessed only by the user who configures the tracing operation.

To specify that any user can read all log files, include the `file world-readable` statement at the `[edit system services dhcp traceoptions]` hierarchy level:

```
[edit system services dhcp traceoptions]
file world-readable;
```

To set the default behavior explicitly, include the `file no-world-readable` statement at the `[edit system services dhcp traceoptions]` hierarchy level:

```
[edit system services dhcp traceoptions]
file no-world-readable;
```

Configuring a Regular Expression for Refining the Output of DHCP Logged Events

By default, the trace operations output includes all lines relevant to the logged events.

You can refine the output by including the `match` statement at the `[edit system services dhcp traceoptions file filename]` hierarchy level and specifying a regular expression (regex) to be matched:

```
[edit system services dhcp traceoptions]
file filename match regex;
```

Configuring DHCP Trace Operation Events

By default, only important events are logged. You can configure the trace operations to be logged by including the following options at the `[edit system services dhcp traceoptions]` hierarchy level:

```
[edit dhcp system services dhcp traceoptions]
flag {
  all;
  binding;
  config;
  conflict;
  event;
  ifdb;
  io;
  lease;
  main;
  misc;
  packet;
  options;
  pool;
```

```

protocol;
rtsock;
scope;
signal;
trace;
ui;
}

```

DHCP Processes Tracing Flags

Table 30 on page 197 describes which operation or event is recorded by each DHCP tracing flag. By default, all flags are disabled.

Table 30: DHCP Processes Tracing Flags

Flag	Operation or Event
all	All operations.
binding	Binding operations.
config	Logins to the configuration database.
conflict	Client-detected conflicts for IP addresses.
event	Important events.
ifdb	Interface database operations.
io	I/O operations.
lease	Lease operations.
main	Main loop operations.
misc	Miscellaneous operations.
packet	DHCP packets.
options	DHCP options.
pool	Address pool operations.
protocol	Protocol operations.
rtsock	Routing socket operations.
scope	Scope operations.
signal	DHCP signal operations.
trace	Tracing operations.
ui	User interface operations.

Configuring the Router as an Extended DHCP Local Server

You can enable the router to function as an extended DHCP local server and configure the extended DHCP local server options on the router. The extended DHCP local server provides an IP address and other configuration information in response to a client request.

The extended DHCP local server enhances traditional DHCP server operation in which the client address pool and client configuration information reside on the DHCP server. With the extended DHCP local server, the client address and configuration information reside in centralized address-assignment pools, which are managed independently of the DHCP local server and which can be shared by different client applications.

The extended DHCP local server also supports advanced pool matching and the use of named address ranges. You can also configure the local server to use DHCP option 82 information in the client PDU to determine which named address range to use for a particular client. The client configuration information, which is configured in the address-assignment pool, includes user-defined options, such as boot server, grace period, and lease time.

Configuring the DHCP environment that includes the extended DHCP local server requires two independent configuration operations, which you can complete in any order. In one operation, you configure the extended DHCP local server on the router and specify how the DHCP local server determines which address-assignment pool to use. In the other operation, you configure the address-assignment pools used by the DHCP local server. The address-assignment pools contain the IP addresses, named address ranges, and configuration information for DHCP clients. See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491 for details about creating and using address-assignment pools.



NOTE: The extended DHCP local server and the address-assignment pools used by the server must be configured in the same logical system and routing instance.

You cannot configure the extended DHCP local server and extended DHCP relay on the same interface.

To configure the extended DHCP local server on the router, include the `dhcp-local-server` statement at the `[edit system services]` hierarchy level:

```
[edit system services]
dhcp-local-server {
  authentication {
    password password-string;
    username-include {
      circuit-type;
      delimiter delimiter-character;
      domain-name domain-name-string;
      logical-system-name;
      mac-address;
```



```

        option-60;
        option-82 <circuit-id> <remote-id>;
        routing-instance-name;
        user-prefix user-prefix-string;
    }
}
group group-name {
    authentication {
        password password-string;
        username-include {
            circuit-type;
            delimiter delimiter-character;
            domain-name domain-name-string;
            logical-system-name;
            mac-address;
            option-60;
            option-82 <circuit-id> <remote-id>;
            routing-instance-name;
            user-prefix user-prefix-string;
        }
    }
}
interface interface-name <upto upto-interface-name> <exclude>;
}
pool-match-order {
    ip-address-first;
    option-82;
}
traceoptions {
    file filename <files number> <size size> <world-readable | no-world-readable>
    <match regex>;
    flag flag;
}
}

```

You can also include these statements at the following hierarchy levels:

- [edit logical-systems *logical-system-name* system services]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* system services]
- [edit routing-instances *routing-instance-name* system services]



NOTE: The extended DHCP local server is incompatible with the J Series router DHCP server. As a result, the DHCP local server and the DHCP or BOOTP relay agent cannot both be enabled on the router at the same time. The extended DHCP local server is fully compatible with the extended DHCP relay feature.

Interaction Among the DHCP Client, Extended DHCP Local Server, and Address-Assignment Pools

In a typical carrier edge network configuration, the DHCP client is on the subscriber's computer, and the DHCP local server is configured on the router. The following steps provide a high-level description of the interaction among the DHCP local server, DHCP client, and address-assignment pools:

1. The DHCP client sends a discover packet to one or more DHCP local servers in the network to obtain configuration parameters and an IP address for the subscriber.
2. Each DHCP local server that receives the discover packet then searches its address-assignment pool for the client address and configuration options. Each local server creates an entry in its internal client table to keep track of the client state, then sends a DHCP offer packet to the client.
3. On receipt of the offer packet, the DHCP client selects the DHCP local server from which to obtain configuration information and sends a request packet indicating the DHCP local server that will grant the address and configuration information.
4. The selected DHCP local server sends an acknowledgement packet to the client that contains the client address lease and configuration parameters. The server also installs the host route and ARP entry, and then monitors the lease state.

Extended DHCP Local Server and Address-Assignment Pools

The extended DHCP local server enhances traditional DHCP server operation in which the client address pool and client configuration information reside on the DHCP server. With the extended DHCP local server, the client address and configuration information reside in centralized address-assignment pools, which are managed independently of the DHCP local server and which can be shared by different client applications.

The extended DHCP local server also supports advanced pool matching and the use of named address ranges. You can also configure the local server to use DHCP option 82 information in the client PDU to determine which named address range to use for a particular client. The client configuration information, which is configured in the address-assignment pool, includes user-defined options, such as boot server, grace period, and lease time.

Configuring the DHCP environment that includes the extended DHCP local server requires two independent configuration operations, which you can complete in any order. In one operation, you configure the extended DHCP local server on the router and specify how the DHCP local server determines which address-assignment pool to use. In the other operation, you configure the address-assignment pools used by the DHCP local server. The address-assignment pools contain the IP addresses, named address ranges, and configuration information for DHCP clients. See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491 for details about creating and using address-assignment pools.



NOTE: The extended DHCP local server and the address-assignment pools used by the server must be configured in the same logical system and routing instance.

Methods Used by the Extended DHCP Local Server to Determine Which Address-Assignment Pool to Use

You can specify the method that the extended DHCP local server uses to determine which address-assignment pool provides the IP address and configuration for a DHCP client. By default, the server matches the IP address in the client DHCP request to the address of the address-assignment pool.

The following sections describe the methods used by the DHCP local server to determine which address-assignment pool to use:

- Matching the Client IP Address to the Address-Assignment Pool on page 201
- Matching Option 82 Information to Named Address Ranges on page 201

Matching the Client IP Address to the Address-Assignment Pool

In the default configuration, the server selects the address-assignment pool to use by matching the IP address in the client DHCP request with the network address of the address-assignment pool. If the client request contains the gateway IP address (giaddr), the local server matches the giaddr to the address-assignment pool's address. If there is no giaddr in the request, the DHCP local server matches the IP address of the receiving interface to the address of the address-assignment pool.

Matching Option 82 Information to Named Address Ranges

You can also configure the extended DHCP local server to match the DHCP relay agent information option (option 82) in the client DHCP packets to a named range in the address-assignment pool used for the client. Named ranges are subsets within the overall address-assignment pool address range, and are configured when you create the address-assignment pool. To use the DHCP local server option 82 matching feature, you must ensure that the **option-82** statement is included in the **dhcp-attributes** statement for the address-assignment pool.



NOTE: To enable the option 82 matching method, you must first specify the **ip-address-first** statement in the **pool-match-order** statement, and then specify the **option-82** statement.

Default Options Provided by the Extended DHCP Server for the DHCP Client

The extended DHCP local server provides a minimal configuration to the DHCP client if the client does not have DHCP option 55 configured. The server provides the subnet mask of the address-assignment pool that is selected for the client. In addition to the subnet mask, the server provides the following values to the client if the information is configured in the selected address-assignment pool:

- **router**—A router located on the client's subnet. This statement is the equivalent of DHCP option 3.
- **domain name**—The name of the domain in which the client searches for a DHCP server host. This is the default domain name that is appended to hostnames that are not fully qualified. This is equivalent to DHCP option 15.
- **domain name server**—A Domain Name System (DNS) name server that is available to the client to resolve hostname-to-client mappings. This is equivalent to DHCP option 6.

Using External AAA Authentication Services to Authenticate DHCP Clients

Both the extended DHCP local server and the extended DHCP relay agent support the use of external AAA authentication services, such as RADIUS, to authenticate DHCP clients. When the extended DHCP local server or relay agent receives a discover PDU from a client, the extended DHCP application contacts the AAA server to authenticate the DHCP client. The extended DHCP application can obtain client addresses and DHCP configuration options from the external AAA authentication server.



NOTE: This topic uses the term extended DHCP application to refer to both the extended DHCP local server and the extended DHCP relay agent.

The external authentication feature also supports AAA directed logout. If the external AAA service supports a user logout directive, the extended DHCP application honors the logout and views it as if it was requested by a CLI management command. All of the client state information and allocated resources are deleted at logout. The extended DHCP application supports directed logout using the list of configured authentication servers you specify with the **authentication-server** statement at the **[edit access profile *profile-name*]** hierarchy level.

Tasks for configuring External AAA authentication services are:

1. Configuring Authentication Support for an Extended DHCP Application on page 202
2. Grouping Interfaces with Common DHCP Configurations on page 204
3. Configuring Passwords for Usernames the DHCP Application Presents to the External AAA Authentication Service on page 205
4. Creating Unique Usernames the Extended DHCP Application Passes to the External AAA Authentication Service on page 205

Configuring Authentication Support for an Extended DHCP Application

To configure authentication support for an extended DHCP application, include the **authentication** statement at these hierarchy levels. You can configure either global authentication support or group-specific support.

You must configure the **username-include** statement to enable the use of authentication. The **password** statement is not required and does not cause DHCP to use authentication if the **username-include** statement is not included.

Extended DHCP local server hierarchies:

- [edit system services dhcp-local-server]
- [edit system services dhcp-local-server group *group-name*]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* system services dhcp-local-server]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* system services dhcp-local-server group *group-name*]
- [edit logical-systems *logical-system-name* system services dhcp-local-server]
- [edit logical-systems *logical-system-name* system services dhcp-local-server group *group-name*]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* system services dhcp-local-server]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* system services dhcp-local-server group *group-name*]
- [edit routing-instances *routing-instance-name* system services dhcp-local-server]
- [edit routing-instances *routing-instance-name* system services dhcp-local-server group *group-name*]

Extended DHCP relay agent hierarchies:

- [edit forwarding-options dhcp-relay]
- [edit forwarding-options dhcp-relay group *group-name*]
- [edit logical-systems *logical-system-name* forwarding-options dhcp-relay]
- [edit logical-systems *logical-system-name* forwarding-options dhcp-relay group *group-name*]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* forwarding-options dhcp-relay]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* forwarding-options dhcp-relay group *group-name*]
- [edit routing-instances *routing-instance-name* forwarding-options dhcp-relay]
- [edit routing-instances *routing-instance-name* forwarding-options dhcp-relay group *group-name*]

```
authentication {
  password password-string;
  username-include {
    circuit-type;
    delimiter delimiter-character;
    domain-name domain-name-string;
    logical-system-name;
    mac-address;
    option-60;
    option-82 <circuit-id> <remote-id>;
    routing-instance-name;
```

```

        user-prefix user-prefix-string;
    }
}

```

Grouping Interfaces with Common DHCP Configurations

The extended DHCP applications enable you to group together a set of interfaces and apply a common DHCP configuration to the named interface group.

To configure an interface group, use the **group** statement.

```

group group-name {
  authentication {
    password password-string;
    username-include {
      circuit-type;
      delimiter delimiter-character;
      domain-name domain-name-string;
      logical-system-name;
      mac-address;
      option-60;
      option-82 <circuit-id> <remote-id>;
      routing-instance-name;
      user-prefix user-prefix-string;
    }
  }
  interface interface-name <upto upto-interface-name> <exclude>;
}

```

You can specify the names of one or more interfaces on which the extended DHCP application is enabled. You can repeat the **interface** *interface-name* statement to specify multiple interfaces within a group, but you cannot specify the same interface in more than one group. For example:

```

group boston {
  interface 192.168.10.1;
  interface 192.168.15.5;
}

```

You can use the **upto** option to specify a range of interfaces on which the extended DHCP application is enabled. For example:

```

group quebec {
  interface 192.168.10.1 upto 192.168.10.255;
}

```

You can use the **exclude** option to exclude a specific interface or a specified range of interfaces from the group. For example:

```

group paris {
  interface 192.168.100.1 exclude;
  interface 192.168.100.100 upto 192.168.100.125 exclude;
}

```

Configuring Passwords for Usernames the DHCP Application Presents to the External AAA Authentication Service

You can configure an optional password that the extended DHCP application presents to the external AAA authentication service to authenticate the specified username.

To configure a password that authenticates the username, use the `password` statement. See “Special Requirements for JUNOS Software Plain-Text Passwords” on page 65 for information about supported characters in passwords. For example:

```
authentication {
  password myPassword1234
}
```

Creating Unique Usernames the Extended DHCP Application Passes to the External AAA Authentication Service

You can configure the extended DHCP application to include additional fields in the username passed to the external AAA authentication service when the DHCP client logs in. This additional information enables you to construct usernames that uniquely identify subscribers.



NOTE: No authentication is performed if you do not include a username in the authentication configuration; however, the IP address is provided by the local pool if it is configured.

To configure unique usernames, use the `username-include` statement. You can include any or all of the additional statements.

```
authentication {
  username-include {
    circuit-type;
    delimiter delimiter-character;
    domain-name domain-name-string;
    logical-system-name;
    mac-address;
    option-60;
    option-82 <circuit-id> <remote-id>;
    routing-instance-name;
    user-prefix user-prefix-string;
  }
}
```

The following list describes the attributes that can be included as part of the username:

- `circuit-type`—The circuit type used by the DHCP client, for example `enet`.
- `delimiter`—The delimiter character that separates components that make up the concatenated username. The semicolon (;) is not supported as a delimiter character.

- **domain-name**—The client domain name as string. The router adds the @ delimiter to the username.
- **logical-system-name**—The name of the logical system, if the receiving interface is in a logical system.
- **mac-address**—The client MAC address, in a string of the format xxxx.xxxx.xxxx.
- **option-60**—The portion of the option 60 payload that follows the length field.
- **option-82 <circuit-id> <remote-id>;**—The specified contents of the option 82 payload.
 - **circuit-id**—The payload of the agent circuit ID suboption.
 - **remote-id**—The payload of the Agent Remote ID suboption.
 - Both **circuit-id** and **remote-id**—The payloads of both suboptions, in the format: circuit-id[delimiter]remote-id.
 - Neither **circuit-id** or **remote-id**—The raw payload of the option 82 from the PDU is concatenated to the username.
- **routing-instance-name**—The name of the routing instance, if the receiving interface is in a routing instance.
- **user-prefix**—A string indicating the user prefix.

The router creates the unique username by including the specified additional information in the following order, with the fields separated by a delimiter. The default delimiter is a period (.). You can specify a different delimiter; however, the semicolon character (;) is not allowed.

```
user-prefix[delimiter]mac-address[delimiter]logical-system-name[delimiter]
routing-instance-name[delimiter]circuit-type[delimiter]option-82[delimiter]
option-60@domain-name
```

The following example shows a sample configuration that creates a unique username. The username is shown after the configuration.

```
authentication {
  username-include {
    circuit-type;
    domain-name isp55.com;
    mac-address;
    user-prefix wallybrown;
  }
}
```

The resulting unique username is:

```
wallybrown.0090.1a01.1234.enet@isp55.com
```

Client Configuration Information Exchanged Between the External Authentication Server, DHCP Application, and DHCP Client

When the extended DHCP application receives a response from an external authentication server, the response might include information in addition to the IP

address and subnet mask. The extended DHCP application uses the information from the authentication grant for the response the DHCP application sends to the DHCP client. The DHCP application can either send the information in its original form or the application might merge the information with local configuration specifications. For example, if the authentication grant includes an address pool name and a local configuration specifies DHCP attributes for that pool, the extended DHCP application merges the authentication results and the attributes in the reply that the server sends to the client.

A local configuration is optional—a client can be fully configured by the external authentication service. However, if the external authentication service does not provide client configuration, you must configure the local address assignment pool to provide the configuration for the client. When a local configuration specifies options, the extended DHCP application adds the local configuration options to the offer PDU the server sends to the client. If the two sets of options overlap, the options in the authentication response from the external service take precedence.

When you use RADIUS to provide the authentication, the additional information might be in the form of RADIUS attributes and Juniper Networks VSAs. The following list shows the information that RADIUS might include in the authentication grant. See “RADIUS Attributes and Juniper Networks VSAs Supported by the AAA Service Framework” on page 484 for a complete list of RADIUS attributes and Juniper Networks VSAs that the extended DHCP applications supports for subscriber access management.

- Client IP address—RADIUS attribute 8, Framed-IP-Address
- Subnet mask for client IP address (DHCP option 1)—RADIUS attribute 9, Framed-IP-Netmask
- Primary domain server (DHCP option 6)—VSA 26-4, Primary-DNS
- Secondary domain server (DHCP option 6)—VSA 26-5 Secondary-DNS
- Primary WINS server (DHCP option 44)—VSA 26-6, Primary-WINS
- Secondary WINS server (DHCP option 44)—VSA 26-7, Secondary-WINS
- Address assignment pool name—RADIUS attribute 88, Framed-Pool
- Lease time—RADIUS attribute 27, Session-Timeout
- DHCP relay server—VSA 26-109, DHCP-Guided-Relay-Server

Tracing Extended DHCP Local Server Operations

The extended DHCP tracing operations track the extended DHCP local server operations and record them in a log file. By default, no extended DHCP local server processes are traced. If you include the **traceoptions** statement at the **[edit system services dhcp-local-server]** hierarchy level, the default tracing behavior is the following:

- Important extended DHCP local server events are logged in a file called **jdhcpd** located in the **/var/log** directory.
- When the file **jdhcpd** reaches 128 kilobytes (KB), it is renamed **jdhcpd.0**, then **jdhcpd.1**, and so on, until there are 3 trace files. Then the oldest trace file (**jdhcpd.2**) is overwritten. For more information about how log files are created, see the *JUNOS System Log Messages Reference*.

- Log files can be accessed only by the user who configures the tracing operation.

To trace DHCP local server operations, include the `traceoptions` statement at the `[edit system services dhcp-local-server]` hierarchy level:

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

The following topics describe the tracing operation configuration statements:

Configuring the Filename of the Extended DHCP Local Server Processes Log

By default, the name of the file that records trace output is `jdhcpd`. You can specify a different name by including the `file` statement at the `[edit system services dhcp-local-server traceoptions]` hierarchy level:

```
[edit system services dhcp-local-server traceoptions]
file filename;
```

Configuring the Number and Size of Extended DHCP Local Server Processes Log Files

By default, when the trace file reaches 128 kilobytes (KB) in size, it is renamed `jdhcpd.0`, then `jdhcpd.1`, and so on, until there are three trace files. Then the oldest trace file (`jdhcpd.2`) is overwritten.

You can configure the limits on the number and size of trace files by including the following statements at the `[edit system services dhcp-local-server traceoptions]` hierarchy level:

```
[edit system services dhcp-local-server traceoptions]
file filename files number size size;
```

For example, set the maximum file size to 2 MB, and the maximum number of files to 20. When the file that receives the output of the tracking operation (`jdhcpd`) reaches 2 MB, `jdhcpd` is renamed `jdhcpd.0`, and a new file called `jdhcpd` is created. When the new `jdhcpd` reaches 2 MB, `jdhcpd.0` is renamed `jdhcpd.1` and *filename* is renamed `jdhcpd.0`. This process repeats until there are 20 trace files. Then the oldest file (`jdhcpd.19`) is overwritten by the newest file (`jdhcpd.0`).

The number of files can be from 2 through 1000 files. The file size of each file can be from 10KB through 1 gigabyte (GB).

Configuring Access to the Log File

By default, log files can be accessed only by the user who configures the tracing operation.

To specify that any user can read all log files, include the `file world-readable` statement at the `[edit system services dhcp-local-server traceoptions]` hierarchy level:

```
[edit system services dhcp-local-server traceoptions]
file filename world-readable;
```

To set the default behavior explicitly, include the `file no-world-readable` statement at the `[edit system services dhcp-local-server traceoptions]` hierarchy level:

```
[edit system services dhcp-local-server traceoptions]
file filename no-world-readable;
```

Configuring a Regular Expression for Lines to Be Logged

By default, the trace operations output includes all lines relevant to the logged events.

You can refine the output by including the `match` statement at the `[edit system services dhcp-local-server traceoptions]` hierarchy level and specifying a regular expression (regex) to be matched:

```
[edit system services dhcp-local-server traceoptions]
file filename match regex;
```

Configuring Trace Option Flags

By default, only important events are logged. You can configure the trace operations to be logged by including extended DHCP local server tracing flags at the `[edit system services dhcp-local-server traceoptions]` hierarchy level:

```
[edit system services dhcp-local-server traceoptions]
flag flag;
```

You can configure the following tracing flags:

- `all`—Trace all operations.
- `auth`—Trace authentication operations.
- `database`—Trace database events.
- `fwd`—Trace firewall process events.
- `general`—Trace miscellaneous events.
- `ha`—Trace high availability-related events.
- `interface`—Trace interface operations.
- `io`—Trace I/O operations.
- `packet`—Trace packet decoding operations.
- `packet-option`—Trace DHCP option decoding operations.
- `rpd`—Trace routing protocol process events.
- `rtsock`—Trace routing socket operations.
- `session-db`—Trace session database operations.

- `state`—Trace changes in state.
- `ui`—Trace user interface operations.

Example: Configuring Minimum Extended DHCP Local Server Configuration

The following example shows the minimum configuration you need to use the extended DHCP local server on the router:

This example creates the server group named `group_one`, and specifies that the DHCP local server is enabled on interface `fe-0/0/2.0` within the group. The DHCP local server uses the default pool match configuration of `ip-address-first`.

```
[edit system services]
dhcp-local-server {
  group group_one {
    interface fe-0/0/2.0;
  }
}
```

Example: Extended DHCP Local Server Configuration with Optional Pool Matching

The following example shows an extended DHCP local server configuration that includes optional pool matching and interface groups. This configuration specifies that the DHCP local server uses option 82 information to match the named address range for client IP address assignment. The option 82 matching must also be included in the address-assignment pool configuration.

```
[edit system services]
dhcp-local-server {
  group group_one {
    interface fe-0/0/2.0;
    interface fe-0/0/2.1;
  }
  group group_two {
    interface fe-0/0/3.0;
    interface fe-0/0/3.1;
  }
  pool-match-order {
    ip-address-first;
    option-82;
  }
}
```

Verifying and Managing DHCP Local Server Configuration

To display the client address bindings for the extended DHCP local server, use the following operational commands:

- `show dhcp server binding`
- `show dhcp server statistics`

To clear client address bindings and DHCP local server statistics, use the following operational commands:

- clear dhcp server binding
- clear dhcp server statistics

For information about using these operations commands, see the *JUNOS System Basics and Services Reference*.

Configuring DTCP-over-SSH Service for the Flow-Tap Application

The active monitoring flow-tap application requires you to configure the flow-tap DTCP-over-SSH service. Flow-tap enables you to intercept IPv4 packets transiting an active monitoring router and send a copy of matching packets to one or more content destinations, for use in flexible trend analysis of security threats and in lawful intercept of data.

To enable the flow-tap DTCP-over-SSH service, include the following statements at the [edit system services] hierarchy level:

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

By default, the router supports a limited number of simultaneous flow-tap DTCP-over-SSH sessions and connection attempts per minute. Optionally, you can include either or both of the following statements to change the defaults:

- **connection-limit *limit***—Maximum number of simultaneous connections (a value from 1 through 250). The default is 75.
- **rate-limit *limit***—Maximum number of connection attempts accepted per minute (a value from 1 through 250). The default is 150.

You must also define user permissions that enable flow-tap users to configure flow-tap services. Specify a login class and access privileges for flow-tap users at the [edit system login class *class-name* permissions] hierarchy level:

```
[edit system login class class-name permissions]
(flow-tap | flow-tap-control | flow-tap-operation);
```

The permission bit for a flow-tap login class can be one of the following:

- **flow-tap**—Can view the flow-tap configuration in configuration mode.
- **flow-tap-control**—Can view the flow-tap configuration in configuration mode and configure flow-tap configuration information at the [edit services flow-tap] hierarchy level.
- **flow-tap-operation**—Can make flow-tap requests to the router from a remote location using a DTCP client.



NOTE: Only users with a configured access privilege of **flow-tap-operation** can initiate flow-tap requests.

You can also specify user permissions through the Juniper-User-Permissions RADIUS attribute.

To enable the flow-tap DTCP-over-SSH service, you must also include statements at the **[edit interfaces]** hierarchy level to specify an Adaptive Services PIC that runs the flow-tap service and conveys flow-tap filters from the mediation device to the router. In addition, you must include the **flow-tap** statement at the **[edit services]** hierarchy level.

Configuring Finger Service for Remote Access to the Router

To configure the router to accept finger as an access service, include the **finger** statement at the **[edit system services]** hierarchy level:

```
[edit system services]
finger {
  <connection-limit limit>;
  <rate-limit limit>;
}
```

By default, the router supports a limited number of simultaneous finger sessions and connection attempts per minute. Optionally, you can include either or both of the following statements to change the defaults:

- **connection-limit *limit***—Maximum number of simultaneous connections (a value from 1 through 250). The default is 75.
- **rate-limit *limit***—Maximum number of connection attempts accepted per minute (a value from 1 through 250). The default is 150.

You cannot include the **finger** statement on routers that run the JUNOS-FIPS software. We recommend that you do not use the finger service in a Common Criteria environment.

Configuring FTP Service for Remote Access to the Router

To configure the router to accept FTP as an access service, include the **ftp** statement at the **[edit system services]** hierarchy level:

```
[edit system services]
ftp {
  <connection-limit limit>;
  <rate-limit limit>;
}
```

By default, the router supports a limited number of simultaneous FTP sessions and connection attempts per minute. Optionally, you can include either or both of the following statements to change the defaults:

- **connection-limit *limit***—Maximum number of simultaneous connections (a value from 1 through 250). The default is 75.
- **rate-limit *limit***—Maximum number of connection attempts accepted per minute (a value from 1 through 250). The default is 150.

You can use passive FTP to access devices that accept only passive FTP services. All commands and statements that use FTP also accept passive FTP. Include the **ftp** statement at the [edit system services] hierarchy level to use either active FTP or passive FTP.

To start a passive FTP session, use **pasvftp** (instead of **ftp**) in the standard FTP format (**ftp://destination**). For example:

```
request system software add pasvftp://name.com/jinstall.tgz
```

You cannot include the **ftp** statement on routers that run the JUNOS-FIPS software. We recommend that you do not use the finger service in a Common Criteria environment.

Configuring SSH Service for Remote Access to the Router

To configure the router to accept SSH as an access service, include the **ssh** statement at the [edit system services] hierarchy level:

```
[edit system services]
ssh {
  root-login (allow | deny | deny-password);
  protocol-version [v1 v2];
  <connection-limit limit>;
  <rate-limit limit>;
}
```

By default, the router supports a limited number of simultaneous SSH sessions and connection attempts per minute. Optionally, you can include either or both of the following statements to change the defaults:

- **connection-limit *limit***—Maximum number of simultaneous connections (a value from 1 through 250). The default is 75.
- **rate-limit *limit***—Maximum number of connection attempts accepted per minute (a value from 1 through 250). The default is 150.

For information about other configuration settings, see the following topics:

- Configuring the Root Login Through SSH on page 214
- Configuring the SSH Protocol Version on page 214

Configuring the Root Login Through SSH

By default, users are allowed to log in to the router as **root** through SSH. To control user access through SSH, include the **root-login** statement at the **[edit systems services ssh]** hierarchy level:

```
[edit system services ssh]
root-login (allow | deny | deny-password);
```

allow—Allows users to log in to the router as root through SSH. The default is **allow**.

deny—Disables users from logging in to the router as root through SSH.

deny-password—Allows users to log in to the router as root through SSH when the authentication method (for example, RSA) does not require a password.



NOTE: The **root-login** and **protocol-version** statements are supported in JUNOS Release 5.0 and later. If you downgrade to a release earlier than JUNOS Release 5.0, the **root-login** and **protocol-version** statements are ignored if they are present in the configuration file.

Configuring the SSH Protocol Version

By default, version 2 of the SSH protocol is enabled. To configure the router to use only version 1 of the SSH protocol, include the **protocol-version** statement and specify **v1** at the **[edit system services ssh]** hierarchy level:

```
[edit system services ssh]
protocol-version [ v1 ];
```

To configure the router to use version 1 and 2 of the SSH protocol, include the **protocol-version** statement and specify **v1** and **v2** at the **[edit system services ssh]** hierarchy level:

```
[edit system services ssh]
protocol-version [ v1 v2 ];
```

You can specify **v1**, **v2**, or both versions ([**v1 v2**]) of the SSH protocol. The default is **v2**.

For J Series Services Routers, the export license software only supports SSH version 1.



NOTE: The **root-login** and **protocol-version** statements are supported in JUNOS Release 5.0 and later. If you downgrade to a release prior to release 5.0, the **root-login** and **protocol-version** statements are ignored if they are present in the configuration file.

Configuring Outbound SSH Service

You can configure a router running the JUNOS Software to initiate a TCP/IP connection with a client management application that would be blocked if the client attempted to initiate the connection (for example, if the router is behind a firewall). A single `outbound-ssh` configuration statement instructs the router to create a TCP/IP connection with the client management application and to forward the router's identity. Once the connection is established, the management application initiates the SSH sequence as the client and the router as the server that authenticates the client.



NOTE: There is no initiation command with outbound SSH. Once outbound SSH is configured and committed, the router begins to initiate an outbound SSH connection based on the committed configuration. It continues to attempt to create this connection until successful. If the connection between the router and the client management application is broken, the router again attempts to create a new outbound SSH connection until successful. This connection is maintained until the outbound SSH stanza is removed from the configuration.

To configure the router running JUNOS Software for outbound SSH connections, include the `outbound-ssh` statement at the `[edit system services]` hierarchy level:

```
[edit system services]
outbound-ssh {
  client client-id {
    address {
      port port-number;
      retry number;
      timeout seconds;
    }
    device-id device-id;
    keep-alive {
      retry number;
      timeout seconds;
    }
    reconnect-strategy (in-order | sticky);
    secret password;
    services netconf;
  }
  traceoptions {
    file filename <files number> <match regex> <size size> <world-readable |
      no-world-readable>;
    flag flag;
    no-remote-trace;
  }
}
```

The following topics describe the tasks for configuring the outbound-SSH service:

1. Configuring the Device Identifier for Outbound SSH Connections on page 216
2. Sending the Router's Public SSH Host Key to the Outbound SSH Client on page 216

3. Configuring Keepalive Messages for Outbound SSH Connections on page 217
4. Configuring a New Outbound SSH Connection on page 218
5. Configuring the Outbound SSH Client to Accept NETCONF as an Available Service on page 218
6. Configuring Outbound SSH Clients on page 218

Configuring the Device Identifier for Outbound SSH Connections

Each time the router establishes an outbound SSH connection, it first sends an initiation sequence to the management client. This sequence identifies the router to the management client. Within this transmission is the value of *device-id*.

To configure the router's device identifier, include the **device-id** statement at the [edit system services outbound-ssh client *client-id*] hierarchy level:

```
[edit system services outbound-ssh client client-id]
device-id device-id;
```

The initiation sequence when **secret** is not configured:

```
MSG-ID: DEVICE-CONN-INFO\r\n
MSG-VER: V1\r\n
DEVICE-ID: <device-id>\r\n
```

Sending the Router's Public SSH Host Key to the Outbound SSH Client

Each time the router establishes an outbound SSH connection, it first sends an initiation sequence to the management client. This sequence identifies the router to the management client. Within this transmission is the value of *device-id*.

To configure the router's device identifier, include the **device-id** statement at the [edit system services outbound-ssh client *client-id*] hierarchy level:

```
[edit system services outbound-ssh client client-id]
device-id device-id;
```

The initiation sequence when **secret** is not configured:

```
MSG-ID: DEVICE-CONN-INFO\r\n
MSG-VER: V1\r\n
DEVICE-ID: <device-id>\r\n
```

During the initialization of an SSH connection, the client authenticates the identity of the router using the router's public SSH host key. Therefore, before the client can initiate the SSH sequence, it needs the router's public SSH key. When you configure the **secret** statement, the router running JUNOS Software passes the router's public SSH key as part of the outbound SSH connection initiation sequence.

When the **secret** statement is set and the router establishes an outbound SSH connection, the router communicates its device ID, its public SSH key, and an SHA1 hash derived in part from the **secret** statement. The value of the **secret** statement is shared between the router and the management client. The client uses the shared

secret to authenticate the public SSH host key it is receiving to determine whether the public key is from the router identified by the `device-id` statement.

Using the `secret` statement to transport the router's public SSH host key is optional. You can manually transport and install the public key onto the client system.



NOTE: Including the `secret` statement means that the router's public SSH host key is sent every time the router establishes a connection to the client. It is then up to the client to decide what to do with the SSH host key if it already has one for that router. We recommend that you replace the client's copy with the new key. Host keys can change for various reasons and by replacing the key each time a connection is established, you ensure that the client has the latest key.

To configure a router that is running the JUNOS Software to send the router's public SSH host key when connection to the client occurs, include the `secret` statement at the `[edit system services outbound-ssh client client-id]` hierarchy level:

```
[edit system services outbound-ssh client client-id]
secret password;
```

The message sent by the JUNOS router when the `secret` attribute is configured:

```
MSG-ID: DEVICE-CONN-INFO\r\n
MSG-VER: V1\r\n
DEVICE-ID: <device-id>\r\n
HOST-KEY: <public-host-key>\r\n
HMAC:<HMAC(pub-SSH-host-key, <secret>>)>\r\n
```

Configuring Keepalive Messages for Outbound SSH Connections

Once the client application has the router's public SSH host key, it can then initiate the SSH sequence as if it had created the TCP/IP connection and authenticate the router using its copy of the router's public host SSH key as part of that sequence. The router authenticates the client user through the mechanisms supported in the JUNOS Software (RSA/DSA public string or password authentication).

To enable the router to send SSH protocol keepalive messages to the client application, configure the `keep-alive` statement at the `[edit system services outbound-ssh client client-id]` hierarchy level:

```
[edit system services outbound-ssh client client-id]
keep-alive {
    retry number;
    timeout seconds;
}
```

The `timeout` option specifies how long the router waits to receive data before sending a request for acknowledgment from the application. The default is 15 seconds.

The `retry` option specifies how many keepalive messages the router sends without receiving a response from the client. When that number is exceeded, the router

disconnects from the application, ending the outbound SSH connection. The default is three retries.

Configuring a New Outbound SSH Connection

When disconnected, the router begins to initiate a new outbound SSH connection. To specify how the router reconnects to the server after a connection is dropped, include the `reconnect-strategy` statement at the `[edit system services outbound-ssh client client-id]` hierarchy level:

```
[edit system services outbound-ssh client-id]
reconnect-strategy (sticky | in-order);
```

The `sticky` option configures the router to reconnect to the server that it disconnected.

The `in-order` option configures the router to reconnect to the first configured server. If this server is unavailable, the router tries to connect to the next configured server. This process repeats until a connection is completed.

You can also specify the number of retry attempts and set the amount of time before stopping the reconnection attempts. See “Configuring Keepalive Messages for Outbound SSH Connections” on page 217.

Configuring the Outbound SSH Client to Accept NETCONF as an Available Service

To configure the application to accept NETCONF as an available service, include the `services netconf` statement at the `[edit system services outbound-ssh client client-id]` hierarchy level:

```
[edit system services outbound-ssh client client-id]
services {
  netconf;
}
```

Configuring Outbound SSH Clients

To configure the clients available for this outbound SSH connection, list each client with a separate `address` statement at the `[edit system services outbound-ssh client client-id]` hierarchy level:

```
[edit system services outbound-ssh client client-id]
address {
  retry number;
  timeout seconds;
  port port-number;
}
```

The client *client-id* value is not forwarded to the client management application. This value serves to uniquely identify the `outbound-ssh` configuration stanza. Each `outbound-ssh` stanza represents a single outbound SSH connection. Thus, the administrator is free to assign the *client-id* any meaningful unique value.

The **address** statement is the IP address or host name of the client.

The **timeout** statement specifies how long the application waits between attempts to reconnect to the specified IP address, in seconds. The default is 15 seconds.

The **retry** statement specifies how many connection attempts a router can make to the specified IP address. The default is 3.

The **port** statement specifies the port at which a server listens for outbound SSH connection requests.

Configuring Telnet Service for Remote Access to a Router

To configure the router to accept Telnet as an access service, include the **telnet** statement at the [edit system services] hierarchy level:

```
[edit system services]
telnet {
  <connection-limit limit>;
  <rate-limit limit>;
}
```

By default, the router supports a limited number of simultaneous Telnet sessions and connection attempts per minute.

Optionally, you can include either or both of the following statements to change the defaults:

- **connection-limit *limit***—Maximum number of simultaneous connections (a value from 1 through 250). The default is 75.
- **rate-limit *limit***—Maximum number of connection attempts accepted per minute (a value from 1 through 250). The default is 150.

You cannot include the **telnet** statement on routers that run the JUNOS-FIPS software. We recommend that you do not use Telnet in a Common Criteria environment.

Configuring Password Authentication for Console Access to PICs

By default, there is no password setting for console access. To configure console access to the Physical Interface Cards (PICs), include the **pic-console-authentication** statement at the [edit system] hierarchy level:

```
[edit system]
pic-console-authentication {
  (encrypted-password "password" | plain-text-password);
}
```

encrypted-password "password"—Use Message Digest 5 (MD5) or other encrypted authentication. Specify the MD5 or other password. You can specify only one encrypted password.

You cannot configure a blank password for **encrypted-password** using blank quotation marks (" "). You must configure a password whose number of characters range from 1 through 128 characters and enclose the password in quotation marks.

plain-text-password—Use a plain-text password. The command-line interface (CLI) prompts you for the password and then encrypts it. The CLI displays the encrypted version, and the software places the encrypted version in its user database. You can specify only one plain-text password.

Configuring the JUNOS Software to Display a System Login Message

By default, no login message is displayed. To configure a system login message, include the **message** statement at the [edit system login] hierarchy level:

```
[edit system login]
message text;
```

If the message text contains any spaces, enclose it in quotation marks.

Special Characters—You can format the message using the following special characters:

- \n—New line
- \t—Horizontal tab
- \'—Single quotation mark
- \"—Double quotation mark
- \\—Backslash

The following is a sample login message configuration:

```
[edit]
system {
  login {
    message "\n\n\n\tUNAUTHORIZED USE OF THIS SYSTEM\n
\tIS STRICTLY PROHIBITED!\n\n\tPlease contact
\t'company-noc@company.com\t' to gain\naccess
to this equipment if you need authorization.\n\n\n";
  }
}
```

The preceding login message configuration example produces a login message similar to the following:

```
server% telnet router1
Trying 1.1.1.1...
Connected to router1.
Escape character is '^]'.


```

```
UNAUTHORIZED USE OF THIS SYSTEM
IS STRICTLY PROHIBITED!
```

Please contact 'company-noc@company.com' to gain access to this equipment if you need authorization.

```
router1 (ttyp0)
```

```
login:
```

A system login message appears before the user logs in. A system login announcement appears after the user logs in. See “Configuring the JUNOS Software to Display a System Login Announcement” on page 221.

Configuring the JUNOS Software to Display a System Login Announcement

By default, no login announcement is displayed. To configure a system login announcement, include the `announcement` statement at the `[edit system login]` hierarchy level:

```
[edit system login]
announcement text;
```

If the announcement text contains any spaces, enclose it in quotation marks.

A system login announcement appears after the user logs in. A system login message appears before the user logs in. See “Configuring the JUNOS Software to Display a System Login Message” on page 220.



TIP: You can use the same special characters described in “Configuring the JUNOS Software to Display a System Login Message” on page 220 to format your system login announcement.

Disabling JUNOS Software Processes



CAUTION: Never disable any of the software processes unless instructed to do so by a Customer Support engineer.

To disable a software process, specify the appropriate option in the `processes` statement at the `[edit system]` hierarchy level:

```
[edit system]
processes {
  process-name (enable | disable);
}
```



NOTE: The *process-name* variable is one of the valid process names. You can obtain a complete list of process names by using the CLI command completion feature. For additional information, see **processes**.

Configuring Failover to Backup Media if a JUNOS Software Process Fails

For routers with redundant Routing Engines, you can configure the router to switch to backup media that contains a version of the system if a software process fails repeatedly. You can configure the router to fail over either to backup media or to the other Routing Engine. To configure automatic switchover to backup media if a software process fails, include the **failover** statement at the [edit system processes *process-name*] hierarchy level:

```
[edit system processes]
  process-name failover (alternate-media | other-routing-engine);
```

process-name is one of the valid process names. If this statement is configured for a process, and that process fails four times within 30 seconds, the router reboots from either the alternative media or the other Routing Engine.

Configuring Password Authentication for the Diagnostics Port

If you have been asked by Customer Support personnel to connect a physical console to a control board or forwarding component on the router (such as the System Control Board [SCB], System and Switch Board [SSB], or Switching and Forwarding Module [SFM]) to perform diagnostics, you can configure a password on the diagnostics port. This password provides an extra level of security.

To configure a password on the diagnostics port, include the **diag-port-authentication** statement at the [edit system] hierarchy level:

```
[edit system]
  diag-port-authentication (encrypted-password "password" | plain-text-password);
```

You cannot configure a blank password for **encrypted-password** using blank quotation marks (" "). You must configure a password whose number of characters range from 1 through 128 characters and enclose the password in quotation marks.

You can use an MD5 password, or you can enter a plain-text password that the JUNOS Software encrypts (using MD5-style encryption) before it places it into the password database. For an MD5 password, specify the password in the configuration. Null-password (empty) is not permitted.

If you configure the **plain-text-password** option, the CLI prompts you for the password.

For routers that have more than one SSB, the same password is used for both SSBs.

Viewing Core Files from JUNOS Software Processes

When an internal JUNOS process generates a core file, the output found at `/var/crash/` and `/var/tmp/` can now be viewed. This provides a quick method of finding core issues across large networks.

Use the CLI command `show system core-dumps` to view core dumps.

```
root@sierra> show system core-dumps
-rw----- 1 root  wheel  268369920 Jun 18 17:59 /var/crash/vmcore.0
-rw-rw---- 1 root  field   3371008 Jun 18 17:53 /var/tmp/rpd.core.0
-rw-r--r-- 1 root  wheel   27775914 Jun 18 17:59 /var/crash/kernel.0
```

Saving Core Files from JUNOS Software Processes

By default, when an internal JUNOS process generates a core file, the file and associated context information are saved for debugging purposes in a compressed tar file named `/var/tmp/process-name.core.core-number.tgz`. The contextual information includes the configuration and system log message files.

To disable the saving of core files and associated context information, include the `no-saved-core-context` statement at the `[edit system]` hierarchy level:

```
[edit system]
no-saved-core-context;
```

To save the core files only, include the `saved-core-files` statement at the `[edit system]` hierarchy level and specify the number of files to save:

```
[edit system]
saved-core-files number;
```

number is the number of core files to save and can be a value from 1 through 64.

To save the core files along with the contextual information, include the `saved-core-context` statement at the `[edit system]` hierarchy level:

```
[edit system]
saved-core-context;
```

Using JUNOS Software to Configure Logical System Administrators

Using the JUNOS Software, you can partition a single router into multiple logical devices that perform independent routing tasks. When creating logical systems, you must configure logical system administrators and interfaces, assign logical interfaces to logical systems, and configure various other logical system statements.



NOTE: Beginning with JUNOS Software Release 9.3, the logical router feature has been renamed logical system.

All configuration statements, operational commands, **show** command outputs, error messages, log messages, and SNMP MIB objects that contain the string `logical-router` or `logical-routers` have been changed to `logical-system` and `logical-systems`, respectively.

The master administrator can assign one or more logical system administrators to each logical system. Once assigned to a logical system, administrators are restricted to viewing only configurations of the logical system to which they are assigned and accessing only the operational commands that apply to that particular logical system. This restriction means that these administrators cannot access global configuration statements, and all command output is restricted to the logical system to which the administrators are assigned.

To configure logical system administrators, include the `logical-system` *logical-system-name* statement at the `[edit system login class class-name]` hierarchy level and apply the class to the user. For example:

```
[edit]
system {
  login {
    class admin1 {
      permissions all;
      logical-system logical-system-LS1;
    }
    class admin2 {
      permissions view; # Gives users assigned to class admin2 the ability to view
                        # but not to change the configuration.
      logical-system logical-system-LS2;
    }
    user user1 {
      class admin1;
    }
    user user2 {
      class admin2;
    }
  }
}
```

Fully implementing logical systems requires that you also configure any protocols, routing statements, and policy statements for the logical system.

Using JUNOS Software to Configure a Router to Transfer Its Configuration to an Archive Site

You can configure a router to transfer its configuration to an archive file periodically. Tasks to configure the router configuration transfer to an archive site are:

1. Configuring the Router to Transfer Its Currently Active Configuration to an Archive on page 225
2. Configuring the Transfer Interval for Periodic Transfer of the Active Configuration to an Archive Site on page 225
3. Configuring Transfer of the Current Active Configuration When a Configuration Is Committed on page 226
4. Configuring Archive Sites for Transfer of Active Configuration Files on page 226

Configuring the Router to Transfer Its Currently Active Configuration to an Archive

If you want to back up your router's current configuration to an archive site, you can configure the router to transfer its currently active configuration by FTP periodically or after each commit.

To configure the router to transfer its currently active configuration to an archive site, include statements at the [edit system archival configuration] hierarchy level:

```
[edit system archival configuration]
transfer-interval interval;
transfer-on-commit;
archive-sites {
  ftp://username<:password>@host-address<:port>/url-path;
  scp://username<:password>@host-address<:port>/url-path;
}
```



NOTE: When specifying a URL in a JUNOS statement using an IPv6 host address, you must enclose the entire URL in quotation marks (") and enclose the IPv6 host address in brackets ([]). For example, "ftp://username<:password>@[ipv6-host-address]<:port>/url-path"

Configuring the Transfer Interval for Periodic Transfer of the Active Configuration to an Archive Site

To configure the router to periodically transfer its currently active configuration to an archive site, include the `transfer-interval` statement at the [edit system archival configuration] hierarchy level:

```
[edit system archival configuration]
transfer-interval interval;
```

The *interval* is a period of time ranging from 15 through 2880 minutes.

Configuring Transfer of the Current Active Configuration When a Configuration Is Committed

To configure the router to transfer its currently active configuration to an archive site each time you commit a candidate configuration, include the `transfer-on-commit` statement at the `[edit system archival configuration]` hierarchy level:

```
[edit system archival configuration]
transfer-on-commit;
```



NOTE: When specifying a URL in a JUNOS statement using an IPv6 host address, you must enclose the entire URL in quotation marks (" ") and enclose the IPv6 host address in brackets ([]). For example,
`"scp://username<:password>@[ipv6-host-address]<:port>/url-path"`

Configuring Archive Sites for Transfer of Active Configuration Files

When you configure the router to transfer its configuration files, you specify an archive site to which the files are transferred. If you specify more than one archive site, the router attempts to transfer files to the first archive site in the list, moving to the next site only if the transfer fails.

When you use the `archive-sites` statement, you can specify a destination as a Hypertext Transfer Protocol (HTTP) URL, FTP URL, or secure copy (SCP)-style remote file specification. The URL type `file://` is also supported.

To configure the archive site, include the `archive-sites` statement at the `[edit system archival configuration]` hierarchy level:

```
[edit system archival configuration]
archive-sites {
  ftp://username@host:<port>url-path password password;
  http://username@host:<port>url-path password password;
  scp://username@host:<port>url-path password password;
  file://<path>/<filename>;
}
```



NOTE: When specifying a URL in a JUNOS statement using an IPv6 host address, you must enclose the entire URL in quotation marks (" ") and enclose the IPv6 host address in brackets ([]). For example,
`"scp://username<:password>@[ipv6-host-address]<:port>/url-path"`

When you specify the archive site, do not add a forward slash (/) to the end of the URL. The format for the destination filename is as follows:

```
<router-name>_juniper.conf[.gz]_YYYYMMDD_HHMMSS
```



NOTE: The time included in the destination filename is always in Coordinated Universal Time (UTC) regardless of whether the time on the router is configured as UTC or the local time zone. The default time zone on the router is UTC.

Using JUNOS Software to Specify the Number of Configurations Stored on the CompactFlash Card

By default, the JUNOS Software saves the current configuration and three previous versions of the committed configuration on the CompactFlash card. The currently operational JUNOS Software configuration is stored in the file `juniper.conf.gz`, and the last three committed configurations are stored in the files `juniper.conf.1.gz`, `juniper.conf.2.gz`, and `juniper.conf.3.gz`. These four files are located in the router's CompactFlash card in the directory `/config`.

In addition to saving the current configuration and the current operational version, you can also specify how many previous versions of the committed configurations you want stored on the CompactFlash card in the directory `/config`. The remaining previous versions of committed configurations are stored in the directory `/var/db/config` on the hard disk. This is useful when you have very large configurations that might not fit on the CompactFlash card.

To specify how many previous versions of the committed configurations you want stored on the CompactFlash card, include the `max-configurations-on-flash` statement at the `[edit system]` hierarchy level:

```
[edit system]
max-configurations-on-flash number;
```

number is a value from 0 through 49.

Configuring RADIUS System Accounting

With RADIUS accounting enabled, Juniper Network routers, acting as RADIUS clients, can notify the RADIUS server about user activities such as software logins, configuration changes, and interactive commands. The framework for RADIUS accounting is described in RFC 2866.

Tasks for configuring RADIUS system accounting are:

1. Configuring Auditing of User Events on a RADIUS Server on page 227
2. Specifying RADIUS Server Accounting and Auditing Events on page 228
3. Configuring RADIUS Server Accounting on page 228

Configuring Auditing of User Events on a RADIUS Server

To audit user events, include the following statements at the `[edit system accounting]` hierarchy level:

```
[edit system accounting]
```

```

events [ events ];
destination {
  radius {
    server {
      server-address {
        accounting-port port-number;
        secret password;
        source-address address;
        retry number;
        timeout seconds;
      }
    }
  }
}

```

Specifying RADIUS Server Accounting and Auditing Events

To specify the events you want to audit when using a RADIUS server for authentication, include the **events** statement at the [edit system accounting] hierarchy level:

```

[edit system accounting]
events [ events ];

```

events is one or more of the following:

- login—Audit logins
- change-log—Audit configuration changes
- interactive-commands—Audit interactive commands (any command-line input)

Configuring RADIUS Server Accounting

To configure RADIUS server accounting, include the **server** statement at the [edit system accounting destination radius] hierarchy level:

```

server {
  server-address {
    accounting-port port-number;
    secret password;
    source-address address;
    retry number;
    timeout seconds;
  }
}

```

server-address specifies the address of the RADIUS server. To configure multiple RADIUS servers, include multiple **server** statements.



NOTE: If no RADIUS servers are configured at the [edit system accounting destination radius] statement hierarchy level, the JUNOS Software uses the RADIUS servers configured at the [edit system radius-server] hierarchy level.

accounting-port *port-number* specifies the RADIUS server accounting port number.

The default port number is 1813.



NOTE: If you enable RADIUS accounting at the [edit access profile *profile-name* accounting-order] hierarchy level, accounting is triggered on the default port of 1813 even if you do not specify a value for the accounting-port statement.

You must specify a secret (password) that the local router passes to the RADIUS client by including the **secret** statement. If the password contains spaces, enclose the entire password in quotation marks (" ").

In the **source-address** statement, specify a source address for the RADIUS server. Each RADIUS request sent to a RADIUS server uses the specified source address. The source address is a valid IPv4 address configured on one of the router interfaces.

Optionally, you can specify the number of times that the router attempts to contact a RADIUS authentication server by including the **retry** statement. By default, the router retries three times. You can configure the router to retry from 1 through 10 times.

Optionally, you can specify the length of time that the local router waits to receive a response from a RADIUS server by including the **timeout** statement. By default, the router waits 3 seconds. You can configure the timeout to be from 1 through 90 seconds.

Example: Configuring RADIUS System Accounting

The following example shows three servers (10.5.5.5, 10.6.6.6, and 10.7.7.7) configured for RADIUS accounting.

```
system {
  accounting {
    events [ login change-log interactive-commands ];
    destination {
      radius {
        server {
          10.5.5.5 {
            accounting-port 3333;
            secret $9$dkafeqwrew;
            source-address 10.1.1.1;
            retry 3;
            timeout 3;
          }
          10.6.6.6 secret $9$fe3erqwrez;
```

```

    10.7.7.7 secret $9$f34929ftby;
  }
}
}
}
}

```

Configuring TACACS+ System Accounting

You can use TACACS+ to track and log software logins, configuration changes, and interactive commands. To audit these events, include the following statements at the [edit system accounting] hierarchy level:

```

[edit system accounting]
events [ events ];
destination {
  tacplus {
    server {
      server-address {
        port port-number;
        secret password;
        single-connection;
        timeout seconds;
      }
    }
  }
}

```

Tasks for configuring TACACS+ system accounting are:

1. Specifying TACACS+ Auditing and Accounting Events on page 230
2. Configuring TACACS+ Server Accounting on page 230

Specifying TACACS+ Auditing and Accounting Events

To specify the events you want to audit when using a TACACS+ server for authentication, include the **events** statement at the [edit system accounting] hierarchy level:

```

[edit system accounting]
events [ events ];

```

events is one or more of the following:

- **login**—Audit logins
- **change-log**—Audit configuration changes
- **interactive-commands**—Audit interactive commands (any command-line input)

Configuring TACACS+ Server Accounting

To configure TACACS+ server accounting, include the **server** statement at the [edit system accounting destination tacplus] hierarchy level:


```
[edit system accounting destination tacplus]
server {
  server-address {
    port port-number;
    secret password;
    single-connection;
    timeout seconds;
  }
}
```

server-address specifies the address of the TACACS+ server. To configure multiple TACACS+ servers, include multiple **server** statements.



NOTE: If no TACACS+ servers are configured at the [edit system accounting destination tacplus] statement hierarchy level, the JUNOS Software uses the TACACS+ servers configured at the [edit system tacplus-server] hierarchy level.

port-number specifies the TACACS+ server port number.

You must specify a secret (password) that the local router passes to the TACACS+ client by including the **secret** statement. If the password contains spaces, enclose the entire password in quotation marks (" "). The password used by the local router must match that used by the server.

Optionally, you can specify the length of time that the local router waits to receive a response from a TACACS+ server by including the **timeout** statement. By default, the router waits 3 seconds. You can configure this to be a value in the range from 1 through 90 seconds.

Optionally, you can maintain one open TCP connection to the server for multiple requests, rather than opening a connection for each connection attempt, by including the **single-connection** statement.

To ensure that start and stop requests for accounting of login events are correctly logged in the Accounting file instead of the Administration log file on a TACACS+ server, include either the **no-cmd-attribute-value** statement or the **exclude-cmd-attribute** at the [edit system tacplus-options] hierarchy level.

If you use the **no-cmd-attribute-value** statement, the value of the **cmd** attribute is set to a null string in the start and stop requests. If you use the **exclude-cmd-attribute** statement, the **cmd** attribute is totally excluded from the start and stop requests. Both statements support the correct logging of accounting requests in the Accounting file, instead of the Administration file.

```
[edit system tacplus-options]
(no-cmd-attribute-value | exclude-cmd-attribute);
```

Configuring TACACS+ Accounting on a TX Matrix Router

On a TX Matrix router, TACACS+ accounting should be configured only under the groups **re0** and **re1**.



NOTE: Accounting should *not* be configured at the [edit system] hierarchy; on a TX Matrix router, control is done under the switch-card chassis only.

Configuring the JUNOS Software to Work with SRC Software

You can enable JUNOS Software to work with the Session and Resource Control (SRC) software. The SRC software supports dynamic service activation engine (SAE) functionality on JUNOS routers. To do this, include the following statements at the [edit system services service-deployment] hierarchy level:

```
[edit system services service-deployment]
servers server-address {
  port port-number;
}
source-address source-address;
```

server-address is the IPv4 address of the SRC server.

By default, *port-number* is set to 3333 and is a TCP port number.

source-address is optional, and is the local IP version 4 (IPv4) address to be used as the source address for traffic to the SRC server.



NOTE: By default, when a connection between SRC and a Juniper Networks router is established, the SRC process (sdxd) starts a JUNOScript session as **user root**. Beginning with JUNOS Release 7.6, you have the option of configuring **user sdxd** with a different classification at the [edit system login] hierarchy level.

For more information about SRC software, see the SRC documentation set.

Configuring the JUNOS Software ICMPv4 Rate Limit for ICMPv4 Routing Engine Messages

To limit the rate at which ICMPv4 messages can be generated by the Routing Engine and sent to the Routing Engine, include the **icmpv4-rate-limit** statement at the [edit system internet-options] hierarchy level:

```
icmpv4-rate-limit {
  bucket-size bucket-size;
  packet-rate packet-rate;
}
```

The bucket size is the number of seconds in the rate-limiting bucket. The packet rate is the packets earned per second. Specify a **bucket-size** from 0 through 4294967295 seconds. The default value is 5 seconds. Specify a **packet-rate** from 0 through 4,294,967,295. The default value is 1000.

Configuring the JUNOS Software ICMPv6 Rate Limit for ICMPv6 Routing Engine Messages

To limit the rate at which ICMPv6 messages are sent, include the `icmpv6-rate-limit` statement at the `[edit system internet-options]` hierarchy level:

```
icmpv6-rate-limit {
    bucket-size bucket-size;
    packet-rate packet-rate;
}
```

The bucket size is the the number of seconds in the rate-limiting bucket. The packet rate is the packets earned per second. Specify a `bucket-size` from 0 through 4294967295 seconds. The default value is 5 seconds. Specify a `packet-rate` from 0 through 4294967295. The default value is 1000.

Configuring the JUNOS Software for IP-IP Path MTU Discovery on IP-IP Tunnel Connections

By default, path maximum transmission unit (MTU) discovery on outgoing IP-IP tunnel connections is enabled. To enable IP-IP path MTU discovery, include the `ipip-path-mtu-discovery` statement at the `[edit system internet-options]` hierarchy level:

To disable IP-IP path MTU discovery, include the `no-ipip-path-mtu-discovery` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
no-ipip-path-mtu-discovery;
```

To reenable IP-IP path MTU discovery, include the `ipip-path-mtu-discovery` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
ipip-path-mtu-discovery;
```

- Related Topics**
- Configuring the JUNOS Software for IPv6 Path MTU Discovery on page 235
 - Configuring the JUNOS Software for Path MTU Discovery on Outgoing GRE Tunnel Connections on page 236
 - Configuring the JUNOS Software for Path MTU Discovery on Outgoing TCP Connections on page 236

Configuring TCP MSS for Session Negotiation

During session connection establishment, two peers agree in negotiations to determine the IP segment size of packets that they will exchange during their communication. The TCP MSS (maximum segment size) value in TCP SYN packets specifies the maximum number of bytes that a TCP packet's data field, or segment, can contain. An MSS value that is set too high could result in an IP datagram that is too large to

send and that must be fragmented. Fragmentation can incur additional overhead cost and packet loss.

To diminish the likelihood of fragmentation and to protect against packet loss, you can use the **tcp-mss** statement to specify a lower TCP MSS value. The **tcp-mss** statement applies to all IPv4 TCP SYN packets traversing all the router's ingress interfaces whose MSS value is higher than the one you specify. You cannot exempt particular ports from its effects.

The following sections describe how to configure TCP MSS on T Series and M Series routers and J Series Services Routers, respectively:

1. Configuring TCP MSS on T Series and M Series Routers on page 234
2. Configuring TCP MSS on J Series Services Routers on page 234

Configuring TCP MSS on T Series and M Series Routers

To specify a TCP MSS value on T Series and M Series routers, include the **tcp-mss** statement at the **[edit services service-set service-set-name]** hierarchy level:

```
[edit services service-set service-set-name]
tcp-mss mss-value;
interface-service {
    service-interface sp-fpc/pic/port;
}
```

The range of the **tcp-mss mss-value** parameter is from 536 through 65535.

To view statistics of SYN packets received and SYN packets whose MSS value is modified, issue the **show services service-sets statistics tcp-mss** operational mode command.

For further information about configuring TCP MSS on T Series and M Series routers, see the *JUNOS Services Interfaces Configuration Guide*.

Configuring TCP MSS on J Series Services Routers

To specify a TCP MSS value on a J Series Services Router, include the following statement at the **[edit system internet-options]** hierarchy level:

```
[edit system internet-options]
tcp-mss {
    mss-value;
}
```

The range of the **mss-value** parameter is from 64 through 65535.

To remove the TCP MSS specification, use the following command:

```
delete system internet-options tcp-mss
```

For more information about configuring TCP MSS and session negotiation on J Series Services Routers, see the *J-series Services Router Basic LAN and WAN Access Configuration Guide*.

Configuring the JUNOS Software for IPv6 Path MTU Discovery

By default, path MTU (PMTU) discovery for IPv6 packets is enabled. To disable IPv6 PMTU discovery, include the `no-ipv6-path-mtu-discovery` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
no-ipv6-path-mtu-discovery;
```

To configure IPv6 PMTU discovery timeout in minutes, include the `ipv6-path-mtu-discovery-timeout` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
ipv6-path-mtu-discovery-timeout minutes;
```

For details about IPv6 PMTU, see RFC 1981, *Path MTU Discovery for IP version 6*.

- Related Topics**
- Configuring the JUNOS Software for IP-IP Path MTU Discovery on IP-IP Tunnel Connections on page 233
 - Configuring the JUNOS Software for Path MTU Discovery on Outgoing GRE Tunnel Connections on page 236
 - Configuring the JUNOS Software for Path MTU Discovery on Outgoing TCP Connections on page 236

Configuring the JUNOS Software for IPv6 Duplicate Address Detection Attempts

The `ipv6-duplicate-addr-detection-transmits` statement at the `[edit system internet-options]` hierarchy level controls the number of attempts for IPv6 duplicate address detection. The default value is 3.

Configuring the JUNOS Software for Acceptance of IPv6 Packets with a Zero Hop Limit

The `ipv6-reject-zero-hop-limit` and `no-ipv6-reject-zero-hop-limit` statements are used to enable and disable rejection of incoming IPv6 packets that have a zero hop limit value in their header.

By default, such packets are rejected both when they are addressed to the local host and when they are transiting the router. To accept zero hop-limit packets addressed to the local host, include the `no-ipv6-reject-zero-hop-limit` statement at the `[edit system internet-options]` hierarchy level. Transit packets are still dropped.

```
[edit system internet-options]
no-ipv6-reject-zero-hop-limit;
```

Configuring the JUNOS Software for Path MTU Discovery on Outgoing GRE Tunnel Connections

By default, path MTU discovery on outgoing GRE tunnel connections is enabled. To disable GRE path MTU discovery, include the `no-gre-path-mtu-discovery` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
no-gre-path-mtu-discovery;
```

To reenable GRE path MTU discovery, include the `gre-path-mtu-discovery` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
gre-path-mtu-discovery;
```

Configuring the JUNOS Software for Path MTU Discovery on Outgoing TCP Connections

By default, path MTU discovery on outgoing TCP connections is disabled. To enable path MTU discovery, include the `path-mtu-discovery` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
path-mtu-discovery;
```

To disable path MTU discovery on outgoing TCP connections, include the `no-path-mtu-discovery` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
no-path-mtu-discovery;
```

Configuring the JUNOS Software to Ignore ICMP Source Quench Messages

By default, Internet Control Message Protocol (ICMP) source quench is disabled. You enable `source quench` when you want the JUNOS Software to ignore ICMP source quench messages. To do this, include the `source-quench` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
source-quench;
```

To disable ICMP source quench, include the `no-source-quench` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
no-source-quench;
```

Configuring the JUNOS Software to Enable the Router to Drop Packets with the SYN and FIN Bits Set

By default, the router accepts packets that have both the SYN and FIN bits set in the TCP flag. You can configure the router to drop packets with both the SYN and FIN bits set. Accepting packets with the SYN and FIN bits set can result in security vulnerabilities, such as denial-of-service attacks. To configure the router to drop such packets, include the `tcp-drop-synfin-set` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
tcp-drop-synfin-set;
```

Configuring the JUNOS Software to Disable TCP RFC 1323 Extensions

To disable RFC 1323 TCP extensions, include the `no-tcp-rfc1323` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
no-tcp-rfc1323;
```

Configuring the JUNOS Software to Disable the TCP RFC 1323 PAWS Extension

To configure the JUNOS Software to disable Protection Against Wrapped Sequence (PAWS) number extension (described in RFC 1323, *TCP Extensions for High Performance*), include the `no-tcp-rfc1323-paws` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
no-tcp-rfc1323-paws;
```

Configuring the JUNOS Software to Extend the Default Port Address Range

By default, the upper range of a port address is 5000. You can increase the range from which the port number can be selected to decrease the probability that someone can determine your port number.

To configure the JUNOS Software to extend the default port address range, include the `source-port` statement at the `[edit system internet-options]` hierarchy level:

```
[edit system internet-options]
source-port upper-limit upper-limit;
```

`upper-limit upper-limit` is the upper limit of a source port address and can be a value from 5000 through 65,355.

Configuring the JUNOS Software ARP Learning and Aging Options for Mapping IPv4 Network Addresses to MAC Addresses

The Address Resolution Protocol (ARP) is a protocol used by IPv4 to map IP network addresses to MAC addresses. This topic describes how to set passive ARP learning and ARP aging options for routers.

Tasks for configuring ARP learning and aging are:

1. Configuring Passive ARP Learning for Backup VRRP Routers on page 238
2. Adjusting the ARP Aging Timer on page 238

Configuring Passive ARP Learning for Backup VRRP Routers

By default, the backup VRRP router drops ARP requests for the VRRP-IP to VRRP-MAC address translation. The backup router does not learn the ARP (IP-to-MAC address) mappings for the hosts sending the requests. When it detects a failure of the master router and becomes the new master, the backup router must learn all the entries that were present in the ARP cache of the master router. In environments with many directly attached hosts, such as metro Ethernet environments, the number of ARP entries to learn can be high. This can cause a significant transition delay, during which traffic transmitted to some of the hosts might be dropped.

Passive ARP learning enables the ARP cache in the backup router to hold approximately the same contents as the ARP cache in the master router, thus preventing the problem of learning ARP entries in a burst. To enable passive ARP learning, include the `passive-learning` statement at the `[edit system arp]` hierarchy level:

```
[edit system arp]
passive-learning;
```

We recommend setting passive learning on both the backup and master VRRP routers. This prevents the need to intervene manually when the master router becomes the backup router. While a router is operating as the master, the passive learning configuration has no operational impact. The configuration takes effect only when the router is operating as a backup router.

Adjusting the ARP Aging Timer

By default, the ARP aging timer is set at 20 minutes. In environments with many directly attached hosts, such as metro Ethernet environments, increasing the amount of time between ARP updates by configuring the ARP aging timer can improve performance. However, in some scenarios, it might be desirable to lower the ARP aging timer value to prevent the flooding of traffic and improve performance.

In JUNOS Release 9.4 and later, the range of the ARP aging timer is from 1 through 240 minutes.

To configure a system-wide ARP aging timer, include the `aging-timer` statement at the `[edit system arp]` hierarchy level:


```
[edit system arp]
aging-timer minutes;
```

You can also configure the ARP aging timer for each logical interface of family type `inet`. To configure the ARP aging timer at the logical interface level, specify the timer value in minutes at the

[edit system arp aging-timer interface *interface-name*] hierarchy level:

```
[edit system arp aging-timer interface interface-name]
aging-timer aging-timer-minutes;
```



NOTE: If the aging timer value is configured both at the system and the logical interface levels, the value configured at the logical interface level takes precedence for the specific logical interface.

The timer value you configure takes effect as ARP entries expire. Each refreshed ARP entry receives the new timer value. The new timer value does not apply to ARP entries that exist at the time you commit the configuration.

Using JUNOS Software to Configure System Alarms to Appear Automatically on J Series Routers

You can configure J Series routers to execute a `show system alarms` command whenever a user with the login class `admin` logs on to the router. To do so, include the `login-alarms` statement at the [edit system login class admin] hierarchy level:

```
[edit system login class admin]
login-alarms;
```

For more information on the `show system alarms` command, see the *JUNOS System Basics and Services Command Reference*.

System Alarms on J Series Routers

Table 31 on page 239 describes system alarms that may occur on J Series routers. These alarms are preset and cannot be modified.

Table 31: System Alarms on J Series Routers

Alarm Type	Alarm Summary	Remedy
Configuration	This alarm appears if you have not created a rescue configuration for the router. If you inadvertently commit a configuration that denies management access to the router, you must either connect a console to the router or invoke a rescue configuration. Using a rescue configuration is the recommended method. A rescue configuration is one that you know enables management access to the router.	Create the rescue configuration.

Table 31: System Alarms on J Series Routers *(continued)*

Alarm Type	Alarm Summary	Remedy
License	This alarm appears if you have configured at least one software feature that requires a feature license, but no valid license for the feature is currently installed.	Install a valid license key.

Chapter 11

Security Configuration Example

This chapter covers the following topics:

- Example: Configuring a Router Name and Domain Name on page 241
- Example: Configuring RADIUS Authentication on page 241
- Example: Creating Login Classes on page 242
- Example: Defining User Login Accounts on page 243
- Example: Defining RADIUS Template Accounts on page 243
- Example: Enabling SSH Connection Services on page 244
- Example: Configuring System Logging on page 244
- Example: Configuring NTP as a Single Time Source for Router Clock Synchronization on page 245
- Example: Configuring ATM, SONET, Loopback, and Out-of-band Management Interfaces on page 245
- Example: Configuring SNMPv3 on page 247
- Examples: Configuring Protocol-Independent Routing Properties on page 250
- Example: Configuring the BGP and IS-IS Routing Protocols on page 251
- Configuring Firewall Policies and Filters on page 253
- Example: Consolidated Security Configuration on page 258

Example: Configuring a Router Name and Domain Name

The following example shows how to configure the router's name and domain name:

```
[edit]
system {
    host-name Secure-Router;
    domain-name company.com;
    default-address-selection;
}
```

Example: Configuring RADIUS Authentication

The JUNOS Software supports two protocols for central authentication of users on multiple routers: Remote Authentication Dial-In User Service (RADIUS) and Terminal Access Controller Access Control System Plus (TACACS+). We recommend RADIUS

because it is a multivendor IETF standard, and its features are more widely accepted than those of TACACS+ or other proprietary systems. In addition, we recommend using a one-time-password system for increased security, and all vendors of these systems support RADIUS.

In the JUNOS model for centralized RADIUS authentication, you create one or more template accounts on the router, and the users' access to the router is configured to use the template account. In this configuration, if the RADIUS server is not reachable, the fallback authentication mechanism is through the local account set up on the router.

The following example shows how to configure RADIUS authentication:

```
[edit]
system {
  authentication-order [ radius password ];
  root-authentication {
    encrypted-password "$9$aH1j8gqQ1gjjghgjiiii"; # SECRET-DATA
  }
  name-server {
    10.1.1.1;
    10.1.1.2;
  }
}
```

The following example shows how to enable RADIUS authentication and define the shared secret between the client and the server. This enables the client and server to know that they are talking to the trusted peer.

Define a timeout value for each server so if there is no response within the specified number of seconds, the router can try either the next server or the next authentication mechanism.

```
[edit]
system {
  radius-server {
    10.1.2.1 {
      secret "$9$aH1j8gqQ1sdjerrhser"; # SECRET-DATA
      timeout 5;
    }
    10.1.2.2 {
      secret "$9$aH1j8gqQ1csdoiuardwefoiud"; # SECRET-DATA
      timeout 5;
    }
  }
}
```

Example: Creating Login Classes

The following example shows how to create several user classes, each with specific privileges. In this example, you configure timeouts to disconnect the class members after a period of inactivity. Users' privilege levels, and therefore the classes of which they are members, should be dependent on their responsibilities within the organization, and the permissions shown here are only examples.

The first class of users (called “observation”) can only view statistics and configuration. They are not allowed to modify any configuration. The second class of users (called “operation”) can view and modify the configuration. The third class of users (called “engineering”) has unlimited access and control.

```
[edit]
system {
  login {
    class observation {
      idle-timeout 5;
      permissions [ view ];
    }
    class operation {
      idle-timeout 5;
      permissions [ admin clear configure interface interface-control network
        reset routing routing-control snmp snmp-control trace-control
        firewall-control rollback ];
    }
    class engineering {
      idle-timeout 5;
      permissions all;
    }
  }
}
```

Example: Defining User Login Accounts

The following example shows how to define the local superuser account. If RADIUS fails or becomes unreachable, revert to the local accounts on the router.

```
[edit]
system {
  login {
    user admin {
      uid 1000;
      class engineering;
      authentication {
        encrypted-password "<PASSWORD>"; # SECRET-DATA
      }
    }
  }
}
```

Example: Defining RADIUS Template Accounts

The following example shows how to define RADIUS template accounts for different users or groups of users:

```
[edit]
system {
  login {
    user observation {
      uid 1001;
      class observation;
    }
  }
}
```

```

    }
    user operation {
        uid 1002;
        class operation;
    }
    user engineering {
        uid 1003;
        class engineering;
    }
}

```

Example: Enabling SSH Connection Services

The following example shows how to enable connection services on the router. SSH provides secure encrypted communications over an insecure network and is therefore useful for inband router management. Like all other types of network-based access, however, SSH access to the router is disabled by default in the JUNOS Software. The following configuration enables SSH access and sets optional parameters that can be used to control the number of concurrent SSH sessions and the maximum number of SSH sessions that can be established in one minute. The **rate-limit** option can be useful in protecting against SYN flood denial-of-service (DoS) attacks on the SSH port.

```

[edit]
system {
    services {
        ssh connection-limit 10 rate-limit 4;
    }
}

```

Example: Configuring System Logging

The system log file records when authentication and authorization is granted and rejected, and what user commands are executed. It provides an excellent way to track all management activity on the router. Checking these files for failed authentication events can help identify attempts to hack into the router. These files can also provide logs of all the command executed on the router and who has performed them. You can review logs of the commands executed on the router and correlate any event in the network with changes made at a particular time. These files are stored locally on the router. Place the firewall logs in a separate system log file.

The following example shows how to configure a system log file:

```

[edit]
system {
    syslog {
        file messages {
            any notice;
            authorization info;
            daemon any;
            kernel any;
            archive size 10m files 5 no-world-readable;
        }
    }
}

```

```

    }
    file authorization-commands {
        authorization any;
        interactive-commands any;
    }
    file firewall-logs {
        firewall any;
    }
}

```

Example: Configuring NTP as a Single Time Source for Router Clock Synchronization

Debugging and troubleshooting are much easier when the timestamps in the log files of all routers are synchronized, because events that span the network can be correlated with synchronous entries in multiple logs. We strongly recommend using the Network Time Protocol (NTP) to synchronize the system clocks of routers and other network equipment.

By default, NTP operates in an entirely unauthenticated manner. If a malicious attempt to influence the accuracy of a router's clock succeeds, it could have negative effects on system logging, make troubleshooting and intrusion detection more difficult, and impede other management functions.

The following sample configuration synchronizes all the routers in the network to a single time source. We recommend using authentication to make sure that the NTP peer is trusted. The **boot-server** statement identifies the server from which the initial time of day and date is obtained when the router boots. The **server** statement identifies the NTP server used for periodic time synchronization. The **authentication-key** statement specifies that an HMAC-Message Digest 5 (MD5) scheme should be used to hash the key value for authentication, which prevents the router from synchronizing with an attacker's host posing as the time server.

```

[edit]
system {
    ntp {
        authentication-key 2 type md5 value "$9$aH1j8gqQ1gvyjghgjiiii"; # SECRET-DATA
        boot-server 10.1.4.1;
        server 10.1.4.2;
    }
}

```

Example: Configuring ATM, SONET, Loopback, and Out-of-band Management Interfaces

The following example shows how to configure the interfaces on your router. It covers configurations for Asynchronous Transfer Mode (ATM), SONET, loopback, and out-of-band management interfaces.

The following example shows how to configure an ATM interface:

```

[edit]
interfaces {

```

```

at-4/0/0 {
  description core-router;
  atm-options {
    vpi 0 maximum-vc 1024;
    ilmi;
  }
  unit 131 {
    description to-other-core-router;
    encapsulation atm-snap;
    point-to-point;
    vci 0.131;
    family inet {
      address 12.1.1.1/30;
    }
    family iso;
  }
}

```

The **fxp0** interface can be used for out-of-band management. However, because most service providers use inband communication for management (because of lower operating costs), you can disable this interface to make the router more secure.

The following example shows how to configure an **fxp0** interface as a loopback interface:

```

[edit]
interfaces {
  fxp0 {
    disable;
  }
}

```

The following example shows how to configure the loopback interface and apply a firewall filter to protect the Routing Engine. This filter, which you define at the **[edit firewall]** hierarchy level, checks all traffic destined for the Routing Engine that enters the router from the customer interfaces. Adding or modifying filters for every interface on the router is not necessary.

```

[edit]
interfaces {
  lo0 {
    unit 0 {
      family inet {
        filter {
          input protect-routing-engine;
        }
        address 10.10.5.1/32;
      }
      family iso {
        address 48.0005.80dd.f900.0000.0001.0001.0000.0000.011.00;
      }
    }
  }
}

```


The following example shows how to configure a SONET interface.

```
[edit]
interfaces {
  so-2/0/0 {
    description To-other-router;
    clocking external;
    sonet-options {
      fcs 32;
      payload-scrambler;
    }
    unit 0 {
      family inet {
        address 10.1.5.1/30;
      }
      family iso;
    }
  }
}
```

Example: Configuring SNMPv3

The following example shows how to configure Simple Network Management Protocol version 3 (SNMPv3) on a router running JUNOS Software:

```
[edit snmp]
engine-id {
  use-fxp0-mac-address;
}
view jnxAlarms {
  oid 1.3.6.1.4.1.2636.3.4 include;
}
view interfaces {
  oid 1.3.6.1.2.1.2 include;
}
view ping-mib {
  oid 1.3.6.1.2.1.80 include;
}
[edit snmp v3]
notify n1 {
  tag router1; # Identifies a set of target addresses
  type trap; # Defines type of notification
}
notify n2 {
  tag host1;
  type trap;
}
notify-filter nf1 {
  oid .1 include; # Defines which traps (or which objects for which traps) are sent. In
  this case, includes all traps
}
notify-filter nf2 {
  oid 1.3.6.1.4.1 include; # Sends enterprise-specific traps only
}
notify-filter nf3 {
```

```

oid 1.3.6.1.2.1.1.5 include; # Sends BGP traps only
}
snmp-community index1 {
  community-name "$9$JOzi.QF/AtOz3"; # SECRET-DATA
  security-name john; # Matches the security name at the target-parameters
  tag host1; # Finds the addresses that can be used with this community string
}
target-address ta1 { # Associates the target address with the group san-francisco
  address 10.1.1.1;
  address-mask 255.255.255.0; # Defines the range of addresses
  port 162;
  tag-list router1;
  target-parameters tp1; # Applies configured target parameters
target-address ta2 {
  address 10.1.1.2;
  address-mask 255.255.255.0;
  port 162;
  tag-list host1;
  target-parameters tp2;
}
target-address ta3 {
  address 10.1.1.3;
  address-mask 255.255.255.0;
  port 162;
  tag-list [router1 host1];
  target-parameters tp3;
}
target-parameters tp1 { # Defines the target parameters
  notify-filter nf1; # Specifies which notify filter to apply
  parameters {
    message-processing-model v1;
    security-model v1;
    security-level none;
    security-name john; # Matches the security name configured at the [edit snmp v3
                        snmp-community community-index] hierarchy level
  }
}
target-parameters tp2 {
  notify-filter nf2;
  parameters {
    message-processing-model v1;
    security-model v1;
    security-level none;
    security-name john;
  }
}
target-parameters tp3 {
  notify-filter nf3;
  parameters {
    message-processing-model v1;
    security-model v1;
    security-level none;
    security-name john;
  }
}
usm {

```

```

local-engine { # Defines authentication and encryption for
user user1 { # SNMPv3 users
authentication-md5 {
    authentication-password authentication-password;
}
privacy-des {
    privacy-password password;
}
}
user user2 {
    authentication-sha {
        authentication-password authentication-password;
    }
    privacy-none;
}
user user3 {
    authentication-none;
    privacy-none;
}
user user4 {
    authentication-md5 {
        authentication-password authentication-password;
    }
    privacy-3des {
        privacy-password password;
    }
}
user user5 {
    authentication-sha {
        authentication-password authentication-password;
    }
    privacy-aes128 {
        privacy-password password;
    }
}
vacm {
    access {
        group san-francisco {# Defines the access privileges for the group
default-context-prefix { # san-francisco
security-model v1 {
    security-level none {
        notify-view ping-mib;
        read-view interfaces;
        write-view jnxAlarms;
    }
}
}
}
}
security-to-group {
    security-model v1 {
        security-name john {# Assigns john to the security group san-francisco
group san-francisco;
    }
    security-name bob {
        group new-york;
    }
}

```

```

security-name elizabeth {
    group chicago;
}

```

Examples: Configuring Protocol-Independent Routing Properties

This section covers the following topics:

- Example: Configuring the Router ID and Autonomous System Number for BGP on page 250
- Example: Configuring Martian Addresses on page 250
- Example: Viewing Reserved IRI IP Addresses on page 251

Example: Configuring the Router ID and Autonomous System Number for BGP

The following example shows how to configure a router ID and autonomous system (AS) number for the Border Gateway Protocol (BGP):

```

[edit]
routing-options {
    router-id 10.1.7.1;
    autonomous-system 222;
}

```

Example: Configuring Martian Addresses

The following example shows how to configure martian addresses, which are reserved host or network addresses about which all routing information should be ignored. By default, the JUNOS Software blocks the following martian addresses: 0.0.0.0/8, 127.0.0.0/8, 128.0.0.0/16, 191.255.0.0/16, 192.0.0.0/24, 223.255.55.0/24, and 240.0.0.0/4. It is also a good idea to block private address space (addresses defined in RFC 1918). You can add these addresses and other martian addresses to the default martian addresses.

```

[edit]
routing-options {
    martians {
        1.0.0.0/8 exact;
        10.0.0.0/8 exact;
        19.255.0.0/16 exact;
        59.0.0.0/8 exact;
        129.156.0.0/16 exact;
        172.16.0.0/12 exact;
        192.0.2.0/24 exact;
        192.5.0.0/24 exact;
        192.9.200.0/24 exact;
        192.9.99.0/24 exact;
        192.168.0.0/16 exact;
        224.0.0.0/3 exact;
    }
}

```

Example: Viewing Reserved IRI IP Addresses

A number of interception related information (IRI) IP addresses, such as 128.0.0.1, are reserved for internal communication. 128.0.0.1 is the base of the IRI IP address. The upper limit of this range depends on the chassis configuration of the router and may use 129.x.x.x, 130.x.x.x, and so on.

The following example shows how to use the CLI command `show route table __juniper_private1__` to view the router's configured IP addresses, including the reserved IRI IP addresses.

```
user@host> show route table __juniper_private1__
__juniper_private1__.inet.0: 8 destinations, 8 routes (5 active, 0 holddown, 3
hidden)
+ = Active Route, - = Last Active, * = Both

10.0.0.0/8          *[Direct/0] 7w1d 03:24:45
                    > via fxp1.0
10.0.0.1/32         *[Local/0] 7w1d 03:22:48
                    Local via sp-1/2/0.16383
10.0.0.4/32         *[Local/0] 7w1d 03:24:45
                    Local via fxp1.0
10.0.0.34/32        *[Direct/0] 7w1d 03:22:32
                    > via sp-1/2/0.16383
128.0.0.0/2         *[Direct/0] 7w1d 03:24:45
                    > via fxp1.0

__juniper_private1__.inet6.0: 4 destinations, 4 routes (4 active, 0 holddown, 0
hidden)
+ = Active Route, - = Last Active, * = Both

fe80::/64           *[Direct/0] 7w1d 03:24:45
                    > via fxp1.0
fe80::200:ff:fe00:4/128
                    *[Local/0] 7w1d 03:24:45
                    Local via fxp1.0
fec0::/64           *[Direct/0] 7w1d 03:24:45
                    > via fxp1.0
fec0::a:0:0:4/128   *[Local/0] 7w1d 03:24:45
                    Local via fxp1.0
```

Example: Configuring the BGP and IS-IS Routing Protocols

The main task of a router is to use its routing and forwarding tables to forward user traffic to its intended destination. Attackers can send forged routing protocol packets to a router with the intent of changing or corrupting the contents of its routing table or other databases, which in turn can degrade the functionality of the router and the network. To prevent such attacks, routers must ensure that they form routing protocol relationships (peering or neighboring relationships) to trusted peers. One way of doing this is by authenticating routing protocol messages. We strongly recommend using authentication when configuring routing protocols. The JUNOS Software supports HMAC-MD5 authentication for BGP, Intermediate System-to-Intermediate System (IS-IS), Open Shortest Path First (OSPF), Routing Information Protocol (RIP), and Resource Reservation Protocol (RSVP). HMAC-MD5 uses a secret key that is combined

with the data being transmitted to compute a hash. The computed hash is transmitted along with the data. The receiver uses the matching key to recompute and validate the message hash. If an attacker has forged or modified the message, the hash will not match and the data will be discarded.

In the following examples, we configure BGP as the exterior gateway protocol (EGP) and IS-IS as the interior gateway protocol (IGP). If you use OSPF, configure it similarly to the IS-IS configuration shown.

Configuring BGP

The following example shows the configuration of a single authentication key for the BGP peer group internal peers. You can also configure BGP authentication at the neighbor or routing instance levels, or for all BGP sessions. As with any security configuration, there is a tradeoff between the degree of granularity (and to some extent the degree of security) and the amount of management necessary to maintain the system. This example also configures a number of tracing options for routing protocol events and errors, which can be good indicators of attacks against routing protocols. These events include protocol authentication failures, which might point to an attacker that is sending spoofed or otherwise malformed routing packets to the router in an attempt to elicit a particular behavior.

```
[edit]
protocols {
  bgp {
    group ibgp {
      type internal;
      traceoptions {
        file bgp-trace size 1m files 10;
        flag state;
        flag general;
      }
      local-address 10.10.5.1;
      log-updown;
      neighbor 10.2.1.1;
      authentication-key "$9$aH1j8gqQ1gvygjhggiiii";
    }
    group ebgp {
      type external;
      traceoptions {
        file ebgp-trace size 10m files 10;
        flag state;
        flag general;
      }
      local-address 10.10.5.1;
      log-updown;
      peer-as 2;
      neighbor 10.2.1.2;
      authentication-key "$9$aH1j8gqQ1gvygjhggiiii";
    }
  }
}
```

Configuring IS-IS

Although all JUNOS IGP's support authentication, some are inherently more secure than others. Most service providers use OSPF or IS-IS to allow fast internal convergence and scalability and to use traffic engineering capabilities with Multiprotocol Label Switching (MPLS). Because IS-IS does not operate at the network layer, it is more difficult to spoof than OSPF, which is encapsulated in IP and is therefore subject to remote spoofing and DoS attacks.

The following example also shows how to configure a number of tracing options for routing protocol events and errors, which can be good indicators of attacks against routing protocols. These events include protocol authentication failures, which might point to an attacker that is sending spoofed or otherwise malformed routing packets to the router in an attempt to elicit a particular behavior.

```
[edit]
protocols {
  isis {
    authentication-key "$9$aH1j8gqQ1gyjgjhgiiii"; # SECRET-DATA
    authentication-type md5;
    traceoptions {
      file isis-trace size 10m files 10;
      flag normal;
      flag error;
    }
    interface at-0/0/0.131 {
      lsp-interval 50;
      level 2 disable;
      level 1 {
        metric 3;
        hello-interval 5;
        hold-time 60;
      }
    }
    interface lo0.0 {
      passive;
    }
  }
}
```

Configuring Firewall Policies and Filters

- Example: Configuring Firewall Filters on page 254
- Example: Configuring Firewall Policies on page 257

Example: Configuring Firewall Filters

The following example shows how to configure a firewall filter to protect the Routing Engine. To protect the Routing Engine, it is important to constrain the traffic load from each of the allowed services. Rate-limiting control traffic helps protect the Routing Engine from attack packets that are forged such that they appear to be legitimate traffic and are then sent at such a high rate as to cause a DoS attack.

Routing and control traffic are essential to proper functioning of the router, and rapid convergence of routing protocols is crucial for stabilizing the network during times of network instability. While it might seem desirable to limit the amount of routing protocol traffic to protect against various types of attacks, it is very difficult to determine a fixed maximum rate for protocol traffic, because it depends upon the number of peers and adjacencies, which varies over time. Therefore, it is best not to rate-limit routing protocol traffic.

By contrast, because management traffic is less essential and more deterministic than routing protocol traffic, it can be policed to a fixed rate, to prevent it from consuming resources necessary for less flexible traffic. We recommend allocating a fixed amount of bandwidth to each type of management traffic so that an attacker cannot consume all the router's CPU if an attack is launched using any single service.

```
[edit]
firewall {
  filter protect-routing-engine {
    policer ssh-policer {
      if-exceeding {
        bandwidth-limit 1m;
        burst-size-limit 15k;
      }
      then discard;
    }
    policer small-bandwidth-policer {
      if-exceeding {
        bandwidth-limit 1m;
        burst-size-limit 15k;
      }
      then discard;
    }
    policer snmp-policer {
      if-exceeding {
        bandwidth-limit 1m;
        burst-size-limit 15k;
      }
      then discard;
    }
    policer ntp-policer {
      if-exceeding {
        bandwidth-limit 1m;
        burst-size-limit 15k;
      }
      then discard;
    }
    policer dns-policer {
```



```

    if-exceeding {
        bandwidth-limit 1m;
        burst-size-limit 15k;
    }
    then discard;
}
policer radius-policer {
    if-exceeding {
        bandwidth-limit 1m;
        burst-size-limit 15k;
    }
    then discard;
}
policer tcp-policer {
    if-exceeding {
        bandwidth-limit 500k;
        burst-size-limit 15k;
    }
    then discard;
}
/* The following terms accept traffic only from the trusted sources. The trusted
   traffic is rate-limited with the exception of the routing protocols. */
/* The following term protects against ICMP flooding attacks against the Routing
   Engine. */
term icmp {
    from {
        protocol icmp;
        icmp-type [ echo-request echo-reply unreachable time-exceeded ];
    }
    then {
        policer small-bandwidth-policer;
        accept;
    }
}
term tcp-connection {
    from {
        source-prefix-list {
            ssh-addresses;
            bgp-addresses;
        }
        protocol tcp;
        tcp-flags "(syn & !ack) | fin | rst";
    }
    then {
        policer tcp-policer;
        accept;
    }
}
/* The following term protects SSH traffic destined for the Routing Engine. */
term ssh {
    from {
        source-prefix-list {
            ssh-addresses;
        }
        protocol tcp;
        port [ ssh telnet ];
    }
}

```

```

    }
    policer ssh-policer;
    then accept;
}
/* The following term protects BGP traffic destined for the Routing Engine. */
term bgp {
  from {
    source-prefix-list {
      bgp-addresses;
    }
    protocol tcp;
    port bgp;
  }
  then accept;
}
term snmp {
  from {
    source-prefix-list {
      snmp-addresses;
    }
    protocol udp;
    port snmp;
  }
  then {
    policer snmp-policer;
    accept;
  }
}
term ntp {
  from {
    source-prefix-list {
      ntp-addresses;
    }
    protocol udp;
    port ntp;
  }
  then {
    policer ntp-policer;
    accept;
  }
}
term dns {
  from {
    source-address {
      dns-addresses;
    }
    protocol udp;
    port domain;
  }
  then {
    policer dns-policer;
    accept;
  }
}
term radius {
  from {

```



```

    prefix-list dns-address {
        10.1.1.0/24;
    }
    prefix-list radius-address {
        10.1.2.0/24;
    }
}

```

Example: Consolidated Security Configuration

This topic provides a complete example of configuring various security features available in the JUNOS Software to secure your router:

Configuring Basic System Information	<pre> system { host-name Secure-Router; domain-name company.com; default-address-selection; } </pre>
Configuring RADIUS Authentication	<pre> authentication-order [radius password]; root-authentication { encrypted-password "\$9\$aH1j8gqQ1gijghgijgiiii"; # SECRET-DATA } name-server { 10.1.1.1; 10.1.1.2; } radius-server { 10.1.2.1 { secret "\$9\$aH1j8gqQ1sdjerrhser"; # SECRET-DATA timeout 5; } 10.1.2.2 { secret "\$9\$aH1j8gqQ1csdoiuardwefoiud"; # SECRET-DATA timeout 5; } } </pre>
Configuring Login Classes	<pre> login { class observation { idle-timeout 5; permissions [view]; } class operation { idle-timeout 5; permissions [admin clear configure interface interface-control network reset routing routing-control snmp snmp-control trace-control firewall-control rollback]; } class engineering { idle-timeout 5; permissions all; } } </pre>

Configuring User Login Accounts	<pre> user admin { uid 1000; class engineering; authentication { encrypted-password "<PASSWORD>"; # SECRET-DATA } } </pre>
Configuring RADIUS Template Accounts	<pre> user observation { uid 1001; class observation; } user operation { uid 1002; class operation; } user engineering { uid 1003; class engineering; } </pre>
Configuring SSH Connection Services	<pre> services { ssh connection-limit 10 rate-limit 4; } </pre>
Configuring System Logging	<pre> syslog { file messages { any notice; authorization info; daemon any; kernel any; archive size 10m files 5 no-world-readable; } file authorization-commands { authorization any; interactive-commands any; } file firewall-logs { firewall any; } } </pre>
Configuring the Time Source	<pre> ntp { authentication-key 2 type md5 value "\$9\$aH1j8gqQ1g1gyjghgigiinii"; \ # SECRET-DATA boot-server 10.1.4.1; server 10.1.4.2; } </pre>
Configuring Interfaces	<pre> interfaces { at-4/0/0 { description core router; atm-options { vpi 0 maximum-vcs 1024; } } } </pre>

```

        ilmi;
    }
    unit 131 {
        description to-other-core-router;
        encapsulation atm-snap;
        point-to-point;
        vci 0.131;
        family inet {
            address 12.1.1.1/30;
        }
        family iso;
    }
}
fxp0 {
    disable;
}
lo0 {
    unit 0 {
        family inet {
            filter {
                input protect-routing-engine;
            }
            address 10.10.5.1/32;
        }
        family iso {
            address 48.0005.80dd.f900.0000.0001.0001.0000.0000.011.00;
        }
    }
}
so-2/0/0 {
    description To-other-router;
    clocking external;
    sonet-options {
        fcs 32;
        payload-scrambler;
    }
    unit 0 {
        family inet {
            address 10.1.5.1/30;
        }
        family iso;
    }
}
}
}

```

Configuring SNMP

```

[edit snmp]
engine-id {
    use-fxp0-mac-address;
}
view jnxAlarms {
    oid .1.3.6.1.4.1.2636.3.4 include;
}
view interfaces {
    oid .1.3.6.1.2.1.2 include;
}

```

```

view ping-mib {
    oid .1.3.6.1.2.1.80 include;
}
[edit snmp v3]
notify n1 {
    tag router1;          # Identifies a set of target addresses
    type trap;            # Defines type of notification
}
notify n2 {
    tag host1;
    type trap;
}
notify-filter nf1 {
    oid 1 include;        # Defines which (or the objects for which) traps
                          # will be sent. In this case, include all traps.
}
notify-filter nf2 {
    oid 1.3.6.1.4.1 include; # Sends enterprise-specific traps only
}
notify-filter nf3 {
    oid 1.3.6.1.2.1.1.5 include; # Sends BGP traps only
}
snmp-community index1 {
    community-name "$9$JOzi.QF/AtOz3"; # SECRET-DATA
    security-name john; # Matches the security name at the target parameters
    tag host1; # Finds the addresses that can be used with this community
    string
}
target-address ta1 { # Associates the target address with the group san-francisco
    address 10.1.1.1;
    address-mask 255.255.255.0; # Defines the range of addresses
    port 162;
    tag-list router1;
    target-parameters tp1; # Applies configured target parameters
}
target-address ta2 {
    address 10.1.1.2;
    address-mask 255.255.255.0;
    port 162;
    tag-list host1;
    target-parameters tp2;
}
target-address ta3 {
    address 10.1.1.3;
    address-mask 255.255.255.0;
    port 162;
    tag-list [router1 host1];
    target-parameters tp3;
}
target-parameters tp1 { # Defines the target parameters
    notify-filter nf1; # Specifies which notify filter to apply
    parameters {
        message-processing-model v1;
        security-model v1;
        security-level none;
        security-name john; # Matches the security name configured at the [edit snmpv3
                             snmp-community community-index] hierarchy level
    }
}

```

```

}
} # hierarchy level
target-parameters tp2 {
  notify-filter nf2;
  parameters {
    message-processing-model v1;
    security-model v1;
    security-level none;
    security-name john;
  }
}
target-parameters tp3 {
  notify-filter nf3;
  parameters {
    message-processing-model v1;
    security-model v1;
    security-level none;
    security-name john;
  }
}
}
usm {
  local-engine {      #Defines authentication and encryption for SNMP3 users.
    user user1 {
      authentication-md5 {
        authentication-password authentication-password;
      }
      privacy-des {
        privacy-password privacy-password;
      }
    }
    user user2 {
      authentication-sha {
        authentication-password authentication-password;
      }
      privacy-none;
    }
    user user3 {
      authentication-none;
      privacy-none;
    }
    user user4 {
      authentication-md5 {
        authentication-password authentication-password;
      }
      privacy-3des {
        privacy-password password;
      }
    }
    user user5 {
      authentication-sha {
        authentication-password authentication-password;
      }
      privacy-aes128 {
        privacy-password password;
      }
    }
  }
}

```



```

}
vacm {
  access {
    group san-francisco {          # Defines the access privileges for the group
      default-context-prefix {    # san-francisco
        security-model v1 {
          security-level none {
            notify-view ping-mib;
            read-view interfaces;
            write-view jnxAlarms;
          }
        }
      }
    }
  }
}
security-to-group {
  security-model v1 {
    security-name john {          # Assigns john to the security group
      group san-francisco;        # san-francisco
    }
    security-name bob {
      group new-york;
    }
    security-name elizabeth {
      group chicago;
    }
  }
}

```

Configuring the Router ID and AS Number for BGP

```

[edit]
  routing-options {
    router-id 10.1.7.1;
    autonomous-system 222;
  }

```

Configuring Martian Addresses

```

[edit]
  routing-options {
    martians {
      1.0.0.0/8 exact;
      10.0.0.0/8 exact;
      19.255.0.0/16 exact;
      59.0.0.0/8 exact;
      129.156.0.0/16 exact;
      172.16.0.0/12 exact;
      192.0.2.0/24 exact;
      192.5.0.0/24 exact;
      192.9.200.0/24 exact;
      192.9.99.0/24 exact;
      192.168.0.0/16 exact;
      224.0.0.0/3 exact;
    }
  }

```

Configuring Routing Protocols

```

  protocols {
  }

```

```

BGP      bgp {
            group ibgp {
                type internal;
                traceoptions {
                    file bgp-trace size 1m files 10;
                    flag state;
                    flag general;
                }
                local-address 10.10.5.1;
                log-updown;
                neighbor 10.2.1.1;
                authentication-key "$9$aH1j8gqQ1gjyjjhgjgiiii";
            }
            group ebgp {
                type external;
                traceoptions {
                    file ebgp-trace size 10m files 10;
                    flag state;
                    flag general;
                }
                local-address 10.10.5.1;
                log-updown;
                peer-as 2;
                neighbor 10.2.1.2;
                authentication-key "$9$aH1j8gqQ1gjyjjhgjgiiii";
            }
        }

```

```

Configuring IS-IS  isis {
                    authentication-key "$9$aH1j8gqQ1gjyjjhgjgiiii"; # SECRET-DATA
                    authentication-type md5;
                    traceoptions {
                        file isis-trace size 10m files 10;
                        flag normal;
                        flag error;
                    }
                    interface at-0/0/0.131 {
                        lsp-interval 50;
                        level 2 disable;
                        level 1 {
                            metric 3;
                            hello-interval 5;
                            hold-time 60;
                        }
                    }
                    interface lo0.0 {
                        passive;
                    }
                }

```

```

Configuring Firewall Policies  policy-options {
                                prefix-list ssh-addresses {
                                    1.1.9.0/24
                                }
                                prefix-list bgp-addresses {

```

```

    10.2.1.0/24;
  }
  prefix-list ntp-addresses {
    10.1.4.0/24
  }
  prefix-list snmp-addresses {
    10.1.6.0/24;
  }
  prefix-list dns-addresses {
    10.1.1.0/24;
  }
  prefix-list radius-addresses {
    10.1.2.0/24;
  }
}

```

Configuring Firewall Filters

```

firewall {
  filter protect-routing-engine {
    term icmp {
      from {
        protocol icmp;
        icmp-type [ echo-request echo-reply unreachable time-exceeded ];
      }
      then {
        policer small-bandwidth-policer;
        accept;
      }
    }
    term tcp-connection {
      from {
        source-prefix-list {
          ssh-addresses;
          bgp-addresses;
        }
        protocol tcp;
        tcp-flags "(syn & !ack) | fin | rst";
      }
      then {
        policer tcp-policer;
        accept;
      }
    }
    term ssh {
      from {
        source-prefix-list {
          ssh-addresses;
        }
        protocol tcp;
        port [ ssh telnet ];
      }
      policer ssh-policer;
      then accept;
    }
    term bgp {
      from {

```

```

        source-prefix-list {
            bgp-addresses;
        }
        protocol tcp;
        port bgp;
    }
    then accept;
}
}
term snmp {
    from {
        source-prefix-list {
            snmp-addresses;
        }
        protocol udp;
        port snmp;
    }
    then {
        policer snmp-policer;
        accept;
    }
}
term ntp {
    from {
        source-prefix-list {
            ntp-addresses;
        }
        protocol udp;
        port ntp;
    }
    then {
        policer ntp-policer;
        accept;
    }
}
term dns {
    from {
        source-address {
            dns-addresses;
        }
        protocol udp;
        port domain;
    }
    then {
        policer dns-policer;
        accept;
    }
}
term radius {
    from {
        source-prefix-list {
            radius-addresses;
        }
        protocol udp;
        port radius;
    }
}

```

```

    then {
        policer radius-policer;
        accept;
    }
}
term trace-route {
    from {
        protocol udp;
        destination-port 33434-33523;
    }
    then {
        policer small-bandwidth-policer;
        accept;
    }
}
term everything-else {
    then {
        syslog;
        log;
        discard;
    }
}
}
policer ssh-policer {
    if-exceeding {
        bandwidth-limit 1m;
        burst-size-limit 15k;
    }
    then discard;
}
policer small-bandwidth-policer {
    if-exceeding {
        bandwidth-limit 1m;
        burst-size-limit 15k;
    }
    then discard;
}
policer snmp-policer {
    if-exceeding {
        bandwidth-limit 1m;
        burst-size-limit 15k;
    }
    then discard;
}
policer ntp-policer {
    if-exceeding {
        bandwidth-limit 1m;
        burst-size-limit 15k;
    }
    then discard;
}
policer dns-policer {
    if-exceeding {
        bandwidth-limit 1m;
        burst-size-limit 15k;
    }
}

```

```
        then discard;
    }
    policer radius-policer {
        if-exceeding {
            bandwidth-limit 1m;
            burst-size-limit 15k;
        }
        then discard;
    }
    policer tcp-policer {
        if-exceeding {
            bandwidth-limit 500k;
            burst-size-limit 15k;
        }
        then discard;
    }
}
```

Chapter 12

Summary of System Management Configuration Statements

The following topics explain each of the system management configuration statements. The statements are organized alphabetically.

accounting

Syntax

```

accounting {
  events [ login change-log interactive-commands ];
  destination {
    radius {
      server {
        server-address {
          accounting-port port-number;
          secret password;
          source-address address;
          retry number;
          timeout seconds;
        }
      }
    }
  }
  tacplus {
    server {
      server-address {
        port port-number;
        secret password;
        single-connection;
        timeout seconds;
      }
    }
  }
}

```

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure audit of TACACS+ or RADIUS authentication events, configuration changes, and interactive commands.

The remaining statements are explained separately.

Usage Guidelines See “Configuring RADIUS System Accounting” on page 227 and “Configuring TACACS+ System Accounting” on page 230.

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

accounting-port

Syntax	<code>accounting-port <i>port-number</i>;</code>
Hierarchy Level	[edit system accounting destination radius server <i>server-address</i>], [edit system radius-server <i>server-address</i>]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Configure the accounting port number on which to contact the RADIUS server.
Options	<i>number</i> —Port number on which to contact the RADIUS server. Default: 1813
Usage Guidelines	See and “Configuring RADIUS Authentication” on page 89 and “Configuring RADIUS System Accounting” on page 227.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

allow-commands

Syntax	<code>allow-commands "<i>regular-expression</i>";</code>
Hierarchy Level	[edit system login class <i>class-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Specify the operational mode commands that members of a login class can use.
Default	If you omit this statement and the <code>deny-commands</code> statement, users can issue only those commands for which they have access privileges through the <code>permissions</code> statement.
Options	<i>regular-expression</i> —Extended (modern) regular expression as defined in POSIX 1003.2. If the regular expression contains any spaces, operators, or wildcard characters, enclose it in quotation marks.
Usage Guidelines	See “Specifying Access Privileges for JUNOS Software Operational Mode Commands” on page 82.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ <code>deny-commands</code> ■ <code>user</code>

allow-configuration

Syntax	allow-configuration " <i>regular-expression</i> ";
Hierarchy Level	[edit system login class <i>class-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Specify the configuration mode commands that members of a login class can use.
Default	If you omit this statement and the deny-configuration statement, users can issue only those commands for which they have access privileges through the permissions statement.
Options	<i>regular-expression</i> —Extended (modern) regular expression as defined in POSIX 1003.2. If the regular expression contains any spaces, operators, or wildcard characters, enclose it in quotation marks.
Usage Guidelines	See “Specifying Access Privileges for JUNOS Software Operational Mode Commands” on page 82.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ deny-commands ■ user

allow-transients

Syntax	allow-transients;
Hierarchy Level	[edit system scripts commit]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	For JUNOS commit scripts, enable transient configuration changes to be committed.
Default	Transient changes are disabled by default. If you do not include the allow-transients statement, and an enabled script generates transient changes, the CLI generates an error message and the commit operation does not succeed.
Usage Guidelines	See the <i>JUNOS Configuration and Diagnostic Automation Guide</i> .
Required Privilege Level	maintenance—To view this statement in the configuration. maintenance-control—To add this statement to the configuration.

announcement

Syntax	announcement text;
Hierarchy Level	[edit system login]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure a system login announcement. This announcement appears after a user logs in.
Options	<i>text</i> —Text of the announcement. If the text contains any spaces, enclose it in quotation marks.
Usage Guidelines	See “Configuring the JUNOS Software to Display a System Login Announcement” on page 221.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration
Related Topics	■ message

archival

Syntax	<pre> archival { configuration { transfer-interval <i>interval</i>; transfer-on-commit; archive-sites { ftp://username:<password>@<host>:<port>/<url-path>; scp://<username>:<password>@<host>:<port>/<url-path>; } } } </pre>
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure copying of the currently active configuration to an archive site. The remaining statements are described separately.
Usage Guidelines	See “Using JUNOS Software to Configure a Router to Transfer Its Configuration to an Archive Site” on page 225.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

archive (All System Log Files)

Syntax	<code>archive size <i>size</i> files <i>number</i> (world-readable no-world-readable);</code>
Hierarchy Level	<code>[edit system syslog]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure archiving of all system log files. The remaining statements are described separately.
Usage Guidelines	See “Specifying Log File Size, Number, and Archiving Properties” on page 141.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

archive (Individual System Log File)

Syntax	<pre>archive { archive-sites { <i>site-name</i> <password <i>password</i>>; } files <i>number</i> size <i>size</i> start-time <i>date.time</i> transfer-interval <i>interval</i> (world-readable no-world-readable); }</pre>
Hierarchy Level	<code>[edit system syslog file <i>filename</i>]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure archiving of specific system log files. The remaining statements are described separately.
Usage Guidelines	See “Specifying Log File Size, Number, and Archiving Properties” on page 141.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

archive-sites (Configuration)

Syntax archive-sites {
 ftp://username@host:<port>url-path password password;
 http://username@host:<port>url-path password password;
 scp://username@host:<port>url-path password password;
 file://<path>/<filename>;
 }

Hierarchy Level [edit system archival configuration]

Release Information Statement introduced before JUNOS Release 7.4.

Description Specify where to transfer the current configuration files. When specifying a URL in a JUNOS statement using an IPv6 host address, you must enclose the entire URL in quotation marks (" ") and enclose the IPv6 host address in brackets ([]). For example, "scp://username<:password>@[ipv6-host-address]<:port>/url-path"

If you specify more than one archive site, the router attempts to transfer the configuration files to the first archive site in the list, moving to the next only if the transfer fails. The format for the destination filename is *router-name_juniper.conf[.gz]_YYYYMMDD_HHMMSS*.



NOTE: The time included in the destination filename is always in Coordinated Universal Time (UTC) regardless of whether the time on the router is configured as UTC or the local time zone. The default time zone on the router is UTC.

Usage Guidelines See “Configuring Archive Sites for Transfer of Active Configuration Files” on page 226.

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

Related Topics

- transfer-on-commit
- transfer-on-commit
- configuration

archive-sites (System Log)

Syntax	archive-sites { <i>site-name</i> ; }
Hierarchy Level	[edit system file <i>filename</i> archive]
Release Information	Statement introduced in JUNOS Release 8.5.
Description	Configure an archive site. If more than one site name is configured, a list of archive sites for the system log files is created. When a file is archived, the router attempts to transfer the file to the first URL in the list, moving to the next site only if the transfer does not succeed. The log file is stored at the archive site with the filename specified at the [edit system syslog] hierarchy level.
Options	<i>site-name</i> —Any valid FTP URL to a destination. For information about how to specify valid FTP URLs, see “Format for Specifying Filenames and URLs in JUNOS CLI Commands” on page 40.
Usage Guidelines	See “Configuring Archive Sites for Transfer of Active Configuration Files” on page 226.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

arp

Syntax arp {
 passive-learning;
 aging-timer *minutes*;
 }

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description Specify ARP options. You can enable backup VRRP routers to learn ARP requests for VRRP-IP to VRRP-MAC address translation. You can also set the time interval between ARP updates.

Options **passive-learning**—Configures backup VRRP routers to learn the ARP mappings (IP-to-MAC address) for hosts sending the requests. By default, the backup VRRP router drops these requests; therefore, if the master router fails, the backup router must learn all entries present in the ARP cache of the master router. Configuring passive learning reduces transition delay when the backup router is activated.

aging-timer—Time interval in minutes between ARP updates. In environments where the number of ARP entries to update is high (for example, metro Ethernet environments), increasing the time between updates can improve system performance.

Default: 20 minutes

Range: 5 to 240 minutes

Usage Guidelines See the *JUNOS Network Interfaces Configuration Guide*.

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

Related Topics ■ Configuring the JUNOS Software ARP Learning and Aging Options for Mapping IPv4 Network Addresses to MAC Addresses on page 238.

authentication (Login)

Syntax authentication {
 (encrypted-password "*password*" | plain-text-password);
 ssh-dsa "*public-key*";
 ssh-rsa "*public-key*";
 }

Hierarchy Level [edit system login user *username*]

Release Information Statement introduced before JUNOS Release 7.4.

Description Authentication methods that a user can use to log in to the router. You can assign multiple authentication methods to a single user.

Options encrypted-password "*password*"—Use Message Digest 5 (MD5) or other encrypted authentication. Specify the MD5 or other password. You can specify only one encrypted password for each user.

You cannot configure a blank password for **encrypted-password** using blank quotation marks (" "). You must configure a password whose number of characters range from 1 through 128 characters and enclose the password in quotation marks.

plain-text-password—Use a plain-text password. The command-line interface (CLI) prompts you for the password and then encrypts it.

ssh-dsa "*public-key*"—SSH version 2 authentication. Specify the SSH public key. You can specify one or more public keys for each user.

ssh-rsa "*public-key*"—SSH version 1 and SSH version 2 authentication. Specify the SSH public key. You can specify one or more public keys for each user.

Usage Guidelines See “Configuring JUNOS Software User Accounts” on page 75.

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

Related Topics ■ root-authentication

authentication (Subscriber Access Management)

Syntax	<pre> authentication { password <i>password-string</i>; username-include { circuit-type; delimiter <i>delimiter-character</i>; domain-name <i>domain-name-string</i>; logical-system-name; mac-address; option-60; option-82 <circuit-id> <remote-id>; routing-instance-name; user-prefix <i>user-prefix-string</i>; } }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i>],</p> <p>[edit system services dhcp-local-server],</p> <p>[edit system services dhcp-local-server group <i>group-name</i>]</p>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	<p>Configure the parameters the router sends to the external AAA server. A group configuration takes precedence over a global DHCP relay or DHCP local server configuration.</p> <p>The statements are explained separately.</p>
Usage Guidelines	See “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

authentication-key

Syntax	<code>authentication-key <i>key-number</i> type <i>type</i> value <i>password</i>;</code>
Hierarchy Level	[edit system ntp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Configure Network Time Protocol (NTP) authentication keys so that the router can send authenticated packets. If you configure the router to operate in authenticated mode, you must configure a key.</p> <p>Both the keys and the authentication scheme (MD5) must be identical between a set of peers sharing the same key number.</p>
Options	<p><i>key-number</i>—Positive integer that identifies the key.</p> <p><i>type type</i>—Authentication type. It can only be md5.</p> <p><i>value password</i>—The key itself, which can be from 1 through 8 ASCII characters. If the key contains spaces, enclose it in quotation marks.</p>
Usage Guidelines	See “Configuring NTP Authentication Keys” on page 120.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>
Related Topics	<ul style="list-style-type: none"> ■ broadcast ■ peer ■ server ■ trusted-key

authentication-order

Syntax	<code>authentication-order [<i>authentication-methods</i>];</code>
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the order in which the software tries different user authentication methods when attempting to authenticate a user. For each login attempt, the software tries the authentication methods in order, starting with the first one, until the password matches.
Default	If you do not include the <code>authentication-order</code> statement, users are verified based on their configured passwords.
Options	<p><i>authentication-methods</i>—One or more authentication methods, listed in the order in which they should be tried. The method can be one or more of the following:</p> <ul style="list-style-type: none"> ■ <code>password</code>—Verify the user using the password configured for the user with the <code>authentication</code> statement at the [edit system login user] hierarchy level. ■ <code>radius</code>—Verify the user using RADIUS authentication services. ■ <code>tacplus</code>—Verify the user using TACACS + authentication services.
Usage Guidelines	See “Configuring the JUNOS Software Authentication Order for RADIUS, TACACS + , and Local Password Authentication” on page 106.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

autoinstallation

Syntax

```

autoinstallation {
  interfaces {
    interface-name {
      bootp;
      rarp;
      slarp;
    }
  }
  configuration-servers {
    url;
  }
}

```

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description For J Series Services Routers only. Download a configuration file automatically from an FTP, Hypertext Transfer Protocol (HTTP), or Trivial FTP (TFTP) server. When you power on a J Series Services Router configured for autoinstallation, it requests an IP address from a Dynamic Host Configuration Protocol (DHCP) server. Once the router has an address, it sends a request to a configuration server and downloads and installs a configuration.

The remaining statements are explained separately.

Usage Guidelines See the *J Series Services Router Basic LAN and WAN Access Configuration Guide*.

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

Related Topics

- configuration-servers
- idle-timeout

auxiliary

Syntax	auxiliary { type <i>terminal-type</i> ; }
Hierarchy Level	[edit system ports]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the characteristics of the auxiliary port, which is on the router's craft interface.
Default	The auxiliary port is disabled.
Options	type <i>terminal-type</i> —Type of terminal that is connected to the port. Range: ansi, vt100, small-xterm, xterm Default: The terminal type is unknown, and the user is prompted for the terminal type.
Usage Guidelines	See “Configuring the JUNOS Software to Set Console and Auxiliary Port Properties on a Router Craft Interface” on page 172.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

backup-router

Syntax	backup-router <i>address</i> <destination <i>destination-address</i> >;
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Set a default router (running IP version 4 [IPv4]) to use while the local router (running IPv4) is booting and if the routing protocol processes fail to start. The JUNOS Software removes the route to this router as soon as the software starts.
Options	<i>address</i> —Address of the default router. <i>destination destination-address</i> —(Optional) Destination address that is reachable through the backup router. Include this option to achieve network reachability while loading, configuring, and recovering the router, but without the risk of installing a default route in the forwarding table. Default: All hosts (default route) are reachable through the backup router.
Usage Guidelines	See “Configuring a Backup Router” on page 60.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

boot-file

Syntax	boot-file <i>filename</i> ;
Hierarchy Level	[edit system services dhcp], [edit system services dhcp pool], [edit system services dhcp static-binding]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For J Series Services Routers only. Set the boot file advertised to DHCP clients. After the client receives an IP address and the boot file location from the DHCP server, the client uses the boot image stored in the boot file to complete DHCP setup.
Options	<i>filename</i> —The location of the boot file on the boot server. The filename can include a pathname.
Usage Guidelines	See “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ boot-server

boot-server (DHCP)

Syntax	boot-server <i>address</i> ;
Hierarchy Level	[edit system services dhcp], [edit system services dhcp pool], [edit system services dhcp static-binding]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For J Series Services Routers only. Configure the name of the boot server advertised to DHCP clients. The client uses a boot file located on the boot server to complete DHCP setup.
Options	<i>address</i> —Address of a boot server. You must specify an IPv4 address, not a hostname.
Usage Guidelines	See “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ boot-file

boot-server (NTP)

Syntax	<code>boot-server address;</code>
Hierarchy Level	[edit system ntp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Configure the server that NTP queries when the router boots to determine the local date and time.</p> <p>When you boot the router, it issues an <code>ntpdate</code> request, which polls a network server to determine the local date and time. You need to configure a server that the router uses to determine the time when the router boots. Otherwise, NTP will not be able to synchronize to a time server if the server's time appears to be very far off of the local router's time.</p>
Options	<code>address</code> —Address of an NTP server. You must specify an address, not a hostname.
Usage Guidelines	See “Configuring the NTP Boot Server” on page 115.
Required Privilege Level	<code>system</code> —To view this statement in the configuration. <code>system-control</code> —To add this statement to the configuration.

broadcast

Syntax	<code>broadcast address <key key-number> <version value> <ttl value>;</code>
Hierarchy Level	[edit system ntp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the local router to operate in broadcast mode with the remote system at the specified <i>address</i> . In this mode, the local router sends periodic broadcast messages to a client population at the specified broadcast or multicast <i>address</i> . Normally, you include this statement only when the local router is operating as a transmitter.
Options	<p><i>address</i>—The broadcast address on one of the local networks or a multicast address assigned to NTP. You must specify an address, not a hostname. If the multicast address is used, it must be 224.0.1.1.</p> <p><i>key key-number</i>—(Optional) All packets sent to the address include authentication fields that are encrypted using the specified key number. Range: Any unsigned 32-bit integer</p> <p><i>value</i>—(Optional) Time-to-live (TTL) value to use. Range: 1 through 255 Default: 1</p> <p><i>version value</i>—(Optional) Specify the version number to be used in outgoing NTP packets. Range: 1 through 4 Default: 4</p>
Usage Guidelines	See “Configuring the NTP Time Server and Time Services” on page 117.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

broadcast-client

Syntax	<code>broadcast-client;</code>
Hierarchy Level	<code>[edit system ntp]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the local router to listen for broadcast messages on the local network to discover other servers on the same subnet.
Usage Guidelines	See “Configuring the Router to Listen for Broadcast Messages Using NTP” on page 120.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

bucket-size

Syntax	<code>bucket-size <i>bucket-size</i>;</code>
Hierarchy Level	<code>[edit system internet-options icmpv4-rate-limit],</code> <code>[edit system internet-options icmpv6-rate-limit]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	The number of seconds in the rate limiting bucket.
Options	<code>bucket-size</code> Range: 0 through 4294967295 seconds Default: 5
Usage Guidelines	See “Configuring the JUNOS Software ICMPv4 Rate Limit for ICMPv4 Routing Engine Messages” on page 232 and “Configuring the JUNOS Software ICMPv6 Rate Limit for ICMPv6 Routing Engine Messages” on page 233.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

change-type

Syntax	change-type (character-sets set-transitions);
Hierarchy Level	[edit system login password]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Set requirements for using character sets in plain-text passwords. When combined with the minimum-changes statement, you can check for the total number of character sets included in the password or for the total number of character set changes in the password. Newly created passwords must meet these requirements.
Options	One of the following: <ul style="list-style-type: none"> ■ character-sets—The number of character sets in the password. Valid character sets include uppercase letters, lowercase letters, numbers, punctuation, and other special characters. ■ set-transitions—The number of transitions between character sets.
Usage Guidelines	See “Special Requirements for JUNOS Software Plain-Text Passwords” on page 65.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ minimum-changes

circuit-type

Syntax	circuit-type;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit system services dhcp-local-server authentication username-include],</p> <p>[edit system services dhcp-local-server group <i>group-name</i> authentication username-include]</p>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify that the circuit type is concatenated with the username during the subscriber authentication process.
Usage Guidelines	See “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

class (Define Login Classes)

Syntax	<pre>class <i>class-name</i> { allow-commands "<i>regular-expression</i>"; allow-configuration "<i>regular-expression</i>"; deny-commands "<i>regular-expression</i>"; deny-configuration "<i>regular-expression</i>"; idle-timeout <i>minutes</i>; no-world-readable; permissions [<i>permissions</i>]; }</pre>
Hierarchy Level	[edit system login]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define login classes.
Options	<p><i>class-name</i>—A name you choose for the login class.</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Defining JUNOS Software Login Classes” on page 73.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>
Related Topics	■ user

class (Assign a Class to an Individual User)

Syntax	class <i>class-name</i> ;
Hierarchy Level	[edit system login user <i>username</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure a user’s login class. You must configure one class for each user.
Options	<i>class-name</i> —One of the classes defined at the [edit system login class] hierarchy level.
Usage Guidelines	See “Configuring JUNOS Software User Accounts” on page 75.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

client-identifier

Syntax	client-identifier (ascii <i>client-id</i> hexadecimal <i>client-id</i>);
Hierarchy Level	[edit system services dhcp static-binding]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For J Series Services Routers only. Configure the client's unique identifier. This identifier is used by the DHCP server to index its database of address bindings. Either a client identifier or the client's MAC address is required to uniquely identify the client on the network.
Options	<i>client-id</i> —A name or number that uniquely identifies the client on the network. The client identifier can be an ASCII string or hexadecimal digits.
Usage Guidelines	See “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

commit

Syntax

```
commit {
  allow-transients;
  file filename.xml {
    optional;
    refresh;
    refresh-from url;
    source url;
  }
  refresh;
  refresh-from url;
  source url;
  traceoptions {
    file filename <files number> <size size>;
    flag flag;
  }
}
```

Hierarchy Level [edit system scripts]

Release Information Statement introduced in JUNOS Release 7.4.

Description For JUNOS commit scripts, configure commit-time scripting mechanism.
The statements are explained separately.

Usage Guidelines See the *JUNOS Configuration and Diagnostic Automation Guide*.

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

commit synchronize

Syntax	commit synchronize;
Hierarchy Level	[edit system]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	For multiple Routing Engines only. Configure a commit command to automatically result in a commit synchronize. The Routing Engine on which you execute the commit command (requesting Routing Engine) copies and loads its candidate configuration to the other (responding) Routing Engines. All Routing Engines then perform a syntax check on the candidate configuration file being committed. If no errors are found, the configuration is activated and becomes the current operational configuration on all Routing Engines.
Usage Guidelines	See “Configuring Multiple Routing Engines to Synchronize Committed Configurations Automatically” on page 68.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

compress-configuration-files

Syntax (compress-configuration-files | no-compress-configuration-files);

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description Compress the current operational configuration file. By default, the current operational configuration file is compressed, and is stored in the file `juniper.conf`, in the `/config` file system, along with the last three committed versions of the configuration. However, with large networks, the current configuration file might exceed the available space in the `/config` file system. Compressing the current configuration file allows the file to fit in the file system, typically reducing the size of the file by 90 percent. The current configuration file is compressed on the second commit of the configuration after the first commit is made to include the `compress-configuration-files` statement.



NOTE: We recommend that you enable compression of the router configuration files to minimize the amount of disk space that they require.

Default The current operational configuration file is uncompressed.

Usage Guidelines See “Compressing the Current Configuration File” on page 68.

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

configuration

Syntax configuration {
 transfer-interval *interval*;
 transfer-on-commit;
 archive-sites {
 ftp://<username>:<password>@<host>:<port>/<url-path>;
 }
 }

Hierarchy Level [edit system archival]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure the router to transfer its currently active configuration by means of FTP periodically or after each commit. The remaining statements are explained separately.

Usage Guidelines See “Using JUNOS Software to Configure a Router to Transfer Its Configuration to an Archive Site” on page 225.

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

Related Topics

- transfer-interval
- transfer-on-commit
- archive

configuration-servers

Syntax	configuration-servers { <i>url</i> ; }
Hierarchy Level	[edit system autoinstallation]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For J Series Services Routers only, configure the URL address of a server from which to obtain configuration files. Examples of URLs: tftp://hostname/path/filename ftp://username:prompt@ftp.hostname.net/filename /
Usage Guidelines	See the Getting Started Guide for your router model.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ autoinstallation ■ idle-timeout

connection-limit

Syntax	connection-limit <i>limit</i> ;
Hierarchy Level	[edit system services finger], [edit system services ftp], [edit system services ssh], [edit system services telnet], [edit system services xnm-clear-text], [edit system services xnm-ssl]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the maximum number of established connections for each type of system service.
Options	<i>limit</i> —(Optional) Maximum number of established connections. Range: 1 through 250 Default: 75
Usage Guidelines	See “Configuring System Services for Remote Router Access” on page 176.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

console (Physical Port)

Syntax	<pre>console { insecure; log-out-on-disconnect; type <i>terminal-type</i>; disable; }</pre>
Hierarchy Level	[edit system ports]
Release Information	Statement introduced before JUNOS Release 7.4. disable option added in JUNOS Release 7.6.
Description	Configure the characteristics of the console port, which is on the router's craft interface.
Default	The console port is enabled and its speed is 9600 baud.
Options	<p>insecure—Disable root login connections to the console and auxiliary ports. Configuring the console port as insecure also prevents superusers and anyone with a user identifier (UID) of 0 from establishing terminal connections in multiuser mode.</p> <p>log-out-on-disconnect—Log out the session when the data carrier on the console port is lost.</p> <p>type <i>terminal-type</i>—Type of terminal that is connected to the port. Range: ansi, vt100, small-xterm, xterm Default: The terminal type is unknown, and the user is prompted for the terminal type.</p> <p>disable—Disable console login connections.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Set Console and Auxiliary Port Properties on a Router Craft Interface” on page 172.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

console (System Logging)

Syntax	console { <i>facility severity</i> ; }
Hierarchy Level	[edit system syslog]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the logging of system messages to the system console.
Options	<p><i>facility</i>—Class of messages to log. To specify multiple classes, include multiple <i>facility severity</i> statements. For a list of the facilities, see Table 15 on page 132.</p> <p><i>severity</i>—Severity of the messages that belong to the facility specified by the paired <i>facility</i> name. Messages with severities the specified level and higher are logged. For a list of the severities, see Table 16 on page 132.</p>
Usage Guidelines	See “Directing System Log Messages to the Console” on page 135.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<i>JUNOS System Log Messages Reference</i>

default-address-selection

Syntax	default-address-selection;
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Use the loopback interface, lo0, as the source address for all locally generated IP packets. The lo0 interface is the interface to the router’s Routing Engine.
Default	The outgoing interface is used as the source address.
Usage Guidelines	See “Configuring the JUNOS Software to Select a Fixed Source Address for Locally Generated TCP/IP Packets” on page 174 and the <i>JUNOS Network Interfaces Configuration Guide</i> .
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

default-lease-time

Syntax	default-lease-time <i>seconds</i> ;
Hierarchy Level	[edit system services dhcp], [edit system services dhcp pool], [edit system services dhcp static-binding]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For J Series Services Routers only. Specify the length of time in seconds that a client holds the lease for an IP address assigned by a DHCP server. This setting is used if a lease time is not requested by the client.
Options	<i>seconds</i> —Number of seconds the lease can be held. Default: 86400 (1 day)
Usage Guidelines	See “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ maximum-lease-time

delimiter

Syntax	<code>delimiter <i>delimiter-character</i>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit system services dhcp-local-server authentication username-include],</p> <p>[edit system services dhcp-local-server group <i>group-name</i> authentication username-include]</p>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify the character used as the delimiter between the concatenated components of the username. The semicolon (;) cannot be used as a delimiter.
Usage Guidelines	See “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

deny-commands

Syntax	deny-commands " <i>regular-expression</i> ";
Hierarchy Level	[edit system login class]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Specify the operational mode commands that the user is denied permission to issue, even though the permissions set with the permissions statement would allow it.
Default	If you omit this statement and the allow-commands statement, users can issue only those commands for which they have access privileges through the permissions statement.
Options	<i>regular-expression</i> —Extended (modern) regular expression as defined in POSIX 1003.2. If the regular expression contains any spaces, operators, or wildcard characters, enclose it in quotation marks.
Usage Guidelines	See “Specifying Access Privileges for JUNOS Software Operational Mode Commands” on page 82.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ allow-commands ■ user

deny-configuration

Syntax	deny-configuration " <i>regular-expression</i> ";
Hierarchy Level	[edit system login class]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Specify the configuration mode commands that the user is denied permission to issue, even though the permissions set with the permissions statement would allow it.
Default	If you omit this statement and the allow-configuration statement, users can issue only those commands for which they have access privileges through the permissions statement.
Options	<i>regular-expression</i> —Extended (modern) regular expression as defined in POSIX 1003.2. If the regular expression contains any spaces, operators, or wildcard characters, enclose it in quotation marks.
Usage Guidelines	See “Specifying Access Privileges for JUNOS Software Operational Mode Commands” on page 82.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ allow-configuration ■ user

destination

```

Syntax  destination {
            radius {
              server {
                server-address {
                  accounting-port port-number;
                  secret password;
                  source-address address;
                  retry number;
                  timeout seconds;
                }
              }
            }
            tacplus {
              server {
                server-address {
                  secret password;
                  single-connection;
                  timeout seconds;
                  port port-number;
                }
              }
            }
          }

```

Hierarchy Level [edit system accounting]

Release Information Statement introduced before JUNOS Release 7.4.
radius statement added in JUNOS Release 7.4.

Description Configure the authentication server.

Options The remaining statements are explained separately.

Usage Guidelines See “Configuring RADIUS System Accounting” on page 227 and “Configuring TACACS + System Accounting” on page 230.

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

destination-override

Syntax	destination-override { syslog host <i>ip-address</i> ; }
Hierarchy Level	[edit system tracing]
Release Information	Statement introduced in JUNOS Release 9.2.
Description	This option overrides the system-wide configuration under [edit system tracing] and has no effect if system tracing is not configured.
Options	<p>These options specify the system logs and the host to which remote tracing output is sent:</p> <ul style="list-style-type: none">■ syslog—Specify the system process log files to send to the remote tracing host.■ host <i>ip-address</i>—Specify the IP address to which to send tracing information.
Usage Guidelines	See “JUNOS Software Tracing and Logging Operations” on page 42.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ tracing

dhcp

Syntax dhcp {
 boot-file *filename*;
 boot-server (*address* | *hostname*);
 domain-name *domain-name*;
 domain-search [*domain-list*];
 default-lease-time seconds;
 maximum-lease-time seconds;
 name-server {
 address;
 }
 option {
 [(*id-number* *option-type* *option-value*) | (*id-number* array *option-type* *option-value*)];
 }
 pool *address/prefix-length* {
 address-range {
 low *address*;
 high *address*;
 }
 exclude-address {
 address;
 }
 }
 router {
 address;
 }
 static-binding *mac-address* {
 fixed-address {
 address;
 }
 host *hostname*;
 client-identifier (ascii *client-id* | hexadecimal *client-id*);
 }
 server-identifier *address*;
 wins-server {
 address;
 }
 }

Hierarchy Level [edit system services]

Release Information Statement introduced before JUNOS Release 7.4.

Description For J Series Services Routers only. Configure a router or interface as a DHCP server. A DHCP server can allocate network addresses and deliver configuration information to client hosts on a TCP/IP network.

The remaining statements are explained separately.

Usage Guidelines See “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.

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

dhcp-local-server

Syntax

```

dhcp-local-server {
  authentication {
    password password-string;
    username-include {
      circuit-type;
      delimiter delimiter-character;
      domain-name domain-name-string;
      logical-system-name;
      mac-address;
      option-60;
      option-82 <circuit-id> <remote-id>;
      routing-instance-name;
      user-prefix user-prefix-string;
    }
  }
  group group-name {
    authentication {
      password password-string;
      username-include {
        circuit-type;
        domain-name domain-name-string;
        logical-system-name;
        mac-address;
        option-60;
        option-82;
        routing-instance-name;
        user-prefix user-prefix-string;
      }
    }
    interface interface-name <upto upto-interface-name> <exclude>;
  }
  pool-match-order {
    ip-address-first;
    option-82;
  }
  traceoptions {
    file filename <files number> <size size> <world-readable | no-world-readable><match
      regex>;
    flag flag;
  }
}

```

Hierarchy Level [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* system services],
 [edit logical-systems *logical-system-name* system services],
 [edit routing-instances *routing-instance-name* system services],
 [edit system services]

Release Information Statement introduced in JUNOS Release 9.0.

Description Configure Dynamic Host Configuration Protocol (DHCP) local server options on the router and enable the router to function as an extended DHCP local server. The DHCP local server receives DHCP request and reply packets from DHCP clients and then responds with an IP address and other optional configuration information to the client.

The DHCP local server interacts with the local AAA Service Framework to use back-end authentication servers, such as RADIUS, to provide subscriber authentication. You can configure authentication support on a global basis or for a specific group of interfaces.

The DHCP local server also supports the use of JUNOS Software address-assignment pools or external authorities, such as RADIUS, to provide the client address and configuration information.

The extended DHCP local server is incompatible with the J Series router DHCP server and is not supported on the J Series router. Also, the DHCP local server and the DHCP or BOOTP relay, which are configured under the `[edit forwarding-options helpers]` hierarchy level, cannot both be enabled on the router at the same time. The extended DHCP local server is fully compatible with the extended DHCP relay feature.



NOTE: When you configure the `dhcp-local-server` statement at the routing instance hierarchy level, you must use a routing instance type of virtual-router.

The statements are explained separately.

Usage Guidelines See “Configuring the Router as an Extended DHCP Local Server” on page 198.

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

Related Topics

- address-assignment
- dhcp-attributes

diag-port-authentication

Syntax diag-port-authentication (encrypted-password "*password*" | plain-text-password);

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure a password for performing diagnostics on the router's System Control Board (SCB), System and Switch Board (SSB), Switching and Forwarding Module (SFM), or Forwarding Engine Board (FEB) port.

For routers that have more than one SSB, the same password is used for both SSBs.



NOTE: Do not run diagnostics on the SCB, SSB, SFM, or FEB unless you have been instructed to do so by Customer Support personnel.

Default No password is configured on the diagnostics port.

Options encrypted-password *password*—Use MD5 or other encrypted authentication. Specify the MD5 or other password. You can specify only one encrypted password for each user.

You cannot configure a blank password for **encrypted-password** using blank quotation marks (" "). You must configure a password whose number of characters range from 1 through 128 characters and enclose the password in quotation marks.

plain-text-password—Use a plain-text password. The CLI prompts you for the password and then encrypts it. The CLI displays the encrypted version, and the software places the encrypted version in its user database. You can specify only one plain-text password for each user.

Usage Guidelines See “Configuring Password Authentication for the Diagnostics Port” on page 222.

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

domain-name (DHCP on J Series Services Routers)

Syntax	domain-name <i>domain-name</i> ;
Hierarchy Level	[edit system services dhcp], [edit system services dhcp pool], [edit system services dhcp static-binding]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For J Series Services Routers only. Configure the name of the domain in which clients search for a DHCP server host. This is the default domain name that is appended to hostnames that are not fully qualified.
Options	<i>domain-name</i> —Name of the domain.
Usage Guidelines	See “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

domain-name (Router)

Syntax	domain-name <i>domain-name</i> ;
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the name of the domain in which the router is located. This is the default domain name that is appended to hostnames that are not fully qualified.
Options	<i>domain-name</i> —Name of the domain.
Usage Guidelines	See “Configuring the Domain Name for the Router” on page 58.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

domain-name (Subscriber Access Management)

Syntax	<code>domain-name domain-name-string;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit system services dhcp-local-server authentication username-include],</p> <p>[edit system services dhcp-local-server group <i>group-name</i> authentication username-include]</p>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify the domain name that is concatenated with the username during the subscriber authentication process.
Options	<i>domain-name-string</i> —The domain name formatted string.
Usage Guidelines	See “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

domain-search

Syntax	domain-search [<i>domain-list</i>];
Hierarchy Level	[edit system], [edit system services dhcp], [edit system services dhcp pool], [edit system services dhcp static-bindings]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure a list of domains to be searched.
Options	<i>domain-list</i> —A list of domain names to search. The list can contain up to 6 domain names, with a total of up to 256 characters.
Usage Guidelines	See “Configuring the Domains to Search When a Router Is Included in Multiple Domains” on page 59 and “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

dump-device

Syntax	<pre>dump-device { compact-flash; removable-compact-flash; usb; }</pre>
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>For J Series Services Routers only. Configure the medium used for storing memory snapshots of system failure. When you specify the storage and an operating system fails, the operating system writes a snapshot of the state of the router when it failed to the storage medium. When the operating system is rebooted, the storage device is checked for a snapshot. If found, the snapshot of memory is written to the <code>/var/crash</code> directory on the router and can be examined by Juniper Networks customer support to help determine the cause of failure.</p> <p>If the swap partition on the device medium is not large enough for the system memory snapshot, the snapshot is not successfully written to the directory. Use the request system snapshot command to specify the swap partition.</p>
Options	<p>compact-flash—The primary CompactFlash card.</p> <p>removable-compact-flash—The CompactFlash card on the front of the router (J4300 and J6300 only) as the system software failure memory snapshot device.</p> <p>usb—The device attached to the universal serial bus (USB) port.</p>
Usage Guidelines	See the Getting Started Guide for your router model.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

events

Syntax	events [<i>events</i>];
Hierarchy Level	[edit system accounting]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the types of events to track and log.
Options	<p><i>events</i>—Event types; can be one or more of the following:</p> <ul style="list-style-type: none"> ■ login—Audit logins. ■ change-log—Audit configuration changes. ■ interactive-commands—Audit interactive commands (any command-line input).
Usage Guidelines	See “Specifying TACACS+ Auditing and Accounting Events” on page 230.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

explicit-priority

Syntax	explicit-priority;
Hierarchy Level	<p>[edit system syslog file <i>filename</i>],</p> <p>[edit system syslog host]</p>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Record the priority (facility and severity level) in each standard-format system log message directed to a file or remote destination.</p> <p>When the structured-data statement is also included at the [edit system syslog file <i>filename</i>] hierarchy level, this statement is ignored for the file.</p>
Usage Guidelines	See “Including Priority Information in System Log Messages” on page 143.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>
Related Topics	<ul style="list-style-type: none"> ■ structured-data ■ <i>JUNOS System Log Messages Reference</i>

facility-override

Syntax	<code>facility-override facility;</code>
Hierarchy Level	[edit system syslog host]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Substitute an alternate facility for the default facilities used when messages are directed to a remote destination.
Options	<i>facility</i> —Alternate facility to substitute for the default facilities. For a list of the possible facilities, see Table 18 on page 139.
Usage Guidelines	See “Changing the Alternative Facility Name for Remote System Log Messages” on page 137.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<i>JUNOS System Log Messages Reference</i>

file (Commit Scripts)

Syntax	<pre>file filename.xml { optional; refresh; refresh-from url; source url; }</pre>
Hierarchy Level	[edit system scripts commit]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	For JUNOS commit scripts, enable a commit script that is located in the <code>/var/db/scripts/commit</code> directory.
Options	<i>filename</i> —The name of an XSLT file containing a commit script. The statements are explained separately.
Usage Guidelines	See the <i>JUNOS Configuration and Diagnostic Automation Guide</i> .
Required Privilege Level	maintenance—To view this statement in the configuration. maintenance-control—To add this statement to the configuration.

file (System Logging)

Syntax file *filename* {
 facility severity;
 explicit-priority;
 match "*regular-expression*";
 structured-data {
 brief;
 }
 archive {
 files *number*;
 size *size*;
 (world-readable | no-world-readable);
 }
 }

Hierarchy Level [edit system syslog]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure the logging of system messages to a file.

Options *facility*—Class of messages to log. To specify multiple classes, include multiple *facility severity* statements. For a list of the facilities, see Table 15 on page 132.

filename—File in the `/var/log` directory in which to log messages from the specified facility. To log messages to more than one file, include more than one *file* statement.

severity—Severity of the messages that belong to the facility specified by the paired *facility* name. Messages with severities the specified level and higher are logged. For a list of the severities, see Table 16 on page 132.

The remaining statements are explained separately.

Usage Guidelines See “Directing System Log Messages to a Log File” on page 133.

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

Related Topics *JUNOS System Log Messages Reference*

files

Syntax	<code>files <i>number</i>;</code>
Hierarchy Level	[edit system syslog archive], [edit system syslog file <i>filename</i> archive]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the maximum number of archived log files to retain. When the JUNOS logging utility has written a defined maximum amount of data to a log file <i>logfile</i> , it closes the file, compresses it, and renames it to <i>logfile.0.gz</i> (for information about the maximum file size, see size). The utility then opens and writes to a new file called <i>logfile</i> . When the new file reaches the maximum size, the <i>logfile.0.gz</i> file is renamed to <i>logfile.1.gz</i> , and the new file is closed, compressed, and renamed <i>logfile.0.gz</i> . By default, the logging facility creates up to ten archive files in this manner. Once the maximum number of archive files exists, each time the active log file reaches the maximum size, the contents of the oldest archive file are lost (overwritten by the next oldest file).
Options	<i>number</i> —Maximum number of archived files. Range: 1 through 1000 Default: 10 files
Usage Guidelines	See “Specifying Log File Size, Number, and Archiving Properties” on page 141.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ <code>size</code>, ■ <i>JUNOS System Log Messages Reference</i>

finger

Syntax	finger { <connection-limit <i>limit</i> >; <rate-limit <i>limit</i> >; }
Hierarchy Level	[edit system services]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Allow finger requests from remote systems to the local router. The remaining statements are explained separately.
Usage Guidelines	See “Configuring Finger Service for Remote Access to the Router” on page 212.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

flow-tap-dtcp

Syntax	flow-tap-dtcp { ssh { connection-limit <i>limit</i> ; rate-limit <i>limit</i> ; } }
Hierarchy Level	[edit system services]
Release Information	Statement introduced in JUNOS Release 8.1.
Description	Configure Digital Transmission Content Protection (DTCP) sessions to run over SSH in support of the flow-tap application.
Options	<p>connection-limit <i>limit</i>—(Optional) Maximum number of connections allowed. Range: 1 through 250 Default: 75</p> <p>rate-limit <i>limit</i>—(Optional) Maximum number of connection attempts allowed per minute. Range: 1 through 250 Default: 150</p>
Usage Guidelines	See “Configuring DTCP-over-SSH Service for the Flow-Tap Application” on page 211.
Required Privilege Level	flow-tap—To view this statement in the configuration. flow-tap-control—To add this statement to the configuration.

format

Syntax	format (md5 sha1 des);
Hierarchy Level	[edit system login passwords]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Configure the authentication algorithm for plain-text passwords.
Default	For JUNOS Software, the default encryption format is md5 . For JUNOS-FIPS software, the default encryption format is sha1 .
Options	The hash algorithm that authenticates the password can be one of three algorithms: <ul style="list-style-type: none"> ■ md5—Produces a 128-bit digest. ■ sha1—Produces a 160-bit digest. ■ des—Has a block size of 8 bytes; its key size is 48 bits long.
Usage Guidelines	See “Special Requirements for JUNOS Software Plain-Text Passwords” on page 65.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

ftp

Syntax	ftp { <connection-limit <i>limit</i> >; <rate-limit <i>limit</i> >; }
Hierarchy Level	[edit system services]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Allow FTP requests from remote systems to the local router. The remaining statements are explained separately.
Usage Guidelines	See “Configuring FTP Service for Remote Access to the Router” on page 212.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

full-name

Syntax	<code>full-name <i>complete-name</i>;</code>
Hierarchy Level	[edit system login user]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the complete name of a user.
Options	<i>complete-name</i> —Full name of the user. If the name contains spaces, enclose it in quotation marks.
Usage Guidelines	See “Configuring JUNOS Software User Accounts” on page 75.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

gre-path-mtu-discovery

Syntax	<code>(gre-path-mtu-discovery no-gre-path-mtu-discovery);</code>
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure path MTU discovery for outgoing GRE tunnel connections: <ul style="list-style-type: none"> ■ <code>gre-path-mtu-discovery</code>—Path MTU discovery is enabled. ■ <code>no-gre-path-mtu-discovery</code>—Path MTU discovery is disabled.
Default	Path MTU discovery is enabled.
Usage Guidelines	See “Configuring the JUNOS Software for Path MTU Discovery on Outgoing GRE Tunnel Connections” on page 236.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

group

Syntax `group group-name {
 authentication {
 password password-string;
 username-include {
 circuit-type;
 delimiter delimiter-character;
 domain-name domain-name-string;
 logical-system-name;
 mac-address;
 option-60;
 option-82 <circuit-id> <remote-id>;
 routing-instance-name;
 user-prefix user-prefix-string;
 }
 }
 interface interface-name <upto upto-interface-name> <exclude>;
}`

Hierarchy Level [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* system services dhcp-local-server],
 [edit logical-systems *logical-system-name* system services dhcp-local-server],
 [edit routing-instances *routing-instance-name* system services dhcp-local-server],
 [edit system services dhcp-local-server]

Release Information Statement introduced in JUNOS Release 9.0.

Description Configure a group of interfaces that have a common configuration, such as authentication parameters. A group must contain at least one interface.

Options *group-name*—Name of the group.

Usage Guidelines See “Configuring the Router as an Extended DHCP Local Server” on page 198 and “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.

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

host

Syntax	<pre>host (hostname other-routing-engine) { facility severity; explicit-priority; facility-override facility; log-prefix string; match "regular-expression"; }</pre>
TX Matrix Router	<pre>host (hostname other-routing-engine scc-master) { facility severity; explicit-priority; facility-override facility; log-prefix string; match "regular-expression"; }</pre>
TX Matrix Plus Router	<pre>host (hostname other-routing-engine sfc0-master) { facility severity; explicit-priority; facility-override facility; log-prefix string; match "regular-expression"; }</pre>
Hierarchy Level	[edit system syslog]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the logging of system messages to a remote destination.
Options	<p>facility—Class of messages to log. To specify multiple classes, include multiple <i>facility severity</i> statements. For a list of the facilities, see Table 15 on page 132.</p> <p>hostname—IPv4 address, IPv6 address, or fully qualified hostname of the remote machine to which to direct messages. To direct messages to multiple remote machines, include a host statement for each one.</p> <p>severity—Severity of the messages that belong to the facility specified by the paired <i>facility</i> name. Messages with severities the specified level and higher are logged. For a list of the severities, see Table 16 on page 132.</p> <p>other-routing-engine—Direct messages to the other Routing Engine on a router with two Routing Engines installed and operational.</p> <p>scc-master—(TX Matrix routers only) On a T640 router that is part of a routing matrix, direct messages to the TX Matrix router.</p> <p>sfc0-master—(TX Matrix Plus routers only) On a T1 600 router that is part of a routing matrix, direct messages to the TX Matrix Plus router.</p>

The remaining statements are explained separately.

Usage Guidelines See “Directing System Log Messages to a Remote Machine or the Other Routing Engine” on page 135, “Directing Messages to a Remote Destination from the Routing Matrix Based on the TX Matrix Router” on page 157, and “Directing Messages to a Remote Destination from the Routing Matrix Based on a TX Matrix Plus Router” on page 167.

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

Related Topics *JUNOS System Log Messages Reference*

host-name

Syntax host-name *hostname*;

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description Set the hostname of the router.

Options *hostname*—Name of the router.

Usage Guidelines See “Configuring the Hostname of the Router” on page 56.

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

http

Syntax http {
 interfaces [*interface-names*];
 port *port*;
 }

Hierarchy Level [edit system services web-management]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure port and interfaces for HTTP service, which is unencrypted.

Options interfaces [*interface-names*]—Name of one or more interfaces on which to allow the HTTP service. By default, HTTP access is allowed through built-in Fast Ethernet interfaces only.

The remaining statement is explained separately.

Usage Guidelines See the *J-Web Interface User Guide*.

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

Related Topics ■ https
 ■ port
 ■ web-management

https

Syntax https {
 interfaces [*interface-names*];
 local-certificate *name*;
 port *port*;
 }

Hierarchy Level [edit system services web-management]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure the secure version of HTTP (HTTPS) service, which is encrypted.

Options interfaces [*interface-names*]— Name of one or more interfaces on which to allow the HTTPS service. By default, HTTPS access is allowed through any ingress interface, but HTTP access is allowed through built-in Fast Ethernet interfaces only.

 local-certificate *name*— Name of the X.509 certificate for a secure sockets layer (SSL) connection. An SSL connection is configured at the [edit security certificates local] hierarchy.

The remaining statement is explained separately.

Usage Guidelines See the *J-Web Interface User Guide*.

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

Related Topics ■ http
 ■ port
 ■ web-management

icmpv4-rate-limit

Syntax	icmpv4-rate-limit { bucket-size <i>bucket-size</i> ; packet-rate <i>packet-rate</i> ; }
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure rate limiting parameters for ICMPv4 messages sent.
Options	The remaining statements are explained separately.
Usage Guidelines	See “Configuring the JUNOS Software ICMPv4 Rate Limit for ICMPv4 Routing Engine Messages” on page 232.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

icmpv6-rate-limit

Syntax	icmpv6-rate-limit { bucket-size <i>bucket-size</i> ; packet-rate <i>packet-rate</i> ; }
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure rate limiting parameters for ICMPv6 messages sent.
Options	The remaining statements are explained separately.
Usage Guidelines	See “Configuring the JUNOS Software ICMPv6 Rate Limit for ICMPv6 Routing Engine Messages” on page 233.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

idle-timeout

Syntax	<code>idle-timeout <i>minutes</i>;</code>
Hierarchy Level	<code>[edit system login class <i>class-name</i>]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For a login class, configure the maximum time that a session can be idle before the user is logged off the router. The session times out after remaining at the CLI operational mode prompt for the specified time.
Default	If you omit this statement, a user is never forced off the system after extended idle times.
Options	<i>minutes</i> —Maximum idle time. Range: 0 through 100,000 minutes
Usage Guidelines	See “Configuring the Timeout Value for Idle Login Sessions” on page 87.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ user

inet6-backup-router

Syntax	<code>inet6-backup-router <i>address</i> <destination <i>destination-address</i>>;</code>
Hierarchy Level	<code>[edit system]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Set a default router (running IP version 6 [IPv6]) to use while the local router (running IPv6) is booting and if the routing protocol processes fail to start. The JUNOS Software removes the route to this router as soon as the software starts.
Options	<i>address</i> —Address of the default router. <i>destination destination-address</i> —(Optional) Destination address that is reachable through the backup router. Include this option to achieve network reachability while loading, configuring, and recovering the router, but without the risk of installing a default route in the forwarding table. Default: All hosts (default route) are reachable through the backup router.
Usage Guidelines	See “Configuring a Backup Router” on page 60.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

interface (ARP Aging Timer)

Syntax	<code>interface <i>interface-name</i> minutes;</code>
Hierarchy Level	[edit system arp aging-timer]
Release Information	Statement introduced in JUNOS Release 9.4.
Description	Specify the ARP aging timer in minutes for a logical interface of family type <code>inet</code> .
Options	<i>minutes</i> —Time between ARP updates, in minutes. Default: 20 Range: 1 through 240
Usage Guidelines	See “Adjusting the ARP Aging Timer” on page 238.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

interface (DHCP Local Server)

Syntax	<code>interface <i>interface-name</i> <upto <i>upto-interface-name</i>> <exclude>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i>],</p> <p>[edit system services dhcp-local-server group <i>group-name</i>]</p>
Release Information	<p>Statement introduced in JUNOS Release 9.0.</p> <p><code>upto</code> and <code>exclude</code> options introduced in JUNOS Release 9.1.</p>
Description	Specify one or more interfaces, or a range of interfaces, that are within a specified group on which the DHCP local server is enabled. You can repeat the interface <i>interface-name</i> statement to specify multiple interfaces within a group, but you cannot specify the same interface in more than one group. Also, you cannot use an interface that is being used by the DHCP relay agent.
Options	<p><code>exclude</code>—Exclude an interface or a range of interfaces from the group.</p> <p><i>interface-name</i>—Name of the interface. You can repeat this keyword multiple times.</p> <p><code>upto</code> <i>upto-interface-name</i>—Upper end of the range of interfaces; the lower end of the range is the interface-name entry. The interface specified for <code>upto</code> must <i>not</i> be the same as the interface specified for <i>interface-name</i>.</p>
Usage Guidelines	See “Configuring the Router as an Extended DHCP Local Server” on page 198 and “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

interfaces

Syntax

```

interfaces {
  interface-name {
    bootp;
    rarp;
    slarp;
  }
}

```

Hierarchy Level [edit system autoinstallation]

Release Information Statement introduced before JUNOS Release 7.4.

Description For J Series Services Routers only. Configure the interface on which to perform autoinstallation. A request for an IP address is sent from the interface. Specify the IP address procurement protocol.

Options bootp

rarp—Send requests over Ethernet interfaces.

slarp—Send requests over serial interfaces.

Usage Guidelines See the *J Series Services Router Basic LAN and WAN Access Configuration Guide*.

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

Related Topics ■ autoinstallation

internet-options

Syntax internet-options {
 tcp-mss *mss-value*;
 (gre-path-mtu-discovery | no-gre-path-mtu-discovery);
 icmpv4-rate-limit {
 bucket-size *bucket-size*;
 packet-rate *packet-rate*;
 }
 icmpv6-rate-limit {
 bucket-size *bucket-size*;
 packet-rate *packet-rate*;
 }
 (ipip-path-mtu-discovery | no-ipip-path-mtu-discovery);
 ipv6-duplicate-addr-detection-transmits;
 (ipv6-reject-zero-hop-limit | no-ipv6-reject-zero-hop-limit);
 (ipv6-path-mtu-discovery | no-ipv6-path-mtu-discovery);
 ipv6-path-mtu-discovery-timeout;
 no-tcp-rfc1323;
 no-tcp-rfc1323-paws;
 (path-mtu-discovery | no-path-mtu-discovery);
 source-port upper-limit <*upper-limit*>;
 (source-quench | no-source-quench);
 tcp-drop-synfin-set;
 }

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure system Internet Protocol options to protect against certain types of DoS attacks.

The remaining statements are explained separately.

Usage Guidelines See “Configuring the JUNOS Software ICMPv4 Rate Limit for ICMPv4 Routing Engine Messages” on page 232, “Configuring the JUNOS Software ICMPv6 Rate Limit for ICMPv6 Routing Engine Messages” on page 233, “Configuring the JUNOS Software for IP-IP Path MTU Discovery on IP-IP Tunnel Connections” on page 233, “Configuring the JUNOS Software for Path MTU Discovery on Outgoing GRE Tunnel Connections” on page 236, “Configuring the JUNOS Software for Path MTU Discovery on Outgoing TCP Connections” on page 236, “Configuring the JUNOS Software for IPv6 Duplicate Address Detection Attempts” on page 235, “Configuring the JUNOS Software for Acceptance of IPv6 Packets with a Zero Hop Limit” on page 235, “Configuring the JUNOS Software to Ignore ICMP Source Quench Messages” on page 236, “Configuring the JUNOS Software to Enable the Router to Drop Packets with the SYN and FIN Bits Set” on page 237, “Configuring the JUNOS Software to Disable TCP RFC 1323 Extensions” on page 237, “Configuring the JUNOS Software to Disable the TCP RFC 1323 PAWS Extension” on page 237, “Configuring the JUNOS Software to Extend the Default Port Address Range” on page 237, and “Configuring TCP MSS on J Series Services Routers” on page 234.

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

ip-address-first

Syntax	ip-address-first;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server pool-match-order], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server pool-match-order], [edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server pool-match-order], [edit system services dhcp-local-server pool-match-order]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Configure the extended DHCP local server to use the IP address method to determine which address-assignment pool to use. The local server uses the IP address in the gateway IP address (giaddr) if one is present in the DHCP client PDU. If no giaddr is present, the local server uses the IP address of the receiving interface to find the address-assignment pool. The DHCP local server uses this method by default when no method is explicitly specified.
Usage Guidelines	See “Configuring the Router as an Extended DHCP Local Server” on page 198.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

ipip-path-mtu-discovery

Syntax	(ipip-path-mtu-discovery no-ipip-path-mtu-discovery);
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure path MTU discovery for outgoing IP-IP tunnel connections: <ul style="list-style-type: none"> ■ ipip-path-mtu-discovery—Path MTU discovery is enabled. ■ no-ipip-path-mtu-discovery—Path MTU discovery is disabled.
Default	Path MTU discovery is enabled.
Usage Guidelines	See “Configuring the JUNOS Software for IP-IP Path MTU Discovery on IP-IP Tunnel Connections” on page 233.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

ipv6-duplicate-addr-detection-transmits

Syntax	ipv6-duplicate-addr-detection-transmits;
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Control the number of attempts for IPv6 duplicate address detection.
Default	The default value is 3.
Usage Guidelines	See “Configuring the JUNOS Software for IPv6 Duplicate Address Detection Attempts” on page 235.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

ipv6-path-mtu-discovery

Syntax	(ipv6-path-mtu-discovery no-ipv6-path-mtu-discovery);
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced in JUNOS Release 9.2.
Description	Configure path MTU discovery for IPv6 packets.
Default	IPv6 path MTU discovery is enabled.
Options	ipv6-path-mtu-discovery—IPv6 path MTU discovery is enabled. no-ipv6-path-mtu-discovery—IPv6 path MTU discovery is disabled.
Usage Guidelines	See “Configuring the JUNOS Software for IPv6 Path MTU Discovery” on page 235.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

ipv6-path-mtu-discovery-timeout

Syntax	ipv6-path-mtu-discovery-timeout <i>minutes</i> ;
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced in JUNOS Release 9.2.
Description	Set IPv6 path MTU discovery timeout interval.
Default	The default timeout is 10 minutes.
Usage Guidelines	See “Configuring the JUNOS Software for IPv6 Path MTU Discovery” on page 235.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

ipv6-reject-zero-hop-limit

Syntax	(ipv6-reject-zero-hop-limit no-ipv6-reject-zero-hop-limit);
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Enable and disable rejecting incoming ipv6 packets with zero hop limit in their header.
Usage Guidelines	See “Configuring the JUNOS Software for Acceptance of IPv6 Packets with a Zero Hop Limit” on page 235.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ no-ipv6-reject-zero-hop-limit

limits

Syntax	limits { active-child-process [<i>process-limit</i>]; }
Hierarchy Level	[edit system services web-management]
Release Information	Statement introduced in JUNOS Release 8.3.
Description	Configure limits on the number of simultaneous HTTPD child processes that can be started to prevent DoS attacks on the HTTP port.
Options	active-child-process [<i>process-limit</i>]—Maximum number of simultaneous HTTPD child processes that can be started. Range: 0 through 32 Default: 5
Usage Guidelines	See the <i>J-Web Interface User Guide</i> .
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

load-key-file

Syntax	load-key-file;
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Load RSA (SSH version 1 and SSH version 2) and DSA (SSH version 2) public keys from a file. The file is a URL containing one or more SSH keys.
Usage Guidelines	See “Configuring the Root Password” on page 63 and “Configuring JUNOS Software User Accounts” on page 75.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

local-certificate

Syntax	local-certificate;
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Import or reference a SSL certificate.
Usage Guidelines	See “Configuring SSL Service for JUNOScript Client Applications” on page 178 and “Importing SSL Certificates for JUNOScript Support” on page 618.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

location

Syntax	<pre>location { altitude <i>feet</i>; building <i>name</i>; country-code <i>code</i>; floor <i>number</i>; hcoord <i>horizontal-coordinate</i>; lata <i>service-area</i>; latitude <i>degrees</i>; longitude <i>degrees</i>; npa-nxx <i>number</i>; postal-code <i>postal-code</i>; rack <i>number</i>; vcoord <i>vertical-coordinate</i>; }</pre>
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the system location in various formats.
Options	<p><i>altitude feet</i>—Number of feet above sea level.</p> <p><i>building name</i>—Name of building. The name of the building can be 1 to 28 characters in length. If the string contains spaces, enclose it in quotation marks (" ").</p> <p><i>country-code code</i>—Two-letter country code.</p> <p><i>floor number</i>—Floor in the building.</p> <p><i>hcoord horizontal-coordinate</i>—Bellcore Horizontal Coordinate.</p> <p><i>lata service-area</i>—Long-distance service area.</p> <p><i>latitude degrees</i>—Latitude in degree format.</p> <p><i>longitude degrees</i>—Longitude in degree format.</p> <p><i>npa-nxx number</i>—First six digits of the phone number (area code and exchange).</p> <p><i>postal-code postal-code</i>—Postal code.</p> <p><i>rack number</i>—Rack number.</p> <p><i>vcoord vertical-coordinate</i>—Bellcore Vertical Coordinate.</p>
Usage Guidelines	See “Configuring the Physical Location of the Router” on page 62.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

log-prefix

Syntax	log-prefix <i>string</i> ;
Hierarchy Level	[edit system syslog host]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Include a text string in each message directed to a remote destination.
Options	<i>string</i> —Text string to include in each message.
Usage Guidelines	See “Adding a Text String to System Log Messages” on page 141.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<i>JUNOS System Log Messages Reference</i>

logical-system-name

Syntax	logical-system-name;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit system services dhcp-local-server authentication username-include],</p> <p>[edit system services dhcp-local-server group <i>group-name</i> authentication username-include]</p>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify that the logical system name is concatenated with the username during the subscriber authentication process. No logical system name is concatenated if the configuration is in the default logical system.
Usage Guidelines	See “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

login

Syntax

```
login {
  announcement text;
  class class-name {
    allow-commands "regular-expression";
    allow-configuration "regular-expression";
    deny-commands "regular-expression";
    deny-configuration "regular-expression";
    idle-timeout minutes;
    login-tip;
    permissions [ permissions ];
  }
  message text;
  password {
    change-type (set-transitions | character-set);
    format (md5 | sha1 | des);
    maximum-length length;
    minimum-changes number;
    minimum-length length;
  }
  retry-options {
    backoff-threshold number;
    backoff-factor seconds;
    minimum-time seconds;
    tries-before-disconnect number;
  }
  user username {
    full-name complete-name;
    uid uid-value;
    class class-name;
    authentication authentication;
    (encrypted-password "password" | plain-text-password);
    ssh-rsa "public-key";
    ssh-dsa "public-key";
  }
}
```

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure user access to the router.

Options The remaining statements are explained separately.

Usage Guidelines See “Configuring User Access” on page 71.

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

login-alarms

Syntax	login-alarms;
Hierarchy Level	[edit system login class admin]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For J Series Services Routers only. Show system alarms automatically when an admin user logs on to the router.
Usage Guidelines	See “Using JUNOS Software to Configure System Alarms to Appear Automatically on J Series Routers” on page 239.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	<i>J Series Services Router Administration Guide</i>

login-tip

Syntax	login-tip;
Hierarchy Level	[edit system login class <i>class-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Enable CLI tips at login.
Default	Disabled.
Usage Guidelines	See “Configuring CLI Tips” on page 88.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

mac-address

Syntax	mac-address;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit system services dhcp-local-server authentication username-include],</p> <p>[edit system services dhcp-local-server group <i>group-name</i> authentication username-include]</p>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify that the MAC address from the client PDU is concatenated with the username during the subscriber authentication process.
Usage Guidelines	See “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

match

Syntax	<code>match "regular-expression";</code>
Hierarchy Level	[edit system syslog file <i>filename</i>], [edit system syslog host <i>hostname</i> other-routing-engine scc-master)], [edit system syslog user (<i>username</i> *)]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Specify a text string that must (or must not) appear in a message for the message to be logged to a destination.
Usage Guidelines	See “Using Regular Expressions to Refine the Set of Logged Messages” on page 146.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

max-configurations-on-flash

Syntax	<code>max-configurations-on-flash <i>number</i>;</code>
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Specify the number of configurations stored on the CompactFlash card.
Options	<i>number</i> —The number of configurations stored on the CompactFlash card. Range: 0 through 49. The most recently saved configuration is number 0, and the oldest saved configuration is number 49.
Usage Guidelines	See “Using JUNOS Software to Specify the Number of Configurations Stored on the CompactFlash Card” on page 227.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

maximum-lease-time

Syntax	maximum-lease-time <i>seconds</i> ;
Hierarchy Level	[edit system services dhcp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For J Series Services Routers only. Specify the maximum length of time in seconds for which a client can request and hold a lease on a DHCP server. Exception: Dynamic BOOTP lease length can exceed the maximum lease length specified.
Options	<i>seconds</i> —The maximum number of seconds the lease can be held.
Usage Guidelines	See “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration
Related Topics	■ default-lease-time

maximum-length

Syntax	maximum-length <i>length</i> ;
Hierarchy Level	[edit system login passwords]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Specify the maximum number of characters allowed in plain-text passwords. Newly created passwords must meet this requirement.
Default	For JUNOS-FIPS software, the maximum number of characters for plain-text passwords is 20. For JUNOS Software, no maximum is set.
Options	<i>length</i> —The maximum number of characters the password can include. Range: 1 to 64 characters
Usage Guidelines	See “Special Requirements for JUNOS Software Plain-Text Passwords” on page 65.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

message

Syntax	message text;
Hierarchy Level	[edit system login]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure a system login message. This message appears before a user logs in.
Options	<i>text</i> —Text of the message.
Usage Guidelines	See “Configuring the JUNOS Software to Display a System Login Message” on page 220.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration
Related Topics	■ announcement

minimum-changes

Syntax	minimum-changes <i>number</i> ;
Hierarchy Level	[edit system login passwords]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Specify the minimum number of character sets (or character set changes) required in plain-text passwords. Newly created passwords must meet this requirement. This statement is used in combination with the change-type statement. If the change-type is character-sets , then the number of character sets included in the password is checked against the specified minimum. If change-type is set-transitions , then the number of character set changes in the password is checked against the specified minimum.
Default	For JUNOS Software, the minimum number of changes is 1. For JUNOS-FIPS software, the minimum number of changes is 3.
Options	<i>number</i> —The minimum number of character sets (or character set changes) required for the password.
Usage Guidelines	See “Special Requirements for JUNOS Software Plain-Text Passwords” on page 65.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ change-type

minimum-length

Syntax	minimum-length <i>length</i> ;
Hierarchy Level	[edit system login passwords]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Specify the minimum number of characters required in plain-text passwords. Newly created passwords must meet this requirement.
Default	For JUNOS Software, the minimum number of characters for plain-text passwords is six. For JUNOS-FIPS software, the minimum number of characters for plain-text passwords is 10.
Options	length—The minimum number of characters the password must include. Range: 6 to 20 characters
Usage Guidelines	See “Special Requirements for JUNOS Software Plain-Text Passwords” on page 65.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ maximum-length

mirror-flash-on-disk

Syntax mirror-flash-on-disk;

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure the hard disk to automatically mirror the contents of the CompactFlash card. The hard disk maintains a synchronized mirror copy of the CompactFlash card contents. Data written to the CompactFlash card is simultaneously updated in the mirrored copy of the hard disk. If the CompactFlash card fails to read data, the hard disk automatically retrieves its mirrored copy of the CompactFlash card. This command is not available on the J Series routers.



CAUTION: We recommend that you disable flash disk mirroring when you upgrade or downgrade the router.

You cannot issue the **request system snapshot** command while the **mirror-flash-on-disk** statement is enabled.



NOTE: After you have enabled or disabled the **mirror-flash-on-disk** statement, you must reboot the router for your changes to take effect. To reboot, issue the **request system reboot** command.

Usage Guidelines See “Configuring Automatic Mirroring of the CompactFlash Card on the Hard Disk Drive” on page 61.

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

multicast-client

Syntax	multicast-client <address>;
Hierarchy Level	[edit system ntp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For NTP, configure the local router to listen for multicast messages on the local network to discover other servers on the same subnet.
Options	<i>address</i> —(Optional) One or more IP addresses. If you specify addresses, the router joins those multicast groups. Default: 224.0.1.1.
Usage Guidelines	See “Configuring the Router to Listen for Multicast Messages Using NTP” on page 121.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

name-server

Syntax	name-server { <i>address</i> ; }
Hierarchy Level	[edit system], [edit system services dhcp], [edit system services dhcp pool], [edit system services dhcp static-binding]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure one or more Domain Name System (DNS) name servers.
Options	<i>address</i> —Address of the name server. To configure multiple name servers, include multiple <i>address</i> options.
Usage Guidelines	See “Configuring a DNS Name Server for Resolving a Hostname into Addresses” on page 59 and “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

no-compress-configuration-files

See compress-configuration-files.

no-gre-path-mtu-discovery

See gre-path-mtu-discovery.

no-ipip-path-mtu-discovery

See ipip-path-mtu-discovery.

no-ipv6-reject-zero-hop-limit

See ipv6-reject-zero-hop-limit.

no-multicast-echo

Syntax no-multicast-echo;

Hierarchy Level [edit system]

Release Information Statement introduced in JUNOS Release 8.1

Description Disable the Routing Engine from responding to ICMP echo requests sent to multicast group addresses.

Default The Routing Engine responds to ICMP echo requests sent to multicast group addresses.

Usage Guidelines See “Configuring the JUNOS Software to Disable the Routing Engine Response to Multicast Ping Packets” on page 175.

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

no-path-mtu-discovery

See path-mtu-discovery.

no-ping-record-route

Syntax	no-ping-record-route;
Hierarchy Level	[edit system]
Release Information	Statement introduced in JUNOS Release 9.4.
Description	Configure the JUNOS Software to disable the reporting of the IP address in ping responses.
Usage Guidelines	See “Configuring the JUNOS Software to Disable the Reporting of IP Address and Timestamps in Ping Responses” on page 175.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

no-ping-time-stamp

Syntax	no-ping-time-stamp;
Hierarchy Level	[edit system]
Release Information	Statement introduced in JUNOS Release 9.4.
Description	Configure the JUNOS Software to disable the recording of timestamps in ping responses.
Usage Guidelines	See “Configuring the JUNOS Software to Disable the Reporting of IP Address and Timestamps in Ping Responses” on page 175.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

no-redirects

Syntax	no-redirects;
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Disable the sending of protocol redirect messages by the router.</p> <p>To disable the sending of redirect messages on a per-interface basis, include the <code>no-redirects</code> statement at the [edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> family <i>family</i>] hierarchy level.</p>
Default	The router sends redirect messages.
Usage Guidelines	See “Configuring the JUNOS Software to Disable Protocol Redirect Messages on the Router” on page 173.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>
Related Topics	<i>JUNOS Network Interfaces Configuration Guide</i>

no-remote-trace

See tracing.

no-saved-core-context

See saved-core-context.

no-source-quench

See source-quench.

no-tcp-rfc1323

Syntax	no-tcp-rfc1323;
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the JUNOS Software to disable RFC 1323 TCP extensions.
Usage Guidelines	See “Configuring the JUNOS Software to Disable TCP RFC 1323 Extensions” on page 237.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

no-tcp-rfc1323-paws

Syntax	no-tcp-rfc1323-paws;
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the JUNOS Software to disable the RFC 1323 Protection Against Wrapped Sequence (PAWS) number extension.
Usage Guidelines	See “Configuring the JUNOS Software to Disable the TCP RFC 1323 PAWS Extension” on page 237.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

no-world-readable

See world-readable.

ntp

Syntax ntp {
 authentication-key *number* type *type* value *password*;
 boot-server *address*;
 broadcast <*address*> <*key key-number*> <*version value*> <*ttl value*>;
 broadcast-client;
 multicast-client <*address*>;
 peer *address* <*key key-number*> <*version value*> <*prefer*>;
 server *address* <*key key-number*> <*version value*> <*prefer*>;
 source-address *source-address*;
 trusted-key [*key-numbers*];
 }

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure NTP on the router.

Options The remaining statements are explained separately.

Usage Guidelines See “Synchronizing and Coordinating Time Distribution Using NTP” on page 114.

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

option-60

Syntax	option-60;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit system services dhcp-local-server authentication username-include],</p> <p>[edit system services dhcp-local-server group <i>group-name</i> authentication username-include]</p>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify that the payload of option 60 (vendor class identifier) from the client PDU be concatenated with the username during the subscriber authentication process.
Usage Guidelines	See “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

option-82 (Extended DHCP Local Server)

Syntax	option-82;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server pool-match-order], [edit logical-systems <i>logical-system-name</i> system services dhcp-local-server pool-match-order], [edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server pool-match-order], [edit system services dhcp-local-server pool-match-order]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Configure the extended DHCP local server to use the option 82 value in the DHCP client DHCP PDU together with the ip-address-first method to determine which address-assignment pool to use. You must configure the ip-address-first statement before configuring the option-82 statement. The DHCP local server first determines which address-assignment pool to use based on the ip-address-first method. Then, the local server matches the option 82 value in the client PDU with the option 82 configuration in the address-assignment pool.
Usage Guidelines	See “Configuring the Router as an Extended DHCP Local Server” on page 198.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

option-82 (Subscriber Access Management)

Syntax	<code>option-82 <circuit-id> <remote-id>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit system services dhcp-local-server authentication username-include],</p> <p>[edit system services dhcp-local-server group <i>group-name</i> authentication username-include]</p>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify the type of Option 82 information from the client PDU that is concatenated with the username during the subscriber authentication process. You can specify either, both, or neither of the Agent Circuit ID and Agent Remote ID suboptions. If you specify both, the Agent Circuit ID is supplied first, followed by a delimiter, and then the Agent Remote ID. If you specify that neither suboption is supplied, the raw payload of Option 82 from the PDU is concatenated to the username.
Options	<p><code>circuit-id</code>—The string for the Agent Circuit ID suboption (suboption 1).</p> <p><code>remote-id</code>—The string for the Agent Remote ID suboption (suboption 2).</p>
Usage Guidelines	See “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p><code>system</code>—To view this statement in the configuration.</p> <p><code>system-control</code>—To add this statement to the configuration.</p>

optional

Syntax	optional;
Hierarchy Level	[edit system scripts commit file <i>filename</i>]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	For JUNOS commit scripts, allow a commit operation to succeed even if the script specified in the file statement is missing from the <code>/var/db/scripts/commit</code> directory on the router. The optional statement allows the commit operation to progress as if the commit script were not enabled in the configuration.
Usage Guidelines	See the <i>JUNOS Configuration and Diagnostic Automation Guide</i> .
Required Privilege Level	maintenance—To view this statement in the configuration. maintenance-control—To add this statement to the configuration.

outbound-ssh

Syntax [edit system services]
 outbound-ssh {
 client *client-id* {
 address {
 port *port-number*;
 retry *number*;
 timeout *seconds*;
 }
 device-id *device-id*;
 keep-alive {
 retry *number*;
 timeout *seconds*;
 }
 reconnect-strategy (in-order | sticky);
 secret *password*;
 services netconf;
 }
 traceoptions {
 file filename <files *number*> <match *regex*> <size *size*> <world-readable |
 no-world-readable>;
 flag *flag*;
 no-remote-trace;
 }
 }

Hierarchy Level [edit system services]

Release Information Statement introduced in JUNOS Release 8.4.

Description Configure a router running the JUNOS Software behind a firewall to communicate with client management applications on the other side of the firewall.

Default To configure transmission of the router's device ID to the application, include the `device-id` statement at the [edit system services] hierarchy level.

Options `client-id`—Identifies the `outbound-ssh` configuration stanza on the router. Each `outbound-ssh` stanza represents a single outbound SSH connection. This attribute is not sent to the client.

`device-id`—Identifies the router to the client during the initiation sequence.

`secret`—(Optional) Specifies the JUNOS router's public SSH host key. If added to the `outbound-ssh` statement, during the initialization of the outbound SSH service, the router passes its public key to the management server. This is the recommended method of maintaining a current copy of the router's public key.

`keep-alive`—(Optional) When configured, specifies that the router send keepalive messages to the management server. To configure the keepalive message, you must set both the `timeout` and `retry` attributes.

retry—Specifies the number of keepalive messages the router sends without receiving a response from the client before the current SSH connection will be disconnected. The default is three messages.

timeout—Specifies the amount of time that the JUNOS server waits for data before sending a keep alive signal. The default is 15 seconds.

reconnect-strategy—(Optional) Specifies the method the JUNOS router uses to reestablish a disconnected outbound SSH connection. Two methods available:

- **sticky**—Specifies that the router attempt to reconnect to the management server that it was last connected with first. If the connection is unavailable, it attempts to establish a connection with the next client on the list and so forth until a connection is made.
- **in-order**—Specifies that the router attempt to establish an outbound SSH session based on the management server address list. The router attempts to establish a session with the first server on the list. If this connection is not available, the router attempts to establish a session with the next server, and so on down the list until a connection is established.

When reconnecting to a client, the router attempts to reconnect to the client based on the **retry** and **timeout** values for each client listed.

services—Specifies the services available for the session. Currently, NETCONF is the only service available.

address—Indicates the hostname or the IPv4 address of the NSM application server. You can list multiple clients by adding each client's IP address or hostname along with the following connection parameters:

- **port**—Sets the outbound SSH port for the client. The default is port 22.
- **retry**—Specifies the number of times the JUNOS router will attempt to establish an outbound SSH connection before giving up. The default is 3 tries.
- **timeout**—Sets the amount of time that the router attempts to establish an outbound SSH connection before giving up. The default is 15 seconds.

filename—(Optional) By default, the file name of the log file used to record the trace options is the name of traced process (for example **mib2d** or **snmpd**). Use this option to override the default value.

files—(Optional) The maximum number of trace files generated. By default, the maximum number of trace files is 10. Use this option to override the default value.

When a trace file reaches its maximum size, the system archives the file and starts a new file. The system archives trace files by appending a number to the file name in sequential order from 1 to the maximum value (specified by the default value or the options value set here). Once the maximum value is reached, the numbering sequence is restarted at 1, overwriting the older file.

size—(Optional) The maximum size of the trace file in kilobytes (KB). Once the maximum file size is reached, the system archives the file. The default value is 1000 KB. Use this option to override the default value.

match—(Optional) When used, the system only adds lines to the trace file that match the regular expression specified. For example, if the match value is set to `=error`, the system only records lines to the trace file that include the string `error`.

world-readable | no-world-readable—(Optional) This option specifies whether the files are accessible by the originator of the trace operation only or by any user. By default, log files are only accessible by the user that started the trace operation (`no-world-readable`).

all | configuration | connectivity—(Optional) This flag specifies the type of tracing operation to perform.

all—Log all events.

configuration—Log all events pertaining to the configuration of the router.

connectivity—Log all events pertaining to the establishment of a connection between the client server and the router.

no-remote-trace—(Optional) Disables remote tracing.

Usage Guidelines See “Configuring Outbound SSH Service” on page 215.

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

packet-rate

Syntax `packet-rate packet-rate;`

Hierarchy Level `[edit system internet-options icmpv4-rate-limit],`
`[edit system internet-options icmpv6-rate-limit]`

Release Information Statement introduced before JUNOS Release 7.4.

Description The rate-limiting packets earned per second.

Options `packet-rate`
Range: 0 through 4294967295 seconds
Default: 1000

Usage Guidelines See “Configuring the JUNOS Software ICMPv6 Rate Limit for ICMPv6 Routing Engine Messages” on page 233 and “Configuring the JUNOS Software ICMPv4 Rate Limit for ICMPv4 Routing Engine Messages” on page 232.

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

password (Login)

Syntax password {
 change-type (set-transitions | character-set);
 format (md5 | sha1 | des);
 maximum-length *length*;
 minimum-changes *number*;
 minimum-length *length*;
 }

Hierarchy Level [edit system login]

Release Information Statement introduced in JUNOS Release 7.4.

Description Configure special requirements such as character length and encryption format for plain-text passwords. Newly created passwords must meet these requirements.

Options The remaining statements are explained separately.

Usage Guidelines See “Special Requirements for JUNOS Software Plain-Text Passwords” on page 65.

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

Related Topics ■ maximum-length

password (Subscriber Access Management)

Syntax	<code>password <i>password-string</i>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server authentication],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i> authentication],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication],</p> <p>[edit system services dhcp-local-server authentication],</p> <p>[edit system services dhcp-local-server group <i>group-name</i> authentication]</p>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Configure the password that is sent to the external AAA authentication server for subscriber authentication.
Options	<i>password-string</i> —Authentication password.
Usage Guidelines	See “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

path-mtu-discovery

Syntax	(path-mtu-discovery no-path-mtu-discovery);
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Configure path MTU discovery for outgoing Transmission Control Protocol (TCP) connections:</p> <ul style="list-style-type: none">■ path-mtu-discovery—Path MTU discovery is enabled.■ no-path-mtu-discovery—Path MTU discovery is disabled.
Default	Path MTU discovery is disabled.
Usage Guidelines	See “Configuring the JUNOS Software for Path MTU Discovery on Outgoing TCP Connections” on page 236.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

peer

Syntax	<code>peer address <key key-number> <version value> <prefer>;</code>
Hierarchy Level	[edit system ntp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For NTP, configure the local router to operate in symmetric active mode with the remote system at the specified address. In this mode, the local router and the remote system can synchronize with each other. This configuration is useful in a network in which either the local router or the remote system might be a better source of time.
Options	<p>address—Address of the remote system. You must specify an address, not a hostname.</p> <p>key key-number—(Optional) All packets sent to the address include authentication fields that are encrypted using the specified key number. Range: Any unsigned 32-bit integer</p> <p>prefer—(Optional) Mark the remote system as the preferred host, which means that if all other factors are equal, this remote system is chosen for synchronization among a set of correctly operating systems.</p> <p>version value—(Optional) Specify the NTP version number to be used in outgoing NTP packets. Range: 1 through 4 Default: 4</p>
Usage Guidelines	See “Configuring the NTP Time Server and Time Services” on page 117.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

permissions

Syntax	<code>permissions [<i>permissions</i>];</code>
Hierarchy Level	[edit system login class]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the login access privileges to be provided on the router.
Options	<i>permissions</i> —Privilege type. For a list of permission flag types, see Table 7 on page 79.
Usage Guidelines	See “Configuring Access Privilege Levels” on page 81.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ user

pic-console-authentication

Syntax	<pre>pic-console authentication { (encrypted-password "password" plain-text-password); }</pre>
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure console access to Physical Interface Cards (PICs).
Default	Disabled. By default, there is no password setting for console access.
Options	<p>encrypted-password "password"—Use MD5 or other encrypted authentication. Specify the MD5 or other password. You can specify only one encrypted password.</p> <p>You cannot configure a blank password for encrypted-password using blank quotation marks (" "). You must configure a password whose number of characters range from 1 through 128 characters and enclose the password in quotation marks.</p> <p>plain-text-password—Use a plain-text password. The CLI prompts you for the password and then encrypts it. The CLI displays the encrypted version, and the software places the encrypted version in its user database. You can specify only one plain-text password.</p> <p>The default requirements for plain-text passwords are:</p> <ul style="list-style-type: none"> ■ The password must be between 6 and 128 characters long <ul style="list-style-type: none"> ■ You can include most character classes in a password (uppercase letters, lowercase letters, numbers, punctuation marks, and other special characters). Control characters are not recommended. ■ Valid passwords must contain at least one change of case or character class.
Usage Guidelines	See “Configuring Password Authentication for Console Access to PICs” on page 219.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>
Related Topics	<ul style="list-style-type: none"> ■ Configuring the JUNOS Software to Set Console and Auxiliary Port Properties on a Router Craft Interface on page 172

pool

Syntax `pool address/prefix-length {
 address-range {
 low address;
 high address;
 }
 exclude-address {
 address;
 }
 }`

Hierarchy Level [edit system services dhcp]

Release Information Statement introduced before JUNOS Release 7.4.

Description For J Series Services Routers only. Configure a pool of IP addresses for DHCP clients on a subnet. When a client joins the network, the DHCP server dynamically allocates an IP address from this pool.

Options **address-range**—Lowest and highest IP addresses in the pool that are available for dynamic address assignment. If no range is specified, the pool will use all available addresses within the subnet specified. (Broadcast addresses, interface addresses, and excluded addresses are not available.)

exclude-address—Addresses within the range that are not used for dynamic address assignment. You can exclude one or more addresses within the range.

Usage Guidelines See “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.

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

pool-match-order

Syntax	pool-match-order { ip-address-first; option-82; }
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server], [edit logical-systems <i>logical-system-name</i> system services dhcp-local-server], [edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server], [edit system services dhcp-local-server]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Configure the order in which the DHCP local server uses information in the DHCP client PDU to determine how to obtain an address for the client. By default, the DHCP local server uses the ip-address-first method to determine which address pool to use. The statements are explained separately.
Usage Guidelines	See “Configuring the Router as an Extended DHCP Local Server” on page 198.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

port (HTTP/HTTPS)

Syntax	port <i>port-number</i> ;
Hierarchy Level	[edit system services web-management]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the port on which the HTTP or HTTPS service is connected.
Options	<i>port</i> —The TCP port number on which the specified service listens.
Usage Guidelines	See the <i>J-Web Interface User Guide</i> .
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ web-management ■ http ■ https

port (RADIUS Server)

Syntax	<code>port port-number;</code>
Hierarchy Level	[edit system radius-server <i>address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the port number on which to contact the RADIUS server.
Options	<i>number</i> —Port number on which to contact the RADIUS server. Default: 1812 (as specified in RFC 2865)
Usage Guidelines	See “Configuring RADIUS Authentication” on page 89.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

port (SRC Server)

Syntax	<code>port port-number;</code>
Hierarchy Level	[edit system services service-deployment servers <i>server-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the port number on which to contact the SRC server.
Options	<i>port-number</i> —(Optional) The TCP port number for the SRC server. Default: 3333
Usage Guidelines	See “Configuring the JUNOS Software to Work with SRC Software” on page 232.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

port (TACACS+ Server)

Syntax	<code>port port-number;</code>
Hierarchy Level	[edit system accounting destination tacplus server <i>server-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the port number on which to contact the TACACS+ server.
Options	<i>number</i> —Port number on which to contact the TACACS+ server. Default: 49
Usage Guidelines	See “Configuring TACACS+ System Accounting” on page 230.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

ports

Syntax	<pre> ports { auxiliary { type <i>terminal-type</i>; } console { type <i>terminal-type</i>; } } </pre>
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the properties of the console and auxiliary ports, which are located on the router's craft interface.
Options	The remaining statements are explained separately.
Usage Guidelines	See “Configuring the JUNOS Software to Set Console and Auxiliary Port Properties on a Router Craft Interface” on page 172.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

processes

Syntax `processes {
 process-name (enable | disable) failover (alternate-media | other-routing-engine);
 timeout seconds;
 }`

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure which JUNOS Software processes are running on the router.



CAUTION: Never disable any of the software processes unless instructed to do so by a customer support engineer.

Default All processes are enabled by default.

Options (enable | disable)—(Optional) Enables or disables a specified process.

`failover (alternate-media | other-routing-engine)`—(Optional) For routers with redundant Routing Engines only, switch to backup media if a process fails repeatedly. If a process fails four times within 30 seconds, the router reboots from the alternate media or the other Routing Engine.

`process-name`—One of the valid process names. You can obtain a complete list of process names by using the CLI command completion feature. After specifying a process name, command completion also indicates any additional options for that process.

`timeout seconds`—(Optional) How often the system checks the watchdog timer, in seconds. If the watchdog timer has not been checked in the specified number of seconds, the system reloads. If you set the time value too low, it is possible for the system to reboot immediately after it loads.

Range: 15, 60, 180

Default: 180 seconds (rounded up to 291 seconds by the JUNOS kernel)

Usage Guidelines See “Disabling JUNOS Software Processes” on page 221.

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

protocol-version

Syntax	<code>protocol-version <i>version</i>;</code>
Hierarchy Level	[edit system services ssh]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Specify the secure shell (SSH) protocol version.
Options	<i>version</i> —v1, v2, or [v1 v2] Default: v2
Usage Guidelines	See “Configuring the SSH Protocol Version” on page 214.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

radius

Syntax	<pre>radius { server { server-address { accounting-port <i>port-number</i>; secret <i>password</i>; source-address <i>address</i>; retry <i>number</i>; timeout <i>seconds</i>; } } }</pre>
Hierarchy Level	[edit system accounting destination]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Configure the RADIUS accounting server.
Options	<i>server-address</i> —Address of the RADIUS accounting server. The remaining statements are explained separately.
Usage Guidelines	See “Configuring RADIUS System Accounting” on page 227.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

radius-options

Syntax	radius-options { attributes { nas-ip-address <i>ip-address</i> ; } password-protocol <i>mschap-v2</i> ; }
Hierarchy Level	[edit system]
Release Information	Statement introduced in JUNOS Release 8.3. MS-CHAPv2 password protocol configuration option introduced in JUNOS Release 9.2.
Description	Configure RADIUS options for the NAS-IP address for outgoing RADIUS packets and password protocol used in RADIUS packets.
Options	<i>ip-address</i> —IP address of the network access server (NAS) that requests user authentication. <i>mschap-v2</i> —Protocol MS-CHAPv2, used for password authentication and password changing.
Usage Guidelines	See “Configuring MS-CHAPv2 for Password-Change Support” on page 90.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

radius-server

Syntax radius-server *server-address* {
 accounting-port *port-number*;
 port *number*;
 retry *number*;
 routing-instance *routing-instance-name*;
 secret *password*;
 source-address *source-address*;
 timeout *seconds*;
 }

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure a RADIUS server for Point-to-Point Protocol (PPP).

To configure multiple RADIUS servers, include multiple **radius-server** statements. The servers are tried in order and in a round-robin fashion until a valid response is received from one of the servers or until all the configured retry limits are reached.

Options *server-address*—Address of the RADIUS authentication server.

The remaining statements are explained separately.

Usage Guidelines See “Configuring RADIUS Authentication” on page 89.

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

rate-limit

Syntax	<code>rate-limit <i>limit</i>;</code>
Hierarchy Level	[edit system services finger], [edit system services ftp], [edit system services ssh], [edit system services telnet], [edit system services xnm-clear-text], [edit system services xnm-ssl]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Maximum number of connection attempts on an access service.
Options	<code>rate-limit <i>limit</i></code> —(Optional) Maximum number of connection attempts allowed per minute. Range: 1 through 250 Default: 150
Usage Guidelines	See “Configuring System Services for Remote Router Access” on page 176.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

refresh

Syntax	<code>refresh;</code>
Hierarchy Level	[edit system scripts commit], [edit system scripts commit file <i>filename</i>]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	For JUNOS commit scripts, overwrite the local copy of all enabled commit scripts or a single enabled script located in the <code>/var/db/scripts/commit</code> directory with the copy located at the source URL, as specified in the <code>source</code> statement.
Usage Guidelines	See the <i>JUNOS Configuration and Diagnostic Automation Guide</i> .
Required Privilege Level	maintenance—To view this statement in the configuration. maintenance-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ <code>refresh-from</code> ■ <code>source</code>

refresh-from

Syntax	<code>refresh-from url;</code>
Hierarchy Level	[edit system scripts commit], [edit system scripts commit file <i>filename</i>]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	For JUNOS commit scripts, overwrite the local copy of all enabled commit scripts or a single enabled script located in the <code>/var/db/scripts/commit</code> directory with the copy located at a URL other than the URL specified in the <code>source</code> statement.
Options	<code>url</code> —The source specified as an HTTP URL, FTP URL, or SCP-style remote file specification.
Usage Guidelines	See the <i>JUNOS Configuration and Diagnostic Automation Guide</i> .
Required Privilege Level	<code>maintenance</code> —To view this statement in the configuration. <code>maintenance-control</code> —To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none">■ <code>refresh</code>■ <code>source</code>

retry

Syntax	<code>retry number;</code>
Hierarchy Level	[edit system radius-server <i>server-address</i>], [edit system accounting destination radius server <i>server-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Number of times the router is allowed to try to contact a RADIUS authentication or accounting server.
Options	<i>number</i> —Number of retries allowed for contacting a RADIUS server. Range: 1 through 10 Default: 3
Usage Guidelines	See “Configuring RADIUS Authentication” on page 89 and “Configuring RADIUS System Accounting” on page 227.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ timeout

retry-options

Syntax	<pre> retry-options { backoff-threshold <i>number</i>; backoff-factor <i>seconds</i>; minimum-time <i>seconds</i>; tries-before-disconnect <i>number</i>; }</pre>
Hierarchy Level	[edit system login]
Release Information	Statement introduced in JUNOS Release 8.0.
Description	Maximum number of times a user can attempt to enter a password while logging in through SSH or Telnet before being disconnected.
Options	<p>backoff-threshold <i>number</i>—Threshold for the number of failed login attempts before the user experiences a delay when attempting to reenter a password. Use the backoff-factor option to specify the length of delay, in seconds. Range: 1 through 3 Default: 2</p> <p>backoff-factor <i>seconds</i>—Length of delay after each failed login attempt. The length of delay increases by this value for each subsequent login attempt after the value specified in the backoff-threshold option. Range: 5 through 10 Default: 5</p> <p>minimum-time <i>seconds</i>—Minimum length of time that the connection remains open while the user is attempting to enter a password to log in. Range: 20 through 60 Default: 20</p> <p>tries-before-disconnect <i>number</i>—Maximum number of times a user is allowed to attempt to enter a password to log in through SSH or Telnet. Range: 1 through 10 Default: 10</p>
Usage Guidelines	See “Limiting the Number of User Login Attempts for SSH and Telnet Sessions” on page 76.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ rate-limit

root-authentication

Syntax	<pre>root-authentication { (encrypted-password "password" plain-text-password); ssh-dsa "public-key"; ssh-rsa "public-key"; }</pre>
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the authentication methods for the root-level user, whose username is root.
Options	<p>encrypted-password "password"—Use MD5 or other encrypted authentication. Specify the MD5 or other password. You can specify only one encrypted password.</p> <p>You cannot configure a blank password for encrypted-password using blank quotation marks (" "). You must configure a password whose number of characters range from 1 through 128 characters and enclose the password in quotation marks.</p> <p>plain-text-password—Use a plain-text password. The CLI prompts you for the password and then encrypts it. The CLI displays the encrypted version, and the software places the encrypted version in its user database. You can specify only one plain-text password.</p> <p>ssh-dsa "public-key"—SSH version 2 authentication. Specify the DSA (SSH version 2) public key. You can specify one or more public keys.</p> <p>ssh-rsa "public-key"—SSH version 1 authentication. Specify the RSA (SSH version 1 and SSH version 2) public key. You can specify one or more public keys.</p>
Usage Guidelines	See “Configuring the Root Password” on page 63.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ authentication

root-login

Syntax	root-login (allow deny deny-password);
Hierarchy Level	[edit system services ssh]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Control user access through SSH.
Options	<p>allow—Allow users to log in to the router as root through SSH.</p> <p>Default: allow</p> <p>deny—Disable users from logging in to the router as root through SSH.</p> <p>deny-password—Allow users to log in to the router as root through SSH when the authentication method (for example, RSA authentication) does not require a password.</p>
Usage Guidelines	See “Configuring the Root Login Through SSH” on page 214.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>
Related Topics	■ Configuring SSH Service for Remote Access to the Router on page 213

router

Syntax	<pre>router { address; }</pre>
Hierarchy Level	[edit system services dhcp-service], [edit system services dhcp-service pool], [edit system services dhcp-service static-binding]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For J Series Services Routers only. Specify IPv4 addresses for one or more routers available to a DHCP client. List routers in order of preference.
Options	address—IPv4 address of the router. To configure multiple routers, include multiple address options.
Usage Guidelines	See “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

routing-instance-name

Syntax	routing-instance-name;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit system services dhcp-local-server authentication username-include],</p> <p>[edit system services dhcp-local-server group <i>group-name</i> authentication username-include]</p>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify that the routing instance name is concatenated with the username during the subscriber authentication process. No routing instance name is concatenated if the configuration is in the default routing instance.
Usage Guidelines	See “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

saved-core-context

Syntax	(saved-core-context no-saved-core-context);
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Configure whether the router saves core files generated by internal JUNOS processes, along with contextual information (system log files and a copy of the current configuration):</p> <ul style="list-style-type: none"> ■ saved-core-context—The router saves each cores file and its associated context in a compressed tar file named <code>/var/tmp/process-name.core.core-number.tgz</code>. ■ no-saved-core-context—The router does not save cores files and their associated context. <p>The router saves core files.</p>
Usage Guidelines	See “Saving Core Files from JUNOS Software Processes” on page 223.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ saved-core-files

saved-core-files

Syntax	saved-core-files <i>number</i> ;
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Save core files generated by internal JUNOS processes, but not the associated contextual information (configuration and system log files).
Options	<i>number</i> —Maximum number of core files to save. Range: 1 through 64
Usage Guidelines	See “Saving Core Files from JUNOS Software Processes” on page 223.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ saved-core-context

scripts

Syntax

```
scripts {
  commit {
    file filename.xml {
      optional;
      refresh;
      refresh-from url;
      source url;
    }
    traceoptions {
      file filename <files number> <size size>;
      flag flag;
    }
  }
}
```

Hierarchy Level [edit system]

Release Information Statement introduced in JUNOS Release 7.4.

Description For JUNOS commit scripts, configure scripting mechanisms.

The statements are explained separately.

Usage Guidelines See the *JUNOS Configuration and Diagnostic Automation Guide*.

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

secret

Syntax	<code>secret password;</code>
Hierarchy Level	[edit system accounting destination radius server <i>server-address</i>], [edit system accounting destination tacplus server <i>server-address</i>], [edit system radius-server <i>server-address</i>], [edit system tacplus-server <i>server-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the password to use with the RADIUS or TACACS+ server. The secret password used by the local router must match that used by the server.
Options	<i>password</i> —Password to use; can include spaces included in quotation marks.
Usage Guidelines	See “Configuring RADIUS Authentication” on page 89, “Configuring TACACS+ Authentication” on page 94, “Configuring TACACS+ System Accounting” on page 230, and “Configuring RADIUS System Accounting” on page 227.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

server (NTP)

Syntax	<code>server address <key key-number> <version value> <prefer>;</code>
Hierarchy Level	[edit system ntp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For NTP, configure the local router to operate in client mode with the remote system at the specified address . In this mode, the local router can be synchronized with the remote system, but the remote system can never be synchronized with the local router.
Options	<p>address—Address of the remote system. You must specify an address, not a hostname.</p> <p>key key-number—(Optional) Use the specified key number to encrypt authentication fields in all packets sent to the specified address. Range: Any unsigned 32-bit integer</p> <p>prefer—(Optional) Mark the remote system as preferred host, which means that if all other things are equal, this remote system is chosen for synchronization among a set of correctly operating systems.</p> <p>version value—(Optional) Specify the version number to be used in outgoing NTP packets. Range: 1 through 4 Default: 4</p>
Usage Guidelines	See “Configuring the NTP Time Server and Time Services” on page 117.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

server (RADIUS Accounting)

Syntax

```
server {
  server-address {
    accounting-port port-number;
    secret password;
    source-address address;
    retry number
    timeout seconds;
  }
}
```

Hierarchy Level [edit system accounting destination radius]

Release Information Statement introduced in JUNOS Release 7.4.

Description Configure RADIUS logging.

The remaining statements are explained separately.

Usage Guidelines See “Configuring RADIUS System Accounting” on page 227.

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

server (TACACS+ Accounting)

Syntax

```
server {
  server-address {
    port port-number;
    secret password;
    single-connection;
    timeout seconds;
  }
}
```

Hierarchy Level [edit system accounting destination tacplus]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure TACACS+ logging.

The remaining statements are explained separately.

Usage Guidelines See “Configuring TACACS+ System Accounting” on page 230.

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

server-identifier

Syntax	<code>server-identifier <i>address</i>;</code>
Hierarchy Level	[edit system services dhcp], [edit system services dhcp pool], [edit system services dhcp static-binding]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>For J Series Services Routers only. Configure a server identifier. This is an optional setting that can be used to identify a DHCP server in a DHCP message. It can also be used as a destination address from clients to servers (for example, when the boot file is set, but not the boot server).</p> <p>Servers include the server identifier in DHCP OFFER messages so that clients can distinguish between multiple lease offers. Clients include the server identifier in DHCP REQUEST messages to select a lease and indicate which offer is accepted from multiple lease offers. Also, clients can use the server identifier to send unicast request messages to specific DHCP servers to renew a current lease.</p> <p>This address must be a manually assigned, static IP address. The server cannot send a request and receive an IP address from itself or another DHCP server.</p>
Default	If no server identifier is set, the DHCP server sets the server identifier based on the primary interface address used by the server to receive a client request. For example, if the client sends a DHCP request and the server receives it on fe-0/0/0 and the primary interface address is 1.1.1.1 , then the server identifier is set to 1.1.1.1 .
Options	<i>address</i> —The IPv4 address of the server. This address must be accessible by all clients served within a specified range of addresses (based on an address pool or static binding).
Usage Guidelines	See “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

servers

Syntax	<code>servers server-address { port port-number; }</code>
Hierarchy Level	[edit system services service-deployment]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure an IPv4 address for the Session and Resource Control (SRC) server.
Options	<i>server-address</i> —The TCP port number. Default: 3333 The remaining statement is explained separately.
Usage Guidelines	See “Configuring the JUNOS Software to Work with SRC Software” on page 232.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

service-deployment

Syntax	<code>service-deployment { servers server-address { port port-number; } source-address source-address; }</code>
Hierarchy Level	[edit system services]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Enable JUNOS Software to work with the Session and Resource Control (SRC) software.
Options	The remaining statements are explained separately.
Usage Guidelines	See “Configuring the JUNOS Software to Work with SRC Software” on page 232.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

services

```

Syntax  services {
            dhcp {
                dhcp_services;
            }
            finger {
                <connection-limit limit>;
                <rate-limit limit>;
            }
            ftp {
                <connection-limit limit>;
                <rate-limit limit>;
            }
            ssh {
                root-login (allow | deny | deny-password);
                protocol-version [v1 v2];
                <connection-limit limit>;
                <rate-limit limit >;
            }
            service-deployment {
                servers server-address {
                    port-number port-number;
                }
                source-address source-address;
            }
            telnet {
                <connection-limit limit>;
                <rate-limit limit>;
            }
            web-management {
                http {
                    interfaces [ interface-names ];
                    port port;
                }
                https {
                    interfaces [ interface-names ];
                    local-certificate name;
                    port port;
                }
                limits {
                    active-child-process [ process-limit ];
                }
                session {
                    idle-timeout [ minutes ];
                    session-limit [ session-limit ];
                }
            }
            xnm-clear-text {
                <connection-limit limit>;
                <rate-limit limit>;
            }
            xnm-ssl {

```

```

    <connection-limit limit>;
    <rate-limit limit>;
    <local-certificate name>
  }
}

```

Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Configure the router so that users on remote systems can access the local router through the DHCP server, finger, rlogin, SSH, telnet, Web management, JUNOScript clear-text, JUNOScript SSL, and network utilities or enable JUNOS Software to work with the Session and Resource Control (SRC) software.</p> <p>The statements are explained separately.</p>
Usage Guidelines	See “Configuring System Services for Remote Router Access” on page 176 and “Configuring the JUNOS Software to Work with SRC Software” on page 232.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

session

Syntax	<pre> session { idle-timeout [<i>minutes</i>]; session-limit [<i>session-limit</i>]; } </pre>
Hierarchy Level	[edit system services web-management]
Release Information	Statement introduced in JUNOS Release 8.3.
Description	Configure limits for the number of minutes a session can be idle before it times out, and configure the number of simultaneous J-Web user login sessions.
Options	<p>idle-timeout <i>minutes</i>—Configure the number of minutes a session can be idle before it times out.</p> <p>Range: 1 through 1440</p> <p>Default: 1440</p> <p>session-limit <i>session-limit</i>—Configure the maximum number of simultaneous J-Web user login sessions.</p> <p>Range: 1 through 1024</p> <p>Default: Unlimited</p>
Usage Guidelines	See the <i>J-Web Interface User Guide</i> .
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

single-connection

Syntax	single-connection;
Hierarchy Level	[edit system tacplus-server <i>server-address</i>], [edit system accounting destination tacplus-server <i>server-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Optimize attempts to connect to a TACACS + server. The software maintains one open TCP connection to the server for multiple requests, rather than opening a connection for each connection attempt.
Usage Guidelines	See “Configuring TACACS + Authentication” on page 94 and “Configuring TACACS + System Accounting” on page 230.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

size

Syntax	size <i>size</i> ;
Hierarchy Level	[edit system syslog archive], [edit system syslog file <i>filename</i> archive]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the maximum amount of data that the JUNOS logging utility writes to a log file <i>logfile</i> before archiving it (closing it, compressing it, and changing its name to <i>logfile.0.gz</i>). The utility then opens and writes to a new file called <i>logfile</i> . For information about the number of archive files that the utility creates in this way, see files .
Options	<p><i>size</i>—Maximum size of each system log file, in kilobytes (KB), megabytes (MB), or gigabytes (GB).</p> <p>Syntax: <i>xk</i> to specify the number of kilobytes, <i>xm</i> for the number of megabytes, or <i>xg</i> for the number of gigabytes</p> <p>Range: 64 KB through 1 GB</p> <p>Default: 128 KB for J Series routers; 1 MB for M Series, MX Series, and T Series routers; 10 MB for TX Matrix and TX Matrix Plus routers</p>
Usage Guidelines	See “Specifying Log File Size, Number, and Archiving Properties” on page 141.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ files ■ JUNOS System Log Messages Reference

source

Syntax	<code>source url;</code>
Hierarchy Level	[edit system scripts commit], [edit system scripts commit file <i>filename</i>]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	For JUNOS commit scripts, specify the location of the source file for all enabled commit scripts or a single enabled script located in the <code>/var/db/scripts/commit</code> directory. When you include the refresh statement, the source URL is the location from which the local copy is refreshed.
Options	<i>url</i> —The source specified as an HTTP URL, FTP URL, or SCP-style remote file specification.
Usage Guidelines	See the <i>JUNOS Configuration and Diagnostic Automation Guide</i> .
Required Privilege Level	maintenance—To view this statement in the configuration. maintenance-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ <code>refresh</code> ■ <code>refresh-from</code>

source-address (NTP, RADIUS, System Logging, or TACACS+)

Syntax	<code>source-address source-address;</code>
Hierarchy Level	[edit system accounting destination radius server <i>server-address</i>], [edit system accounting destination tacplus server <i>server-address</i>], [edit system ntp], [edit system radius-server <i>server-address</i>], [edit system syslog], [edit system tacplus-server <i>server-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Specify a source address for each configured TACACS+ server, RADIUS server, NTP server, or the source address to record in system log messages that are directed to a remote machine.
Options	<i>source-address</i> —A valid IP address configured on one of the router interfaces. For system logging, the address is recorded as the message source in messages sent to the remote machines specified in all <code>host hostname</code> statements at the [edit system syslog] hierarchy level, but not for messages directed to the other Routing Engine or to the TX Matrix router or TX Matrix Plus router in a routing matrix based on a TX Matrix router or TX Matrix Plus router.
Usage Guidelines	See “Specifying a Source Address for the JUNOS Software to Access External RADIUS Servers” on page 91, “Specifying a Source Address for an NTP Server” on page 115, and “Specifying an Alternative Source Address for System Log Messages” on page 136.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

source-address (SRC Software)

Syntax	<code>source-address source-address;</code>
Hierarchy Level	[edit system services service-deployment]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Enable JUNOS Software to work with the Session and Resource Control (SRC) software.
Options	<i>source-address</i> —(Optional) The local IPv4 address to be used as source address for traffic to the SRC server. The source address restricts traffic within the out-of-band network.
Usage Guidelines	See “Configuring the JUNOS Software to Work with SRC Software” on page 232.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

source-port

Syntax	source-port upper-limit <upper-limit>;
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the range of port addresses.
Options	upper-limit <i>upper-limit</i> —(Optional) The range of port addresses and can be a value from 5000 through 65,355.
Usage Guidelines	See “Configuring the JUNOS Software to Extend the Default Port Address Range” on page 237.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

source-quench

Syntax	(source-quench no-source-quench);
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure how the JUNOS Software handles Internet Control Message Protocol (ICMP) source quench messages: <ul style="list-style-type: none"> ■ source-quench—The JUNOS Software ignores ICMP source quench messages. ■ no-source-quench—The JUNOS Software does not ignore ICMP source quench messages.
Default	The JUNOS Software does not ignore ICMP source quench messages.
Usage Guidelines	See “Configuring the JUNOS Software to Ignore ICMP Source Quench Messages” on page 236.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

ssh

Syntax	ssh { root-login (allow deny deny-password); protocol-version [v1 v2]; <connection-limit <i>limit</i> >; <rate-limit <i>limit</i> >; }
Hierarchy Level	[edit system services]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Allow SSH requests from remote systems to the local router. The remaining statements are explained separately.
Usage Guidelines	See “Configuring SSH Service for Remote Access to the Router” on page 213.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

start-time

Syntax	start-time <i>date.time</i> ;
Hierarchy Level	[edit system syslog file <i>filename</i> archive]
Release Information	Statement introduced in JUNOS Release 8.5.
Description	Specify the date and time for a one-time transfer of a system logging archive file to a remote archiving site.
Options	<i>date.time</i> —Date and time at which you want the log file transfer to begin. The format for this value is <i>yyyy-mm-dd.hh:mm</i> .
Usage Guidelines	See “Specifying Log File Size, Number, and Archiving Properties” on page 141.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

static-binding

Syntax	<pre>static-binding mac-address { fixed-address { address; } host client-hostname; client-identifier (ascii client-id hexadecimal client-id); }</pre>
Hierarchy Level	[edit system services dhcp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For J Series Services Routers only. Set static bindings for DHCP clients. A static binding is a mapping between a fixed IP address and the client's MAC address or client identifier.
Options	<p>mac-address—The MAC address of the client. This is a hardware address that uniquely identifies a client on the network.</p> <p>fixed-address address—Fixed IP address assigned to the client. Typically a client has one address assigned, but you can assign more.</p> <p>host client-hostname—Hostname of the client requesting the DHCP server. The name can include the local domain name. Otherwise, the name is resolved based on the domain-name statement.</p> <p>client-identifier (ascii client-id hexadecimal client-id)—Used by the DHCP server to index the database of address bindings. The client identifier is an ASCII string or hexadecimal number and can include a type-value pair as specified in RFC 1700, <i>Assigned Numbers</i>. Either a client identifier or the client's MAC address must be configured to uniquely identify the client on the network.</p>
Usage Guidelines	See “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

static-host-mapping

Syntax	<pre>static-host-mapping { hostname { inet [address]; sysid system-identifier; alias [alias]; } }</pre>
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Map a hostname to one or more IP addresses and aliases, and configure an International Organization for Standardization (ISO) system identifier (system ID).
Options	<p><i>alias alias</i>—(Optional) Alias for the hostname.</p> <p><i>hostname</i>—Fully qualified hostname.</p> <p><i>inet address</i>—IP address. You can specify one or more IP addresses for the host.</p> <p><i>sysid system-identifier</i>—ISO system identifier (system ID). This is the 6-byte portion of the Intermediate System-to-Intermediate System (IS-IS) network service access point (NSAP). We recommend that you use the host's IP address represented in binary-coded decimal (BCD) format. For example, the IP address 208.197.169.18 is 2081.9716.9018 in BCD.</p>
Usage Guidelines	See “Configuring the Hostname of the Router” on page 56.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

structured-data

Syntax structured-data {
 brief;
 }

Hierarchy Level [edit system syslog file *filename*]

Release Information Statement introduced in JUNOS Release 8.3.

Description Write system log messages to the log file in structured-data format, which complies with Internet draft draft-ietf-syslog-protocol-23, *The syslog Protocol* (<http://tools.ietf.org/html/draft-ietf-syslog-protocol-23>).



NOTE: When this statement is included, other statements that specify the format for messages written to the file are ignored (the **explicit-priority** statement at the [edit system syslog file *filename*] hierarchy level and the **time-format** statement at the [edit system syslog] hierarchy level).

Usage Guidelines See “Logging Messages in Structured-Data Format” on page 134.

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

Related Topics ■ explicit-priority
 ■ time-format
 ■ *JUNOS System Log Messages Reference*

syslog

Syntax

```

syslog {
  archive {
    files number;
    size size;
    (world-readable | no-world-readable);
  }
  console {
    facility severity;
  }
  file filename {
    facility severity;
    explicit-priority;
    match "regular-expression";
    structured-data {
      brief;
    }
    archive {
      archive-sites {
        site-name;
      }
      files number;
      size size;
      start-time date.time;
      transfer-interval interval;
      (world-readable | no-world-readable);
    }
  }
  host (hostname | other-routing-engine | scc-master) {
    facility severity;
    explicit-priority;
    facility-override facility;
    log-prefix string;
    match "regular-expression";
  }
  source-address source-address;
  time-format (year | millisecond | year millisecond);
  user (username | *) {
    facility severity;
    match "regular-expression";
  }
}

```

Hierarchy Level [edit system]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure the types of system log messages to log to files, a remote destination, user terminals, or the system console.

The statements are explained separately.

Usage Guidelines	See “JUNOS Software System Log Configuration Overview” on page 125.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<i>JUNOS System Log Messages Reference</i>

system

Syntax	system { ... }
Hierarchy Level	[edit]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure system management properties.
Usage Guidelines	See “System Management Complete Configuration Statements” on page 47.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

tacplus

Syntax	<pre>tacplus { server { server-address { port <i>port-number</i>; secret <i>password</i>; single-connection; timeout <i>seconds</i>; } } }</pre>
Hierarchy Level	[edit system accounting destination]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the Terminal Access Controller Access Control System Plus (TACACS+).
Options	<p><i>server-address</i>—Address of the TACACS+ authentication server.</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring TACACS+ System Accounting” on page 230.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

tacplus-options

Syntax	<pre>tacplus-options { service-name <i>service-name</i>; (no-cmd-attribute-value exclude-cmd-attribute); }</pre>
Hierarchy Level	[edit system]
Release Information	<p>Statement introduced before JUNOS Release 7.4.</p> <p>The no-cmd-attribute-value and exclude-cmd-attribute option introduced in JUNOS Release 8.5.</p>
Description	Configure TACACS + options for authentication and accounting.
Options	<p>service-name <i>service-name</i>—The name of the authentication service used when configuring multiple TACACS + servers to use the same authentication service. Default: junos-exec</p> <p>no-cmd-attribute-value—Set the cmd attribute value to an empty string in the TACACS + accounting start and stop requests to enable logging of accounting records in the correct log file on a TACACS + server.</p> <p>exclude-cmd-attribute—Exclude the cmd attribute value completely from start and stop accounting records to enable logging of accounting records in the correct log file on a TACACS + server.</p>
Usage Guidelines	See “Configuring the Same Authentication Service for Multiple TACACS + Servers” on page 95 and “Configuring TACACS + Server Accounting” on page 230.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

tacplus-server

Syntax	<code>tacplus-server server-address { secret <i>password</i>; single-connection; source-address <i>source-address</i>; timeout <i>seconds</i>; }</code>
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the TACACS+ server.
Options	<i>server-address</i> —Address of the TACACS+ authentication server. The remaining statements are explained separately.
Usage Guidelines	See “Configuring TACACS+ Authentication” on page 94.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

tcp-drop-synfin-set

Syntax	<code>tcp-drop-synfin-set;</code>
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the router to drop packets that have both the SYN and FIN bits set.
Usage Guidelines	See “Configuring the JUNOS Software to Enable the Router to Drop Packets with the SYN and FIN Bits Set” on page 237.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

tcp-mss

Syntax	<code>tcp-mss mss-value;</code>
Hierarchy Level	[edit system internet-options]
Release Information	Statement introduced in JUNOS Release 9.2 of J Series Services Routers software.
Description	<p>(J Series Services Routers only) Enable and specify the TCP maximum segment size (TCP MSS) to be used to replace that of TCP SYN packets whose MSS option is set to a higher value than the value you choose.</p> <p>If the router receives a TCP packet with the SYN bit and MSS option set and the MSS option specified in the packet is larger than the MSS specified by the <code>tcp-mss</code> command, the router replaces the MSS value in the packet with the lower value specified by the <code>tcp-mss</code> statement.</p> <p>This statement enables you to specify the MSS size in TCP SYN packets used during session establishment. Decreasing the MSS size helps to limit packet fragmentation and to protect against packet loss that can occur when a packet must be fragmented to meet the MTU size but the packet's DF (don't fragment) bit is set.</p> <p>Use the <code>tcp-mss</code> statement to specify a lower TCP MSS value than the value in the TCP SYN packets.</p>
Options	<p><i>mss-value</i>—TCP MSS value for SYN packets with a higher MSS value set.</p> <p>Range: 64 through 65535 seconds</p> <p>Default: TCP MSS is disabled.</p>
Usage Guidelines	See “Configuring TCP MSS on J Series Services Routers” on page 234.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

telnet

Syntax telnet {
 <connection-limit *limit*>;
 <rate-limit *limit*>;
 }

Hierarchy Level [edit system services]

Release Information Statement introduced before JUNOS Release 7.4.

Description Allow Telnet connections from remote systems to the local router.

 The remaining statements are explained separately.

Usage Guidelines See “Configuring System Services for Remote Router Access” on page 176.

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

time-format

Syntax time-format (year | millisecond | year millisecond);

Hierarchy Level [edit system syslog]

Release Information Statement introduced before JUNOS Release 7.4.

Description Include the year, the millisecond, or both, in the timestamp on every standard-format system log message. The additional information is included for messages directed to each destination configured by a **file**, **console**, or **user** statement at the [edit system syslog] hierarchy level, but not to destinations configured by a **host** statement.

By default, the timestamp specifies the month, date, hour, minute, and second when the message was logged, for example, **Aug 21 12:36:30**.



NOTE: When the **structured-data** statement is included at the [edit system syslog file *filename*] hierarchy level, this statement is ignored for the file.

Options millisecond—Include the millisecond in the timestamp.

year—Include the year in the timestamp.

Usage Guidelines See “Including the Year or Millisecond in Timestamps” on page 145.

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

Related Topics

- structured-data
- *JUNOS System Log Messages Reference*

timeout

Syntax	timeout <i>seconds</i> ;
Hierarchy Level	[edit system radius-server <i>server-address</i>], [edit system tacplus-server <i>server-address</i>], [edit system accounting destination radius server <i>server-address</i>], [edit system accounting destination tacplus server <i>server-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the amount of time that the local router waits to receive a response from a RADIUS or TACACS+ server.
Options	<i>seconds</i> —Amount of time to wait. Range: 1 through 90 seconds Default: 3 seconds
Usage Guidelines	See “Configuring RADIUS Authentication” on page 89 and “Configuring TACACS+ Authentication” on page 94.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ retry

time-zone

Syntax	<code>time-zone (GMT<i>hour-offset</i> <i>time-zone</i>);</code>
Hierarchy Level	[edit system]
Release Information	Statement introduced before JUNOS Release 7.4. GMT <i>hour-offset</i> option added in JUNOS Release 7.4.
Description	Set the local time zone. To have the time zone change take effect for all processes running on the router, you must reboot the router.
Default	UTC
Options	GMT <i>hour-offset</i> —Set the time zone relative to UTC time. Range: -14 through +12 Default: 0

time-zone—Specify the time zone as UTC, which is the default time zone, or as a string such as PDT (Pacific Daylight Time), or use one of the following continents and major cities:

Africa/Abidjan, Africa/Accra, Africa/Addis_Ababa, Africa/Algiers, Africa/Asmera, Africa/Bamako, Africa/Bangui, Africa/Banjul, Africa/Bissau, Africa/Blantyre, Africa/Brazzaville, Africa/Bujumbura, Africa/Cairo, Africa/Casablanca, Africa/Ceuta, Africa/Conakry, Africa/Dakar, Africa/Dar_es_Salaam, Africa/Djibouti, Africa/Douala, Africa/El_Aaiun, Africa/Freetown, Africa/Gaborone, Africa/Harare, Africa/Johannesburg, Africa/Kampala, Africa/Khartoum, Africa/Kigali, Africa/Kinshasa, Africa/Lagos, Africa/Libreville, Africa/Lome, Africa/Luanda, Africa/Lubumbashi, Africa/Lusaka, Africa/Malabo, Africa/Maputo, Africa/Maseru, Africa/Mbabane, Africa/Mogadishu, Africa/Monrovia, Africa/Nairobi, Africa/Ndjamena, Africa/Niamey, Africa/Nouakchott, Africa/Ouagadougou, Africa/Porto-Novo, Africa/Sao_Tome, Africa/Timbuktu, Africa/Tripoli, Africa/Tunis, Africa/Windhoek

America/Adak, America/Anchorage, America/Anguilla, America/Antigua, America/Aruba, America/Asuncion, America/Barbados, America/Belize, America/Bogota, America/Boise, America/Buenos_Aires, America/Caracas, America/Catamarca, America/Cayenne, America/Cayman, America/Chicago, America/Cordoba, America/Costa_Rica, America/Cuiaba, America/Curacao, America/Dawson, America/Dawson_Creek, America/Denver, America/Detroit, America/Dominica, America/Edmonton, America/El_Salvador, America/Ensenada, America/Fortaleza, America/Glace_Bay, America/Godthab, America/Goose_Bay, America/Grand_Turk, America/Grenada, America/Guadeloupe, America/Guatemala, America/Guayaquil, America/Guyana, America/Halifax, America/Havana, America/Indiana/Knox, America/Indiana/Marengo, America/Indiana/Vevay, America/Indianapolis, America/Inuvik, America/Iqaluit, America/Jamaica, America/Jujuy, America/Juneau, America/La_Paz, America/Lima, America/Los_Angeles, America/Louisville, America/Maceio, America/Managua, America/Manaus, America/Martinique, America/Mazatlan, America/Mendoza, America/Menominee, America/Mexico_City, America/Miquelon, America/Montevideo, America/Montreal, America/Montserrat, America/Nassau, America/New_York, America/Nipigon, America/Nome, America/Noronha, America/Panama, America/Pangnirtung, America/Paramaribo,

America/Phoenix, America/Port-au-Prince, America/Port_of_Spain,
 America/Porto_Acre, America/Puerto_Rico, America/Rainy_River,
 America/Rankin_Inlet, America/Regina, America/Rosario, America/Santiago,
 America/Santo_Domingo, America/Sao_Paulo, America/Scoresbysund,
 America/Shiprock, America/St_Johns, America/St_Kitts, America/St_Lucia,
 America/St_Thomas, America/St_Vincent, America/Swift_Current,
 America/Tegucigalpa, America/Thule, America/Thunder_Bay, America/Tijuana,
 America/Tortola, America/Vancouver, America/Whitehorse, America/Winnipeg,
 America/Yakutat, America/Yellowknife
 Antarctica/Casey, Antarctica/DumontDURville, Antarctica/Mawson, Antarctica/McMurdo,
 Antarctica/Palmer, Antarctica/South_Pole
 Arctic/Longyearbyen
 Asia/Aden, Asia/Alma-Ata, Asia/Amman, Asia/Anadyr, Asia/Aqtau, Asia/Aqtobe,
 Asia/Ashkhabad, Asia/Baghdad, Asia/Bahrain, Asia/Baku, Asia/Bangkok,
 Asia/Beirut, Asia/Bishkek, Asia/Brunei, Asia/Calcutta, Asia/Chungking,
 Asia/Colombo, Asia/Dacca, Asia/Damascus, Asia/Dubai, Asia/Dushanbe,
 Asia/Gaza, Asia/Harbin, Asia/Hong_Kong, Asia/Irkutsk, Asia/Ishigaki, Asia/Jakarta,
 Asia/Jayapura, Asia/Jerusalem, Asia/Kabul, Asia/Kamchatka, Asia/Karachi,
 Asia/Kashgar, Asia/Katmandu, Asia/Krasnoyarsk, Asia/Kuala_Lumpur,
 Asia/Kuching, Asia/Kuwait, Asia/Macao, Asia/Magadan, Asia/Manila, Asia/Muscat,
 Asia/Nicosia, Asia/Novosibirsk, Asia/Omsk, Asia/Phnom_Penh, Asia/Pyongyang,
 Asia/Qatar, Asia/Rangoon, Asia/Riyadh, Asia/Saigon, Asia/Seoul, Asia/Shanghai,
 Asia/Singapore, Asia/Taipei, Asia/Tashkent, Asia/Tbilisi, Asia/Tehran, Asia/Thimbu,
 Asia/Tokyo, Asia/Ujung_Pandang, Asia/Ulan_Bator, Asia/Urumqi, Asia/Vientiane,
 Asia/Vladivostok, Asia/Yakutsk, Asia/Yekaterinburg, Asia/Yerevan
 Atlantic/Azores, Atlantic/Bermuda, Atlantic/Canary, Atlantic/Cape_Verde,
 Atlantic/Faeroe, Atlantic/Jan_Mayen, Atlantic/Madeira, Atlantic/Reykjavik,
 Atlantic/South_Georgia, Atlantic/St_Helena, Atlantic/Stanley
 Australia/Adelaide, Australia/Brisbane, Australia/Broken_Hill, Australia/Darwin,
 Australia/Hobart, Australia/Lindeman, Australia/Lord_Howe, Australia/Melbourne,
 Australia/Perth, Australia/Sydney
 Europe/Amsterdam, Europe/Andorra, Europe/Athens, Europe/Belfast,
 Europe/Belgrade, Europe/Berlin, Europe/Bratislava, Europe/Brussels,
 Europe/Bucharest, Europe/Budapest, Europe/Chisinau, Europe/Copenhagen,
 Europe/Dublin, Europe/Gibraltar, Europe/Helsinki, Europe/Istanbul,
 Europe/Kaliningrad, Europe/Kiev, Europe/Lisbon, Europe/Ljubljana, Europe/London,
 Europe/Luxembourg, Europe/Madrid, Europe/Malta, Europe/Minsk, Europe/Monaco,
 Europe/Moscow, Europe/Oslo, Europe/Paris, Europe/Prague, Europe/Riga,
 Europe/Rome, Europe/Samara, Europe/San_Marino, Europe/Sarajevo,
 Europe/Simferopol, Europe/Skopje, Europe/Sofia, Europe/Stockholm,
 Europe/Tallinn, Europe/Tirane, Europe/Vaduz, Europe/Vatican, Europe/Vienna,
 Europe/Vilnius, Europe/Warsaw, Europe/Zagreb, Europe/Zurich
 Indian/Antananarivo, Indian/Chagos, Indian/Christmas, Indian/Cocos, Indian/Comoro,
 Indian/Kerguelen, Indian/Mahe, Indian/Maldives, Indian/Mauritius, Indian/Mayotte,
 Indian/Reunion
 Pacific/Apia, Pacific/Auckland, Pacific/Chatham, Pacific/Easter, Pacific/Efate,
 Pacific/Enderbury, Pacific/Fakaofu, Pacific/Fiji, Pacific/Funafuti, Pacific/Galapagos,
 Pacific/Gambier, Pacific/Guadalcanal, Pacific/Guam, Pacific/Honolulu,
 Pacific/Johnston, Pacific/Kiritimati, Pacific/Kosrae, Pacific/Kwajalein, Pacific/Majuro,
 Pacific/Marquesas, Pacific/Midway, Pacific/Nauru, Pacific/Niue, Pacific/Norfolk,
 Pacific/Noumea, Pacific/Pago_Pago, Pacific/Palau, Pacific/Pitcairn, Pacific/Ponape,
 Pacific/Port_Moresby, Pacific/Rarotonga, Pacific/Saipan, Pacific/Tahiti,
 Pacific/Tarawa, Pacific/Tongatapu, Pacific/Truk, Pacific/Wake, Pacific/Wallis,
 Pacific/Yap

Usage Guidelines See “Modifying the Default Time Zone for a Router Running JUNOS Software” on page 113.

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

traceoptions (Address-Assignment Pool)

Syntax

```

traceoptions {
  file filename {
    files number;
    size maximum-file-size;
    match regex;
    world-readable | no-world-readable
  }
  flag address-assignment;
  flag all;
  flag configuration;
  flag framework;
  flag ldap;
  flag local-authentication;
  flag radius;
}

```

Hierarchy Level [edit system processes general-authentication-service]

Release Information Flag for tracing address-assignment pool operations introduced in JUNOS Release 9.0. option-name option introduced in JUNOS Release 8.3.

Description Configure tracing options.

Options file *filename*—Name of the file that receives the output of the tracing operation. Enclose the name in quotation marks. All files are placed in the directory `/var/log`.

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

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

Range: 2 through 1000

Default: 3 files

flag *flag*—Tracing operation to perform. To specify more than one tracing operation, include multiple **flag** statements. You can include the following flags:

- address-assignment—All address-assignment events
- all—All tracing operations
- configuration—Configuration events
- framework—Authentication framework events
- ldap—LDAP authentication events
- local-authentication—Local authentication events
- radius—RADIUS authentication events

match *regex*—(Optional) Refine the output to include lines that contain the regular expression.

size *size*—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). If you specify a maximum file size, you also must specify a maximum number of trace files with the **files** option and filename.

Syntax: *xk* to specify KB, *xm* to specify MB, or *xg* to specify GB

Range: 10 KB through 1 GB

Default: 128 KB

world-readable—(Optional) Enable unrestricted file access.

Usage Guidelines See “Tracing Address-Assignment Pool Processes” on page 495.

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

traceoptions (Commit Scripts)

Syntax `traceoptions {
 file filename <files number> <size size>;
 flag flag;
 }`

Hierarchy Level [edit system scripts commit]

Release Information Statement introduced in JUNOS Release 7.4.

Description Define tracing operations for the commit scripts.

Default If you do not include this statement, no commit-script-specific tracing operations are performed.

Options *filename*—Name of the file that receives the output of the tracing operation. Enclose the name in quotation marks. All files are placed in the directory `/var/log`. By default, commit script process tracing output is placed in the file `cscript.log`.

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

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

Range: 2 through 1000

Default: 10 files

flag—Tracing operation to perform. To specify more than one tracing operation, include multiple *flag* statements. You can include the following flags:

- *all*—Log all operations
- *events*—Log important events
- *input*—Log commit script input data
- *offline*—Generate data for offline development
- *output*—Log commit script output data
- *rpc*—Log commit script RPCs
- *xslt*—Log the XSLT library

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

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

Syntax: *xk* to specify KB, *xm* to specify MB, or *xg* to specify GB

Range: 128 KB through 1 GB

Default: 128 KB

Usage Guidelines See the *JUNOS Configuration and Diagnostic Automation Guide*.

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

traceoptions (DHCP Server on J Series Services Routers)

Syntax traceoptions {
 file *filename* <files *number*> <match *regex*> <size *size*> <world-readable |
 no-world-readable>;
 flag *flag*;
 }

Hierarchy Level [edit system services dhcp]

Release Information Statement for tracing J Series Services Router DHCP processes introduced in JUNOS Release 8.0.

Description Define tracing operations for DHCP processes.

Options file *filename*—Name of the file that receives the output of the tracing operation. Enclose the name in quotation marks. All files are placed in the directory `/var/log`.

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

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

Range: 2 through 1000

Default: 3 files

flag *flag*—Tracing operation to perform. To specify more than one tracing operation, include multiple **flag** statements. You can include the following flags.

- all—All tracing operations
- binding—Trace binding operations
- config—Log reading of configuration
- conflict—Trace user-detected conflicts for IP addresses
- event—Trace important events
- ifdb—Trace interface database operations
- io—Trace I/O operations
- lease—Trace lease operations
- main—Trace main loop operations
- misc—Trace miscellaneous operations
- packet—Trace DHCP packets
- options—Trace DHCP options
- pool—Trace address pool operations

- **protocol**—Trace protocol operations
- **rtsock**—Trace routing socket operations
- **scope**—Trace scope operations
- **signal**—Trace DHCP signal operations
- **trace**—All tracing operations
- **ui**—Trace user interface operations

match *regex*—(Optional) Refine the output to include lines that contain the regular expression.

- **all**—All tracing operations
- **binding**—Trace binding operations
- **config**—Log reading of configuration
- **conflict**—Trace user-detected conflicts for IP addresses
- **event**—Trace important events
- **ifdb**—Trace interface database operations
- **io**—Trace I/O operations
- **lease**—Trace lease operations
- **main**—Trace main loop operations
- **misc**—Trace miscellaneous operations
- **packet**—Trace DHCP packets
- **options**—Trace DHCP options
- **pool**—Trace address pool operations
- **protocol**—Trace protocol operations
- **rtsock**—Trace routing socket operations
- **scope**—Trace scope operations
- **signal**—Trace DHCP signal operations
- **trace**—All tracing operations
- **ui**—Trace user interface operations
- **match *regex***—(Optional) Refine the output to include lines that contain the regular expression.

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

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

Syntax: *xk* to specify KB, *xm* to specify MB, or *xg* to specify GB

Range: 10 KB through 1 GB

Default: 128 KB

world-readable—(Optional) Enable unrestricted file access.

Usage Guidelines See “Configuring Tracing Operations for DHCP Processes” on page 194.

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

traceoptions (Extended DHCP Local Server)

Syntax	<pre> traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable> <match <i>regex</i>>; flag <i>flag</i>; } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server],</p> <p>[edit system services dhcp-local-server]</p>
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Define tracing operations for DHCP processes.
Options	<p>file <i>filename</i>—Name of the file that receives the output of the tracing operation. Enclose the name in quotation marks. All files are placed in the directory <code>/var/log</code>.</p> <p>files <i>number</i>—(Optional) Maximum number of trace files. When a trace file named <i>trace-file</i> reaches its maximum size, it is renamed <i>trace-file.0</i>, then <i>trace-file.1</i>, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten.</p> <p>If you specify a maximum number of files, you also must specify a maximum file size with the <i>size</i> option and a filename.</p> <p>Range: 2 through 1000</p> <p>Default: 3 files</p> <p>flag <i>flag</i>—Tracing operation to perform. To specify more than one tracing operation, include multiple <i>flag</i> statements. You can include the following flags:</p> <ul style="list-style-type: none"> ■ all—Trace all operations. ■ auth—Trace authentication operations. ■ database—Trace database events. ■ fwd—Trace firewall process events. ■ general—Trace miscellaneous events. ■ ha—Trace high availability-related events. ■ interface—Trace interface operations. ■ io—Trace I/O operations. ■ packet—Trace packet decoding operations. ■ packet-option—Trace DHCP option decoding operations. ■ rpd—Trace routing protocol process events.

- **rtsock**—Trace routing socket operations.
- **session-db**—Trace session database operations.
- **state**—Trace changes in state.
- **ui**—Trace user interface operations.

match *regex*—(Optional) Refine the output to include lines that contain the regular expression.

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

Syntax: **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

Range: 10 KB through 1 GB

Default: 128 KB

world-readable—(Optional) Enable unrestricted file access.

Usage Guidelines See “Tracing Extended DHCP Local Server Operations” on page 207

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

traceoptions (SBC Configuration Process)

```
Syntax  traceoptions {
    file filename <files number> <match regex> <size size>
    <world-readable | no-world-readable>;
    flag flag;
}
```

Hierarchy Level [edit system processes sbc-configuration-process]

Release Information Statement introduced in JUNOS Release 9.5.

Description	Configure trace options for the session border controller (SBC) process of the border signaling gateway (BSG).
--------------------	--

Options file *filename*—Name of the file that receives the output of the tracing operation. Enclose the name in quotation marks. All files are placed in the directory `/var/log`.

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

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

Range: 2 through 1 000

Default: 3 files

flag flag—Tracing operation to perform. To specify more than one tracing operation, include multiple **flag** statements. You can include the following flags:

- all *trace-level*—Trace all SBC process operations.
- common *trace-level*—Trace common events.
- configuration *trace-level*—Trace configuration events.
- device-monitor *trace-level*—Trace device monitor events.
- ipc *trace-level*—Trace IPC events.
- memory—pool *trace-level*—Trace memory pool events.
- ui *trace-level*—Trace user interface operations.
- *trace-level*—Trace level options are related to the severity of the event being traced. When you choose a trace level, messages at that level and higher levels are captured. Enter one of the following trace levels as the *trace-level*:
 - debug—Log all code flow of control.
 - error—Log failures with a short-term effect.
 - info—Log summary for normal operations, such as the policy decisions made for a call.

- **trace**—Log program trace START and EXIT macros.
- **warning**—Log failure recovery events or failure of an external entity.

match *regex*—(Optional) Refine the output to include lines that contain the regular expression.

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

Syntax: **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB.

Range: 10 KB through 1 GB

Default: 128 KB

no-world-readable—(Optional) Disable unrestricted file access.

world-readable—(Optional) Enable unrestricted file access.

Usage Guidelines See “Troubleshooting the IMMSG” in the *JUNOS Multiplay Solutions Guide*.

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

tracing

Syntax	tracing { destination-override syslog host <i>ip-address</i> ; }
Hierarchy Level	[edit system]
Release Information	Statement introduced in JUNOS Release 9.2.
Description	<p>Configure the router to enable remote tracing to a specified host IP-address. The default setting is disabled.</p> <p>The following processes are supported:</p> <ul style="list-style-type: none"> ■ chassisd—chassis-control process ■ eventd—event-processing process ■ cosd—class-of-service process ■ spd—adaptive-services process <p>You can use the <code>no-remote-trace</code> statement, under the [edit system <process-name> traceoptions] hierarchy, to disable remote tracing.</p>
Options	destination-override syslog host <i>ip-address</i> —Overrides the global config under system tracing and has no effect if system tracing is not configured.
Usage Guidelines	See “JUNOS Software Tracing and Logging Operations” on page 42.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ no-remote-trace ■ destination-override


transfer-interval (Configuration)

Syntax	<code>transfer-interval <i>interval</i>;</code>
Hierarchy Level	[edit system archival configuration]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the router to periodically transfer its currently active configuration to an archive site.
Options	<i>interval</i> —Interval at which to transfer the current configuration to an archive site. Range: 15 through 2880 minutes
Usage Guidelines	See “Configuring the Transfer Interval for Periodic Transfer of the Active Configuration to an Archive Site” on page 225.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none">■ archive■ configuration■ transfer-on-commit

transfer-interval (System Log)

Syntax	<code>transfer-interval interval;</code>
Hierarchy Level	[edit system syslog file <i>filename</i> archive]
Release Information	Statement introduced in JUNOS Release 8.5.
Description	Configure the router to periodically transfer a system log to an archive site.
Options	<i>interval</i> —Interval at which to transfer the current configuration to an archive site. Range: 5 through 2880 minutes
Usage Guidelines	See “Specifying Log File Size, Number, and Archiving Properties” on page 141.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ archive

transfer-on-commit

Syntax	<code>transfer-on-commit;</code>
Hierarchy Level	[edit system archival configuration]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the router to transfer its currently active configuration to an archive site each time you commit a candidate configuration.
	NOTE: When specifying a URL in a JUNOS statement using an IPv6 host address, you must enclose the entire URL in quotation marks (" ") and enclose the IPv6 host address in brackets ([]). For example, <code>"ftp://username<:password>@[ipv6-host-address]<:port>/url-path"</code>
Usage Guidelines	See “Configuring Transfer of the Current Active Configuration When a Configuration Is Committed” on page 226.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ configuration ■ transfer-interval ■ archive

trusted-key

Syntax	trusted-key [<i>key-numbers</i>];
Hierarchy Level	[edit system ntp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For NTP, configure the keys you are allowed to use when you configure the local router to synchronize its time with other systems on the network.
Options	<i>key-numbers</i> —One or more key numbers. Each key can be any 32-bit unsigned integer except 0.
Usage Guidelines	See “Configuring NTP Authentication Keys” on page 120.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ authentication-key ■ broadcast ■ peer ■ server

uid

Syntax	uid <i>uid-value</i> ;
Hierarchy Level	[edit system login user]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure a user identifier for a login account.
Options	<i>uid-value</i> —Number associated with the login account. This value must be unique on the router. Range: 100 through 64000
Usage Guidelines	See “Configuring User Access” on page 71.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

user (Access)

Syntax `user username {
 full-name complete-name;
 uid uid-value;
 class class-name;
 authentication {
 (encrypted-password "password" | plain-text-password);
 ssh-rsa "public-key";
 ssh-dsa "public-key";
 }
 }`

Hierarchy Level [edit system login]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure access permission for individual users.

Options The remaining statements are explained separately.

Usage Guidelines See “Configuring JUNOS Software User Accounts” on page 75.

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

Related Topics ■ class

user (System Logging)

Syntax `user (username | *) {
 facility severity;
 match "regular-expression";
 }`

Hierarchy Level [edit system syslog]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure the logging of system messages to user terminals.

Options * (the asterisk)—Log messages to the terminal sessions of all users who are currently logged in.

facility—Class of messages to log. To specify multiple classes, include multiple *facility severity* statements. For a list of the facilities, see Table 15 on page 132.

severity—Severity of the messages that belong to the facility specified by the paired *facility* name. Messages with severities the specified level and higher are logged. For a list of the severities, see Table 16 on page 132.

username—JUNOS login name of the user whose terminal session is to receive system log messages. To log messages to more than one user's terminal session, include more than one **user** statement.

The remaining statement is explained separately.

Usage Guidelines See "Directing System Log Messages to a User Terminal" on page 134.

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

Related Topics *JUNOS System Log Messages Reference*

username-include

Syntax	<pre>username-include { circuit-type; delimiter <i>delimiter-character</i>; domain-name <i>domain-name-string</i>; logical-system-name; mac-address; option-60; option-82 <circuit-id> <remote-id>; routing-instance-name; user-prefix <i>user-prefix-string</i>; }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server authentication],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i> authentication],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication],</p> <p>[edit system services dhcp-local-server authentication],</p> <p>[edit system services dhcp-local-server group <i>group-name</i> authentication]</p>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	<p>Configure the username that the router passes to the external AAA server. You must include at least one of the optional statements for the username to be valid. If you do not configure a username, the router accesses the local authentication service only and does not use external authentication services, such as RADIUS.</p> <p>The statements are explained separately.</p>
Usage Guidelines	See “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

user-prefix

Syntax	<code>user-prefix user-prefix-string;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server authentication username-include],</p> <p>[edit routing-instances <i>routing-instance-name</i> system services dhcp-local-server group <i>group-name</i> authentication username-include],</p> <p>[edit system services dhcp-local-server authentication username-include],</p> <p>[edit system services dhcp-local-server group <i>group-name</i> authentication username-include]</p>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify the user prefix that is concatenated with the username during the subscriber authentication process.
Options	<i>user-prefix-string</i> —The user prefix string.
Usage Guidelines	See “Using External AAA Authentication Services to Authenticate DHCP Clients” on page 202.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

web-management

Syntax	<pre>web-management { http { interfaces [<i>interface-names</i>]; port <i>port</i>; } https { interfaces [<i>interface-names</i>]; local-certificate <i>name</i>; port <i>port</i>; } }</pre>
Hierarchy Level	[edit system services]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure settings for HTTP or HTTPS access. HTTP access allows management of the router using the browser-based J-Web graphical user interface. HTTPS access allows secure management of the router using the J-Web interface. With HTTPS access, communication between the router Web server and your browser is encrypted.
Options	The remaining statements are explained separately.
Usage Guidelines	See the <i>J-Web Interface User Guide</i> .
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ http ■ https ■ port

wins-server

Syntax	wins-server { <code>address</code> ; }
Hierarchy Level	[edit system services dhcp], [edit system services dhcp pool], [edit system services dhcp static-binding]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For J Series Services Routers only. Specify one or more NetBIOS Name Servers. When a DHCP client is added to the network and assigned an IP address, the NetBIOS Name Server manages the Windows Internet Name Service (WINS) database that matches IP addresses (such as 192.168.1.3) to Windows NetBIOS names (such as \\Marketing). List servers in order of preference.
Options	<code>address</code> —IPv4 address of the NetBIOS Name Server running WINS. To configure multiple servers, include multiple <code>address</code> options.
Usage Guidelines	See “Configuring the Router or Interface to Act as a DHCP Server on J Series Services Routers” on page 178.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

world-readable

Syntax	world-readable no-world-readable;
Hierarchy Level	[edit system syslog archive], [edit system syslog file <i>filename</i> archive]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Grant all users permission to read log files, or restrict the permission only to the root user and users who have the JUNOS maintenance permission.
Default	no-world-readable
Usage Guidelines	See “Specifying Log File Size, Number, and Archiving Properties” on page 141.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<i>JUNOS System Log Messages Reference</i>

xnm-clear-text

Syntax	xnm-clear-text { <connection-limit <i>limit</i> >; <rate-limit <i>limit</i> >; }
Hierarchy Level	[edit system services]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Allow JUNOScript clear-text requests from remote systems to the local router. The remaining statements are explained separately.
Usage Guidelines	See “Configuring clear-text or SSL Service for JUNOScript Client Applications” on page 177.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

xnm-ssl

Syntax	xnm-ssl { <connection-limit <i>limit</i> >; <rate-limit <i>limit</i> >; }
Hierarchy Level	[edit system services]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Allow JUNOScript SSL requests from remote systems to the local router. The remaining statements are explained separately.
Usage Guidelines	See “Configuring SSL Service for JUNOScript Client Applications” on page 178.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

Part 3

Access

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- Summary of Access Configuration Statements on page 499

Chapter 13

Configuring Access

This chapter covers the following topics:

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- Example: Configuring CHAP Authentication with RADIUS on page 441
- Configuring Tracing Operations for Access Processes on page 443
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Access Configuration Statements

To configure access, include the following statements at the [edit access] hierarchy level:

```
[edit access]
address-assignment {
  pool pool-name family inet {
    network address-or-prefix </subnet-mask>;
    range name {
      low lower-limit high upper-limit;
    }
    host hostname {
      hardware-address mac-address;
      ip-address ip-address;
    }
    dhcp-attributes {
      [protocol-specific-attributes];
    }
  }
}
address-pool pool-name {
  address address-or-prefix;
  address-range low <lower-limit> high <upper-limit>;
}
group-profile profile-name {
  l2tp {
    interface-id interface-id;
    lcp-renegotiation;
    local-chap;
    maximum-sessions-per-tunnel number;
    multilink {
      drop-timeout milliseconds;
      fragmentation-threshold bytes;
    }
  }
}
ppp {
  cell-overhead;
  encapsulation-overhead bytes;
  framed-pool pool-id;
  idle-timeout seconds;
  interface-id interface-id;
```

```

        keepalive seconds;
        primary-dns primary-dns;
        primary-wins primary-wins;
        secondary-dns secondary-dns;
        secondary-wins secondary-wins;
    }
}
profile profile-name {
    accounting {
        accounting-stop-on-access-deny;
        accounting-stop-on-failure;
        order [ accounting-method ];
        statistics (time);
        update-interval minutes;
    }
    accounting-order radius;
    authentication {
        order [ authentication-methods ];
    }
    authentication-order [ authentication-methods ];
    client client-name {
        chap-secret chap-secret;
        group-profile profile-name;
        ike {
            allowed-proxy-pair {
                remote remote-proxy-address local local-proxy-address;
            }
            pre-shared-key (ascii-text character-string | hexadecimal hexadecimal-digits);
            ike-policy policy-name
            interface-id interface-id;
        }
    }
    l2tp {
        interface-id interface-id;
        lcp-renegotiation;
        local-chap;
        maximum-sessions-per-tunnel number;
        multilink {
            drop-timeout milliseconds;
            fragmentation-threshold bytes;
        }
        ppp-authentication (chap | pap);
        ppp-profile profile-name;
        shared-secret shared-secret;
    }
    pap-password pap-password;
    ppp {
        cell-overhead;
        encapsulation-overhead bytes;
        framed-ip-address ip-address;
        framed-pool framed-pool;
        idle-timeout seconds;
        interface-id interface-id;
        keepalive seconds;
        primary-dns primary-dns;
        primary-wins primary-wins;
        secondary-dns secondary-dns;
    }
}

```

```

        secondary-wins secondary-wins;
    }
    user-group-profile profile-name;
}
radius {
    authentication-server [ ip-address ];
    accounting-server [ ip-address ];
    options {
        accounting-session-id-format (decimal | description);
        ethernet-port-type-virtual;
        interface-description-format [ sub-interface | adapter ];
        nas-identifier identifier-value;
        nas-port-extended-format {
            adapter-width width;
            port-width width;
            slot-width width;
            stacked-vlan-width width;
            vlan-width width;
        }
        override-nas-information;
        revert-interval interval;
        vlan-nas-port-stacked-format;
    }
    attributes {
        ignore {
            framed-ip-netmask;
            input-filter;
            logical-system-routing-instance;
            output-filter;
        }
    }
    exclude
        accounting-authentic [ accounting-on | accounting-off ];
        accounting-delay-time [ accounting-on | accounting-off ];
        accounting-session-id [ access-request | accounting-on | accounting-off |
            accounting-stop ];
        accounting-terminate-cause [ accounting-off ];
        called-station-id [ access-request | accounting-start | accounting-stop ];
        calling-station-id [ access-request | accounting-start | accounting-stop ];
        class [ accounting-start | accounting-stop ];
        dhcp-options [ access-request | accounting-start | accounting-stop ];
        dhcp-gi-address [ access-request | accounting-start | accounting-stop ];
        dhcp-mac-address [ access-request | accounting-start | accounting-stop ];
        output-filter [ accounting-start | accounting-stop ];
        event-timestamp [ accounting-on | accounting-off | accounting-start |
            accounting-stop ];
        framed-ip-address [ accounting-start | accounting-stop ];
        framed-ip-netmask [ accounting-start | accounting-stop ];
        input-filter [ accounting-start | accounting-stop ];
        input-gigapackets [ accounting-stop ];
        input-gigawords [ accounting-stop ];
        interface-description [ access-request | accounting-start | accounting-stop ];
        nas-identifier [ access-request | accounting-on | accounting-off |
            accounting-start | accounting-stop ];
        nas-port [ access-request | accounting-start | accounting-stop ];
        nas-port-id [ access-request | accounting-start | accounting-stop ];
        nas-port-type [ access-request | accounting-start | accounting-stop ];

```



```

        output-gigapackets [ accounting-stop ];
        output-gigawords [ accounting-stop ];
    }
}
radius-server server-address {
    accounting-port port-number;
    port port-number;
    retry attempts ;
    routing-instance routing-instance-name;
    secret password;
    source-address source-address;
    timeout seconds;
}
}
radius-disconnect {
    client-address {
        secret password;
    }
}
radius-disconnect-port port-number;
radius-server server-address {
    accounting-port port-number;
    port port-number;
    retry attempts;
    routing-instance routing-instance-name;
    secret password;
    source-address source-address;
    timeout seconds;
}
traceoptions {
    flag all;
    flag authentication;
    flag chap;
    flag configuration;
    flag kernel;
    flag radius;
}

```

Configuring the PPP Authentication Protocol

The Point-to-Point Protocol (PPP) is an encapsulation protocol for transporting IP traffic across point-to-point links. To configure the Point-to-Point Protocol (PPP), you can configure the Challenge Handshake Authentication Protocol (CHAP). CHAP allows each end of a PPP link to authenticate its peer, as defined in RFC 1994. The authenticator sends its peer a randomly generated challenge that the peer must encrypt using a one-way hash; the peer must then respond with that encrypted result. The key to the hash is a secret known only to the authenticator and authenticated. When the response is received, the authenticator compares its calculated result with the peer's response. If they match, the peer is authenticated.

Each end of the link identifies itself to its peer by including its name in the CHAP challenge and response packets it sends to the peer. This name defaults to the local hostname, or you can explicitly set it using the **local-name** option. When a host

receives a CHAP challenge or CHAP response packet on a particular interface, it uses the peer identity to look up the CHAP secret key to use.

To configure CHAP, include the `profile` statement at the `[edit access]` hierarchy level:

```
[edit access]
profile profile-name {
  client client-name chap-secret chap-secret;
}
```

Then reference the CHAP profile name at the `[edit interfaces]` hierarchy level.

You can configure multiple CHAP profiles, and configure multiple clients for each profile.

`profile` is the mapping between peer identifiers and CHAP secret keys. The identity of the peer contained in the CHAP challenge or response queries the profile for the secret key to use.

`client` is the peer identity.

`chap-secret` is the secret key associated with that peer.

Example: Configuring PPP CHAP

The following example shows how to configure the profile `pe-A-ppp-clients` at the `[edit access]` hierarchy level; then reference it at the `[edit interfaces]` hierarchy level:

```
[edit]
access {
  profile pe-A-ppp-clients {
    client cpe-1 chap-secret "$1$dQYsZ$B5ojUeUjDsUo.yKwcCZ0";
    # SECRET-DATA
    client cpe-2 chap-secret "$1$kdAsfaDAfkjDsASxfafdKdFKJ";
    # SECRET-DATA
  }
}
interfaces {
  so-1/1/1 {
    encapsulation ppp;
    ppp-options {
      chap {
        access-profile pe-A-ppp-clients;
        local-name "pe-A-so-1/1/1";
      }
    }
  }
  so-1/1/2 {
    encapsulation ppp;
    ppp-options {
      chap {
        passive;
        access-profile pe-A-ppp-clients;
        local-name "pe-A-so-1/1/2";
      }
    }
  }
}
```

```

    }
  }
}

```

Example: Configuring CHAP Authentication with RADIUS

You can send RADIUS messages through a routing instance to customer RADIUS servers in a private network. To configure, include the `routing-instance` statement at the `[edit access profile profile-name radius-server]` hierarchy level and apply the profile to an interface with the `access-profile` statement at the `[edit interfaces interface-name unit logical-unit-number ppp-options chap]` hierarchy level.

In this example, PPP peers of interfaces `at-0/0/0.0` and `at-0/0/0.1` are authenticated by a RADIUS server reachable via routing instance A. PPP peers of interfaces `at-0/0/0.2` and `at-0/0/0.3` are authenticated by a RADIUS server reachable via routing instance B.

For more information on RADIUS authentication, see “Configuring RADIUS Authentication” on page 89.

```

system {
  radius-server {
    1.1.1.1 secret $9$dalkfj;
    2.2.2.2 secret $9$adfsaszx;
  }
}
routing-instances {
  A {
    instance-type vrf;
    ...
  }
  B {
    instance-type vrf;
    ...
  }
}
access {
  profile A-PPP-clients {
    authentication-order radius;
    radius-server {
      3.3.3.3 {
        port 3333;
        secret "$9$LO/7NbDjqmPQGdMT"; # # SECRET-DATA
        timeout 3;
        retry 3;
        source-address 99.99.99.99;
        routing-instance A;
      }
      4.4.4.4 {
        routing-instance A;
        secret $9$adfsaszx;
      }
    }
  }
}

```

```

}
profile B-PPP-clients {
  authentication-order radius;
  radius-server {
    5.5.5.5 {
      routing-instance B;
      secret $9$kljhlkhl;
    }
    6.6.6.6 {
      routing-instance B;
      secret $9$kljhlkhl;
    }
  }
}
}
}
interfaces {
  at-0/0/0 {
    atm-options {
      vpi 0;
    }
    unit 0 {
      encapsulation atm-ppp-llc;
      ppp-options {
        chap {
          access-profile A-PPP-clients;
        }
      }
      keepalives {
        interval 20;
        up-count 5;
        down-count 5;
      }
      vci 0.128;
      family inet {
        address 21.21.21.21/32 {
          destination 21.21.21.22;
        }
      }
    }
  }
  unit 1 {
    encapsulation atm-ppp-llc;
    ...
    ppp-options {
      chap {
        access-profile A-PPP-clients;
      }
    }
    ...
  }
  unit 2 {
    encapsulation atm-ppp-llc;
    ...
    ppp-options {
      chap {
        access-profile B-PPP-clients;
      }
    }
  }
}

```

```

    }
    ...
}
unit 3 {
    encapsulation atm-ppp-llc;
    ...
    ppp-options {
        chap {
            access-profile B-PPP-clients;
        }
    }
    ...
}
...
}
...
}

```

Users who log in to the router with telnet or SSH connections are authenticated by the RADIUS server 1.1.1.1. The backup RADIUS server for these users is 2.2.2.2.

Each profile may contain one or more backup RADIUS servers. In this example, PPP peers are CHAP authenticated by the RADIUS server 3.3.3.3 (with 4.4.4.4 as the backup server) or RADIUS server 5.5.5.5 (with 6.6.6.6 as the backup server).

Related Topics ■ Configuring the Authentication Order on page 453

Configuring Tracing Operations for Access Processes

To trace access processes, you can specify options in the `traceoptions` statement at the `[edit access]` hierarchy level. The default tracing behavior is the following:

- Important events are logged in a file called `accessd` located in the `/var/log` directory.
- When the file `accessd` reaches 128 kilobytes (KB), it is renamed `accessd.0`, then `accessd.1` and so on, until there are 3 trace files. Then the oldest trace file (`accessd2`) is overwritten. For more information about how log files are created, see the *JUNOS System Log Messages Reference*.
- Log files can be accessed only by the user who configures the tracing operation.

You cannot change the directory (`/var/log`) in which trace files are located. However, you can customize the other trace file settings by including the following statements at the `[edit access traceoptions]` hierarchy level:

```

[edit access]
traceoptions {
  file filename {
    files number;
    size maximum-file-size;
    world-readable | no-world-readable;
    match regex;
  }
}

```

```

flag all;
flag authentication;
flag chap;
flag configuration;
flag kernel;
flag radius;
}

```

Tasks for configuring tracing operations are:

1. Configuring the Access Processes Log Filename on page 444
2. Configuring the Number and Size of Access Processes Log Files on page 444
3. Configuring Access to the Log File on page 445
4. Configuring a Regular Expression for Lines to Be Logged on page 445
5. Configuring the Trace Operations to Be Logged on page 445

Configuring the Access Processes Log Filename

By default, the name of the file that records trace output is `accesssd`.

To specify a different name, include the `file` statement at the `[edit traceoptions]` hierarchy level:

```

[edit access traceoptions]
file filename;

```

Configuring the Number and Size of Access Processes Log Files

By default, when the trace file reaches 128 kilobytes (KB) in size, it is renamed `filename.0`, then `filename.1`, and so on, until there are 3 trace files. Then the oldest trace file (`filename.2`) is overwritten.

To configure the limits on the number and size of trace files, include the following statements at the `[edit access traceoptions]` hierarchy level:

```

[edit access traceoptions]
file files number size size;

```

For example, set the maximum file size to 2 MB, and the maximum number of files to 20. When the file that receives the output of the tracing operation (`filename`) reaches 2 MB, `filename` is renamed `filename.0`, and a new file called `filename` is created. When the new `filename` reaches 2 MB, `filename.0` is renamed `filename.1` and `filename` is renamed `filename.0`. This process repeats until there are 20 trace files. Then the oldest file (`filename.19`) is overwritten by the newest file (`filename.0`).

The number of files can be from 2 through 1000 files. The file size of each file can be from 10 KB through 1 gigabyte (GB).

Configuring Access to the Log File

By default, log files can be accessed only by the user who configures the tracing operation.

To specify that any user can read all log files, include the `file world-readable` statement at the `[edit access traceoptions]` hierarchy level:

```
[edit access traceoptions]
file world-readable;
```

To explicitly set the default behavior, include the `file no-world-readable` statement at the `[edit event-options traceoptions]` hierarchy level:

```
[edit access traceoptions]
file no-world-readable;
```

Configuring a Regular Expression for Lines to Be Logged

By default, the trace operation output includes all lines relevant to the logged events.

You can refine the output by including the `match` statement at the `[edit access traceoptions file filename]` hierarchy level and specifying a regular expression (regex) to be matched:

```
[edit access traceoptions]
file filename match regex;
```

Configuring the Trace Operations to Be Logged

By default, only important events are logged. You can configure the trace operations to be logged by including the following statements at the `[edit access traceoptions]` hierarchy level:

```
[edit access traceoptions]
flag {
  all;
  authentication;
  chap;
  configuration;
  kernel;
  radius;
}
```

You can specify the following access tracing flags:

- `all`—All tracing operations
- `authentication`—All authentication module handling
- `chap`—All CHAP messages and handling
- `configuration`—Reading of configuration

- kernel—Send all configuration messages to the kernel
- radius—All RADIUS messages and handling

Configuring L2TP for Enabling PPP Tunneling Within a Network

For M7i and M10i routers, you can configure Layer 2 Tunneling Protocol (L2TP) tunneling security services on an Adaptive Services Physical Interface Card (PIC) or a MultiServices PIC. The L2TP protocol allows Point-to-Point Protocol (PPP) to be tunneled within a network.



NOTE: For information about how to configure L2TP service, see the *JUNOS Services Interfaces Configuration Guide* and the *JUNOS Network Interfaces Configuration Guide*.

To configure L2TP, include the following statements at the [edit access] hierarchy level:

```
[edit access]
address-pool pool-name {
    address address-or-prefix;
    address-range low <lower-limit> high <upper-limit>;
}
group-profile profile-name {
    l2tp {
        interface-id interface-id;
        lcp-renegotiation;
        local-chap;
        maximum-sessions-per-tunnel number;
        ppp {
            cell-overhead;
            encapsulation-overhead bytes;
            framed-pool pool-id;
            idle-timeout seconds;
            interface-id interface-id;
            keepalive seconds;
            primary-dns primary-dns;
            primary-wins primary-wins;
            secondary-dns secondary-dns;
            secondary-wins secondary-wins;
        }
    }
}
profile profile-name {
    authentication-order [ authentication-methods ];
    accounting-order radius;
    client client-name {
        chap-secret chap-secret;
        group-profile profile-name;
        l2tp {
            interface-id interface-id;
            lcp-renegotiation;
            local-chap;
            maximum-sessions-per-tunnel number;
```



```

        ppp-authentication (chap | pap);
        shared-secret shared-secret;
    }
    pap-password pap-password;
    ppp {
        cell-overhead;
        encapsulation-overhead bytes;
        framed-ip-address ip-address;
        framed-pool framed-pool;
        idle-timeout seconds;
        interface-id interface-id;
        keepalive seconds;
        primary-dns primary-dns;
        primary-wins primary-wins;
        secondary-dns secondary-dns;
        secondary-wins secondary-wins;
    }
    user-group-profile profile-name;
}
}
radius-disconnect-port port-number {
    radius-disconnect {
        client-address {
            secret password;
        }
    }
}
}
radius-server server-address {
    accounting-port port-number;
    port port-number;
    retry attempts;
    secret password;
    source-address source-address;
    timeout seconds;
}
}
}

```

Defining the Minimum L2TP Configuration

To define the minimum configuration for the Layer 2 Tunneling Protocol (L2TP), include at least the following statements at the [edit access] hierarchy level:

```

[edit access]
address-pool pool-name {
    address address-or-prefix;
    address-range low <lower-limit> high <upper-limit>;
}
profile profile-name {
    authentication-order [ authentication-methods ];
    client client-name {
        chap-secret chap-secret;
        l2tp {
            interface-id interface-id;
            maximum-sessions-per-tunnel number;

```

```

        ppp-authentication (chap | pap);
        shared-secret shared-secret;
    }
    pap-password pap-password;
    ppp {
        framed-ip-address ip-address;
        framed-pool framed-pool;
        interface-id interface-id;
        primary-dns primary-dns;
        primary-wins primary-wins;
        secondary-dns secondary-dns;
        secondary-wins secondary-wins;
    }
}
radius-server server-address {
    accounting-port port-number;
    port port-number;
    retry attempts;
    secret password;
}

```



NOTE: When the L2TP network server (LNS) is configured with RADIUS authentication, the default behavior is to accept the preferred RADIUS-assigned IP address. Previously, the default behavior was to accept and install the nonzero peer IP address received in the Internet Protocol Control Protocol (IPCP) configuration request packet.

Configuring the Address Pool for L2TP Network Server IP Address Allocation

With an address pool, you configure an address or address range. When you define an address pool for a client, the L2TP network server (LNS) allocates IP addresses for clients from an address pool. If you do not want to use an address pool, you can specify an IP address by means of the **framed-ip-address** statement at the [edit access profile *profile-name* client *client-name* ppp] hierarchy level. For information about specifying an IP address, see “Configuring PPP Properties for a Client-Specific Profile” on page 461.



NOTE: When an address pool is modified or deleted, all the sessions using that pool are deleted.

To define an address or a range of addresses, include the **address-pool** statement at the [edit access] hierarchy level:

```

[edit access]
  address-pool pool-name;

```

pool-name is the name assigned to the address pool.

To configure an address, include the **address** statement at the **[edit access address-pool *pool-name*]** hierarchy level:

```
[edit access address-pool pool-name]  
address address-or-prefix;
```

address-or-prefix is one address or a prefix value.

When you specify an address range, it cannot exceed 65,535 IP addresses.

To configure the address range, include the **address-range** statement at the **[edit access address-pool *pool-name*]** hierarchy level:

```
[edit access address-pool pool-name]  
address-range <low lower-limit> <high upper-limit>;
```

- *low lower-limit*—The lower limit of an address range.
- *high upper-limit*—The upper limit of an address range.



NOTE: The address pools for user access and Network Address Translation (NAT) can overlap. When you configure an address pool at the **[edit access address-pool *pool-name*]** hierarchy level, you can also configure an address pool at the **[edit services nat pool *pool-name*]** hierarchy level.

Configuring the Group Profile for Defining L2TP Attributes

Optionally, you can configure the group profile to define the Point-to-Point Protocol (PPP) or Layer 2 Tunneling Protocol (L2TP) attributes. Any client referencing the configured group profile inherits all the group profile attributes.



NOTE: The **group-profile** statement overrides the **user-group-profile** statement, which is configured at the **[edit access profile *profile-name*]** hierarchy level. The **profile** statement overrides the attributes configured at the **[edit access group-profile *profile-name*]** hierarchy level. For information about the **user-group-profile** statement, see “Applying a Configured PPP Group Profile to a Tunnel” on page 462.

Tasks for configuring the group profile are:

1. Configuring L2TP for a Group Profile on page 449
2. Configuring the PPP Attributes for a Group Profile on page 450

Configuring L2TP for a Group Profile

To configure the Layer 2 Tunneling Protocol (L2TP) for the group profile, include the following statements at the **[edit access group-profile *profile-name* l2tp]** hierarchy level:

```
[edit access group-profile profile-name l2tp]
```

```

interface-id interface-id;
lcp-renegotiation;
local-chap;
maximum-sessions-per-tunnel number;

```

interface-id is the identifier for the interface representing an L2TP session configured at the [edit interfaces *interface-name* unit *local-unit-number* dial-options] hierarchy level.

You can configure the LNS so that it renegotiates the link control protocol (LCP) with the PPP client (in the **renegotiation** statement). By default, the PPP client negotiates the LCP with the L2TP access concentrator (LAC). When you do this, the LNS discards the last sent and the last received LCP configuration request attribute value pairs (AVPs) from the LAC; for example, the LCP negotiated between the PPP client and the LAC.

You can configure the JUNOS Software so that the LNS ignores proxy authentication AVPs from the LAC and reauthenticates the PPP client using a CHAP challenge (in the **local-chap** statement). When you do this, the LNS directly authenticates the PPP client. By default, the PPP client is not reauthenticated by the LNS.

number is the maximum number of sessions per L2TP tunnel.

Configuring the PPP Attributes for a Group Profile

To configure the Point-to-Point Protocol (PPP) attributes for a group profile, include the following statements at the [edit access group-profile *profile-name* ppp] hierarchy level:

```

[edit access group-profile profile-name ppp]
cell-overhead;
encapsulation-overhead bytes;
framed-pool pool-id;
idle-timeout seconds;
interface-id interface-id;
keepalive seconds;
primary-dns primary-dns;
primary-wins primary-wins;
secondary-dns secondary-dns;
secondary-wins secondary-wins;

```

The **cell-overhead** statement configures the session to use Asynchronous Transfer Mode (ATM)-aware egress shaping on the IQ2 PIC.

bytes (in the **encapsulation-overhead** statement) configures the number of bytes used as overhead for class-of-service calculations.

pool-id (in the **framed-pool** statement) is the name assigned to the address pool.

seconds (in the **idle-timeout** statement) is the number of seconds a user can remain idle before the session is terminated. By default, idle timeout is set to 0. You can configure this to be a value in the range from 0 through 4,294,967,295.

interface-id (in the *interface-id* statement) is the identifier for the interface representing an L2TP session configured at the [edit interfaces *interface-name* unit *local-unit-number* dial-options] hierarchy level.

seconds (in the *keepalive* statement) is the time period that must elapse before the JUNOS Software checks the status of the PPP session by sending an echo request to the peer. For each session, JUNOS Software sends out three keepalives at 10-second intervals and the session is close if there is no response. By default, the time to send a keepalive message is set to 10 seconds. You configure this to be a value in the range from 0 through 32,767.

primary-dns (in the *primary-dns* statement) is an IP version 4 (IPv4) address.

secondary-dns (in the *secondary-dns* statement) is an IPv4 address.

primary-wins (in the *primary-wins* statement) is an IPv4 address.

secondary-wins (in the *secondary-wins* statement) is an IPv4 address.

Example: Group Profile Configuration

The following example shows how to configure an L2TP and PPP group profile:

```
[edit access]
group-profile westcoast_users {
  ppp {
    framed-pool customer_a;
    keepalive 15;
    primary-dns 192.120.65.1;
    secondary-dns 192.120.65.2;
    primary-wins 192.120.65.3;
    secondary-wins 192.120.65.4;
    interface-id west
  }
}
group-profile eastcoast_users {
  ppp {
    framed-pool customer_b;
    keepalive 15;
    primary-dns 192.120.65.5;
    secondary-dns 192.120.65.6;
    primary-wins 192.120.65.7;
    secondary-wins 192.120.65.8;
    interface-id east;
  }
}
group-profile westcoast_tunnel {
  l2tp {
    maximum-sessions-per-tunnel 100;
  }
}
group-profile east_tunnel {
  l2tp {
    maximum-sessions-per-tunnel 125;
  }
}
```

```
}
}
```

Configuring Access Profiles for L2TP or PPP Parameters

To validate Layer 2 Tunneling Protocol (L2TP) connections and session requests, you set up access profiles by configuring the profile statement at the [edit access] hierarchy level. You can configure multiple profiles. You can also configure multiple clients for each profile.

Tasks for configuring the access profile are:

1. Configuring the Access Profile on page 452
2. Configuring the L2TP Properties for a Profile on page 452
3. Configuring the PPP Properties for a Profile on page 453
4. Configuring the Authentication Order on page 453
5. Configuring the Accounting Order on page 454

Configuring the Access Profile

To configure the profile, include the **profile** statement at the [edit access] hierarchy level:

```
[edit access]
profile profile-name;
```

profile-name is the name assigned to the profile.



NOTE: The **group-profile** statement overrides the **user-group-profile** statement, which is configured at the [edit access profile *profile-name*] hierarchy level. The **profile** statement overrides the attributes configured at the [edit access group-profile *profile-name*] hierarchy level. For information about the **user-group-profile** statement, see “Applying a Configured PPP Group Profile to a Tunnel” on page 462.

When you configure a profile, you can only configure either L2TP or PPP parameters. You cannot configure both at the same time.

Configuring the L2TP Properties for a Profile

To configure the Layer 2 Tunneling Protocol (L2TP) properties for a profile, include the following statements at the [edit access profile *profile-name*] hierarchy level:

```
[edit access profile profile-name]
authentication-order [ authentication-methods ];
accounting-order radius
client client-name {
    group-profile profile-name;
    l2tp {
```

```

        interface-id interface-id;
        lcp-renegotiation;
        local-chap;
        maximum-sessions-per-tunnel number;
        ppp-authentication (chap | pap);
        shared-secret shared-secret;
    }
}
user-group-profile profile-name;

```

Configuring the PPP Properties for a Profile

To configure the PPP properties for a profile, include the following statements at the [edit access profile *profile-name*] hierarchy level:

```

[edit access profile profile-name]
authentication-order [ authentication-methods ];
client client-name {
    chap-secret chap-secret;
    group-profile profile-name;
    pap-password pap-password;
    ppp {
        cell-overhead;
        encapsulation-overhead bytes;
        framed-ip-address ip-address;
        framed-pool framed-pool;
        idle-timeout seconds;
        interface-id interface-id;
        keepalive seconds;
        primary-dns primary-dns;
        primary-wins primary-wins;
        secondary-dns secondary-dns;
        secondary-wins secondary-wins;
    }
}

```



NOTE: When you configure PPP properties for a profile, you typically configure the `chap-secret` statement or `pap-password` statement.

Configuring the Authentication Order

You can configure the order in which the JUNOS Software tries different authentication methods when authenticating peers. For each access attempt, the software tries the authentication methods in order, from first to last.

To configure the authentication order, include the `authentication-order` statement at the [edit access profile *profile-name*] hierarchy level:

```

[edit access profile profile-name]
authentication-order [ authentication-methods ];

```

In *authentication-methods*, specify one or more of the following in the preferred order, from first tried to last tried:

- **radius**—Verify the client using RADIUS authentication services.
- **password**—Verify the client using the information configured at the [edit access profile *profile-name* client *client-name*] hierarchy level.



NOTE: When you configure the authentication methods for L2TP, only the first configured authentication method is used.

For L2TP, RADIUS authentication servers are configured at the [edit access radius-server] hierarchy level. For more information about configuring RADIUS authentication servers, see “Configuring RADIUS Authentication for L2TP” on page 466.

If you do not include the **authentication-order** statement, clients are verified by means of **password** authentication.

Configuring the Accounting Order

Beginning with JUNOS Release 8.0, you can configure RADIUS accounting for an L2TP profile.

With RADIUS accounting enabled, Juniper Networks routers, acting as RADIUS clients, can notify the RADIUS server about user activities such as software logins, configuration changes, and interactive commands. The framework for RADIUS accounting is described in RFC 2866.

To configure RADIUS accounting, include the **accounting-order** statement at the [edit access profile *profile-name*] hierarchy level:

```
[edit access profile profile-name]
  accounting-order radius;
```

When you enable RADIUS accounting for an L2TP profile, it applies to all the clients within that profile. You must enable RADIUS accounting on at least one L2TP profile for the RADIUS authentication server to send accounting stop and start messages.



NOTE: When you enable RADIUS accounting for an L2TP profile, you do not need to configure the **accounting-port** statement at the [edit access radius-server *server-address*] hierarchy level. When you enable RADIUS accounting for an L2TP profile, accounting is triggered on the default port of 1813.

For L2TP, RADIUS authentication servers are configured at the [edit access radius-server] hierarchy level.

Configuring the L2TP Client

To configure the client, include the `client` statement at the `[edit access profile profile-name]` hierarchy level:

```
[edit access profile profile-name]  
client client-name;
```

client-name is the peer identity.

For L2TP, you can optionally use the wildcard (*) to define a default tunnel client to authenticate multiple LACs with the same secret and L2TP attributes. If an LAC with a specific name is not defined in the configuration, the wildcard tunnel client authenticates it.

Example: Defining the Default Tunnel Client

Use the wildcard (*) to define a default tunnel client to authenticate multiple LACs with the same secret:

```
[edit access profile profile-name]  
client * {  
  l2tp {  
    interface-id interface1;  
    lcp-renegotiation;  
    local-chap;  
    maximum-sessions-per-tunnel 500;  
    ppp-authentication chap;  
    shared-secret "$1$dQYsZ$B5ojUeUjDsUo.yKwcCZ0";  
  }  
}
```

For any tunnel client, you can optionally use the user group profile to define default PPP attributes for all users coming in through a tunnel. The user group profile must define PPP attributes. If the user group profile is specified, all users (PPP sessions) use the PPP attributes specified in the user group profile. The PPP attributes specified in the local or RADIUS server take precedence over those specified in the user group profile.

Optionally, you can use a wildcard client to define a user group profile. When you do this, any client entering this tunnel uses the PPP attributes (defined user group profile attributes) as its default PPP attributes.

Example: Defining the User Group Profile

Use a wildcard client to define a user group profile:

```
[edit access profile profile]  
client * {  
  user-group-profile user-group-profile1;  
}
```

For information about how to configure the user group profile, see “Applying a Configured PPP Group Profile to a Tunnel” on page 462.

Configuring the CHAP Secret for an L2TP Profile

CHAP allows each end of a PPP link to authenticate its peer, as defined in RFC 1994. The authenticator sends its peer a randomly generated challenge that the peer must encrypt using a one-way hash; the peer must then respond with that encrypted result. The key to the hash is a secret known only to the authenticator and authenticated. When the response is received, the authenticator compares its calculated result with the peer’s response. If they match, the peer is authenticated.

Each end of the link identifies itself to its peer by including its name in the CHAP challenge and response packets it sends to the peer. This name defaults to the local hostname, or you can explicitly set it using the **local-name** option. When a host receives a CHAP challenge or CHAP response packet on a particular interface, it uses the peer identity to look up the CHAP secret key to use.



NOTE: When you configure PPP properties for a Layer 2 Tunneling Protocol (L2TP) profile, you typically configure the **chap-secret** statement or **pap-password** statement.

To configure CHAP, include the **profile** statement and specify a profile name at the **[edit access]** hierarchy level:

```
[edit access]
profile profile-name {
  client client-name chap-secret data;
}
```

Then reference the CHAP profile name at the **[edit interfaces *interface-name* ppp-options chap]** hierarchy level.

You can configure multiple profiles. You can also configure multiple clients for each profile.

profile is the mapping between peer identifiers and CHAP secret keys. The identity of the peer contained in the CHAP challenge or response queries the profile for the secret key to use.

client is the peer identity.

chap-secret *secret* is the secret key associated with that peer.

Example: Configuring L2TP PPP CHAP

Configure the profile **westcoast_bldg1** at the **[edit access]** hierarchy level, then reference it at the **[edit interfaces]** hierarchy level:

```
[edit]
access {
```

```

profile westcoast_bldg1 {
  client cpe-1 chap-secret "$1$dQYsZ$B5ojUeUjDsUo.yKwcCZ0";
  # SECRET-DATA
  client cpe-2 chap-secret "$1$kdAsfaDAfkjDsASxfafdKdFKJ";
  # SECRET-DATA
}

```

Referencing the Group Profile from the L2TP Profile

You can reference a configured group profile from the L2TP tunnel profile.

To reference the group profile configured at the [edit access group-profile *profile-name*] hierarchy level, include the `group-profile` statement at the [edit access profile *profile-name* client *client-name*] hierarchy level:

```

[edit access profile profile-name client client-name]
group-profile profile-name;

```

profile-name references a configured group profile from a PPP user profile.

Configuring L2TP Properties for a Client-Specific Profile

To define L2TP properties for a client-specific profile, include one or more of the following statements at the [edit access profile *profile-name* client *client-name* l2tp] hierarchy level:



NOTE: When you configure the profile, you can configure either L2TP or PPP parameters, but not both at the same time.

```

[edit access profile profile-name client client-name l2tp]
interface-id interface-id;
lcp-renegotiation;
local-chap;
maximum-sessions-per-tunnel number;
multilink {
  drop-timeout milliseconds;
  fragmentation-threshold bytes;
}
ppp-authentication (chap | pap);
shared-secret shared-secret;

```

interface-id (in the `interface-id` statement) is the identifier for the interface representing an L2TP session configured at the [edit interfaces *interface-name* unit *local-unit-number* dial-options] hierarchy level.

number (in the `maximum-sessions-per-tunnel` statement) is the maximum number of sessions for an L2TP tunnel.

shared-secret (in the `shared-secret` statement) is the shared secret for authenticating the peer.

You can specify PPP authentication (in the **ppp-authentication** statement). By default, the PPP authentication uses CHAP. You can configure this to use Password Authentication Protocol (PAP).

You can configure LNS so it renegotiates LCP with the PPP client (in the **lcp-negotiation** statement). By default, the PPP client negotiates the LCP with the LAC. When you do this, the LNS discards the last sent LCP configuration request and last received LCP configuration request AVPs from the LAC; for example, the LCP negotiated between the PPP client and LAC.

You can configure the JUNOS Software so that the LNS ignores proxy authentication AVPs from the LAC and reauthenticates the PPP client using a CHAP challenge (in the **local-chap** statement). By default, the PPP client is not reauthenticated by the LNS. When you do this, the LNS directly authenticates the PPP client.

You can configure the PPP MP for L2TP if the PPP sessions that are coming into the LNS from the LAC have multilink PPP negotiated. When you do this, you join multilink bundles based on the endpoint discriminator (in the **multilink** statement).

- *milliseconds* (in the **drop-timeout** statement) specifies the number of milliseconds for the timeout that associated with the first fragment on the reassembly queue. If the timeout expires before all the fragments have been collected, the fragments at the beginning of the reassembly queue are dropped. If the drop timeout is not specified, the JUNOS Software holds on to the fragments (fragments may still be dropped if the multilink reassembly algorithm determines that another fragment belonging to the packet on a reassembly queue has been lost).



NOTE: The drop timeout and fragmentation threshold for a bundled multilink might belong to different tunnels. The different tunnels might have different drop timeout and fragmentation thresholds. We recommend configuring group profiles instead of profiles when you have L2TP tunnels.

- *bytes* specifies the maximum size of a packet, in bytes (in the **fragmentation-threshold** statement). If a packet exceeds the fragmentation threshold, the JUNOS Software fragments it into two or more multilink fragments.

Example: PPP MP for L2TP

Join multilink bundles based on the endpoint discriminator:

```
[edit access]
profile tunnel-profile {
  client remote-host {
    l2tp {
      multilink {
        drop-timeout 600;
        fragmentation-threshold 100;
      }
    }
  }
}
```

Example: L2TP Multilink PPP Support on Shared Interfaces

On M7i and M10i routers, L2TP multilink PPP sessions are supported on both dedicated and shared interfaces. This example shows how to configure many multilink bundles on a single ASP shared interface.

```
[edit]
interfaces {
  sp-1/3/0 {
    traceoptions {
      flag all;
    }
    unit 0 {
      family inet;
    }
    unit 20 {
      dial-options {
        l2tp-interface-id test;
        shared;
      }
      family inet;
    }
  }
}
access {
  profile t {
    client cholera {
      l2tp {
        interface-id test;
        multilink;
        shared-secret "$9$n8HX6A01RhIvL1R"; # SECRET-DATA
      }
    }
  }
  profile u {
    authentication-order radius;
  }
  radius-server {
    192.168.65.63 {
      port 1812;
      secret "$9$Vyb4ZHKPQ39mf9pORlexNdbgoZUjqP5"; # SECRET-DATA
    }
  }
}
services {
  l2tp {
    tunnel-group 1 {
      tunnel-access-profile t;
      user-access-profile u;
      local-gateway {
        address 10.70.1.1;
      }
      service-interface sp-1/3/0;
    }
  }
}
```

```

    traceoptions {
      flag all;
      debug-level packet-dump;
      filter {
        protocol l2tp;
        protocol ppp;
        protocol radius;
      }
    }
  }
}

```

Configuring the PAP Password for an L2TP Profile

When you configure PPP properties for an L2TP profile, you typically configure the `chap-secret` statement or `pap-password` statement. For information about how to configure the CHAP secret, see “Configuring the CHAP Secret for an L2TP Profile” on page 456.

To configure the Password Authentication Protocol (PAP) password, include the `pap-password` statement at the `[edit access profile profile-name client client-name]` hierarchy level:

```

[edit access profile profile-name client client-name]
  pap-password pap-password;

```

pap-password is the password for PAP.

Example: Configuring PAP for an L2TP Profile

The following examples shows you how to configure the password authentication protocol for an L2TP profile:

```

[edit access]
profile sunnyvale_bldg_2 {
  client green {
    pap-password "$9$24gGiPfz6CuQFu1EyW8VwYgZUik.5z3";
    ppp {
      interface-id west;
    }
    group-profile sunnyvale_users;
  }
  client red {
    chap-secret "$9$24gGiPfz6CuQFu1EyW8VwYgZUik.5z3";
    group-profile sunnyvale_users;
  }
  authentication-order radius;
}
profile Sunnyvale_bldg_1_tunnel {
  client test {
    l2tp {
      shared-secret "$9$24gGiPfz6CuQFu1EyW8VwYgZUik.5z3";
      ppp-authentication pap;
    }
  }
}

```

```

    }
  }
}

```

Configuring PPP Properties for a Client-Specific Profile

To define PPP properties for a profile, include one or more of the following statements at the [edit access profile *profile-name* client *client-name* ppp] hierarchy level.



NOTE: The properties defined in the profile take precedence over the values defined in the group profile.

```

[edit access profile profile-name client client-name ppp]
cell-overhead;
encapsulation-overhead bytes;
framed-ip-address ip-address;
framed-pool pool-id;
idle-timeout seconds;
interface-id interface-id;
keepalive seconds;
primary-dns primary-dns;
primary-wins primary-wins;
secondary-dns secondary-dns;
secondary-wins secondary-wins;

```



NOTE: When you configure a profile, you can configure either L2TP or PPP parameters, but not both at the same time.

The **cell-overhead** statement configures the session to use ATM-aware egress shaping on the IQ2 PIC.

bytes (in the **encapsulation-overhead** statement) configures the number of bytes used as overhead for class-of-service calculations.

ip-address (in the **framed-ip-address** statement) is the IPv4 prefix.

pool-id (in the **framed-pool** statement) is a configured address pool.

seconds (in the **idle-timeout** statement) is the number of seconds a user can remain idle before the session is terminated. By default, idle timeout is set to 0. You can configure this to be a value in the range from 0 through 4,294,967,295.

interface-id (in the **interface-id** statement) is the identifier for the interface representing an L2TP session configured at the [edit interfaces *interface-name* unit *local-unit-number* dial-options] hierarchy level.

seconds (in the **keepalive** statement) is the time period that must elapse before the JUNOS Software checks the status of the PPP session by sending an echo request to the peer. For each session, JUNOS Software sends out three keepalives at 10-second

intervals and the session is closed if there is no response. By default, the time to send a keepalive messages is set to 10 seconds. You configure this to be a value in the range from 0 through 32,767.

primary-dns (in the *primary-dns* statement) is an IPv4 address.

secondary-dns (in the *secondary-dns* statement) is an IPv4 address.

primary-wins (in the *primary-wins* statement) is an IPv4 address.

secondary-wins (in the *secondary-wins* statement) is an IPv4 address.

Applying a Configured PPP Group Profile to a Tunnel

On Mi7 and M10i routers, you can optionally apply a configured PPP group profile to a tunnel. For any tunnel client, you can use the *user-group-profile* statement to define default PPP attributes for all users coming in through a tunnel. The user group profile must define PPP attributes. If the user group profile is specified, all users (PPP sessions) use the PPP attributes specified in the user group profile.

When a PPP client enters a tunnel, the JUNOS Software first applies the PPP user group profile attributes and then any PPP attributes from the local or RADIUS server. The PPP attributes defined in the RADIUS or local server take precedence over the attributes defined in the user group profile.

To apply configured PPP attributes to a PPP client, include the *user-group-profile* statement at the [edit access profile *profile-name* client *client-name*] hierarchy level:

```
[edit access profile profile-name client client-name]
user-group-profile profile-name;
```

profile-name is a PPP group profile configured at the [edit access group-profile *profile-name*] hierarchy level. When a client enters this tunnel, it uses the *user-group-profile* attributes as the default attributes.

Example: Applying a User Group Profile on the M7i or M10i Router

The following example shows how to apply a configured PPP group profile to a tunnel:

```
[edit access]
group-profile westcoast_users {
  ppp {
    idle-timeout 100;
  }
}
group-profile westcoast_default_configuration {
  ppp {
    framed-pool customer_b;
    idle-timeout 20;
    interface-id west;
    primary-dns 192.120.65.5;
    secondary-dns 192.120.65.6;
    primary-wins 192.120.65.7;
```



```

        secondary-wins 192.120.65.8;
    }
}
profile westcoast_bldg_1_tunnel {
    client test {
        l2tp {
            interface-id west;
            shared-secret "$9$r3HKvLg4ZUDkX7JGjif5p0BIRS8LN";
            # SECRET-DATA
            maximum-sessions-per-tunnel 75;
            ppp-authentication chap;
        }
        user-group-profile westcoast_default_configuration; # Apply default PPP
    }
}
profile westcoast_bldg_1 {
    client white {
        chap-secret "$9$3s2690leK8X7VKM7VwgaJn/Ctu1hclv87Ct87";
        # SECRET-DATA
        ppp {
            idle-timeout 22;
            primary-dns 192.120.65.9;
            framed-ip-address 12.12.12.12/32;
        }
        group-profile westcoast_users; # Reference the west_users group
    }
}

```

Example: Configuring the Access Profile

The following example shows you how to configure the access profile:

```

[edit access]
profile westcoast_bldg_1 {
    client white {
        chap-secret "$9$3s2690leK8X7VKM7VwgaJn/Ctu1hclv87Ct87";
        # SECRET-DATA
        ppp {
            idle-timeout 22;
            primary-dns 192.120.65.10;
            framed-ip-address 12.12.12.12/32;
        }
        group-profile westcoast_users;
    }
    client blue {
        chap-secret "$9$eq1KWxbwgZUHNdjmqmTF3u01Rhr-dsoJDNd";
        # SECRET-DATA
        group-profile sunnyvale_users;
    }
    authentication-order password;
}
profile westcoast_bldg_1_tunnel {
    client test {
        l2tp {
            shared-secret "$9$r3HKvLg4ZUDkX7JGjif5p0BIRS8LN";

```

```

        # SECRET-DATA
        maximum-sessions-per-tunnel 75;
        ppp-authentication chap;
    }
    group-profile westcoast_tunnel;
}
client production {
    l2tp {
        shared-secret "$9$R2QErV8X-goGyIVwg4jiTz36/t0BEleWFnRh
        rIXbs2aJDHqf3nCP5";
        # SECRET-DATA
        ppp-authentication chap;
    }
    group-profile westcoast_tunnel;
}
}

```

Example: Configuring L2TP

The following example shows how to configure L2TP:

```

[edit]
access {
    address-pool customer_a {
        address 1.1.1.1/32;
    }
    address-pool customer_b {
        address-range low 2.2.2.2 high 2.2.3.2;
    }
    group-profile westcoast_users {
        ppp {
            framed-pool customer_a;
            idle-timeout 15;
            primary-dns 192.120.65.1;
            secondary-dns 192.120.65.2;
            primary-wins 192.120.65.3;
            secondary-wins 192.120.65.4;
            interface-id west;
        }
    }
    group-profile eastcoast_users {
        ppp {
            framed-pool customer_b;
            idle-timeout 20;
            primary-dns 192.120.65.5;
            secondary-dns 192.120.65.6;
            primary-wins 192.120.65.7;
            secondary-wins 192.120.65.8;
            interface-id east;
        }
    }
    group-profile westcoast_tunnel {
        l2tp {
            maximum-sessions-per-tunnel 100;
        }
    }
}

```

```

}
group-profile east_tunnel {
    l2tp {
        maximum-sessions-per-tunnel 125;
    }
}
profile westcoast_bldg_1 {
    client white {
        chap-secret "$9$3s2690leK8X7VKM7VwgaJn/Ctu1hclv87Ct87";
        # SECRET-DATA
        ppp {
            idle-timeout 22;
            primary-dns 192.120.65.10;
            framed-ip-address 12.12.12.12/32;
        }
        group-profile westcoast_users;
    }
    client blue {
        chap-secret "$9$eq1KWxbwgZUHNdjqmTF3u01Rhr-dsoJDNd";
        # SECRET-DATA
        group-profile sunnyvale_users;
    }
    authentication-order password;
}
profile west-coast_bldg_2 {
    client red {
        pap-password "$9$3s2690leK8X7VKM8888Ctu1hclv87Ct87";
        # SECRET-DATA
        ppp {
            idle-timeout 22;
            primary-dns 192.120.65.11;
            framed-ip-address 12.12.12.12/32;
        }
        group-profile westcoast_users;
    }
}
profile westcoast_bldg_1_tunnel {
    client test {
        l2tp {
            shared-secret "$9$r3HKvLg4ZUDkX7JGjif5p0BIRS8LN";
            # SECRET-DATA
            maximum-sessions-per-tunnel 75;
            ppp-authentication chap;# The default for PPP authentication is CHAP.
        }
        group-profile westcoast_tunnel;
    }
    client production {
        l2tp {
            shared-secret "$9$R2QErV8X-goGylVwg4jiTz36/t0BEleWFnRh
            rIXbs2aJDHqf3nCP5"; # SECRET-DATA
            ppp-authentication chap;
        }
        group-profile westcoast_tunnel;
    }
}
profile westcoast_bldg_2_tunnel {

```

```

client black {
  l2tp {
    shared-secret "$9$R2QErV8X-goGyIVwg4jiTz36/t0BEleWFnRh
    rIXbs2aJDHqf3nCP5";
    # SECRET-DATA
    ppp-authentication pap;
  }
  group-profile westcoast_tunnel;
}
}

```

Configuring RADIUS Authentication for L2TP

The L2TP network server (LNS) sends RADIUS authentication requests or accounting requests. Authentication requests are sent out to the authentication server port. Accounting requests are sent to the accounting port. To configure RADIUS authentication for L2TP on an M10i or M7i router, include the following statements at the [edit access] hierarchy level:

```

[edit access]
radius-server server-address {
  accounting-port port-number;
  port port-number;
  retry attempts;
  routing-instance routing-instance-name;
  secret password;
  source-address source-address;
  timeout seconds;
}

```



NOTE: The RADIUS servers at the [edit access] hierarchy level are not used by the network access server process (NASD).

You can specify an accounting port number on which to contact the accounting server (in the **accounting-port** statement). Most RADIUS servers use port number 1813 (as specified in RFC 2866, *Radius Accounting*).



NOTE: If you enable RADIUS accounting at the [edit access profile *profile-name* accounting-order] hierarchy level, accounting is triggered on the default port of 1813 even if you do not specify a value for the **accounting-port** statement.

server-address specifies the address of the RADIUS authentication server (in the **radius-server** statement).

You can specify a port number on which to contact the RADIUS authentication server (in the **port** statement). Most RADIUS servers use port number 1812 (as specified in RFC 2865, *Remote Authentication Dial In User Service [RADIUS]*).

You must specify a password in the **secret** statement. If a password includes spaces, enclose the password in quotation marks. The secret used by the local router must match that used by the RADIUS authentication server.

Optionally, you can specify the amount of time that the local router waits to receive a response from a RADIUS server (in the **timeout** statement) and the number of times that the router attempts to contact a RADIUS authentication server (in the **retry** statement). By default, the router waits 3 seconds. You can configure this to be a value in the range from 1 through 90 seconds. By default, the router retries connecting to the server three times. You can configure this to be a value in the range from 1 through 10 times.

In the **source-address** statement, specify a source address for each configured RADIUS server. Each RADIUS request sent to a RADIUS server uses the specified source address. The source address is a valid IPv4 address configured on one of the router interfaces.

To configure multiple RADIUS servers, include multiple **radius-server** statements. For information about how to configure the RADIUS disconnect server for L2TP, see “Configuring the RADIUS Disconnect Server for L2TP” on page 471.



NOTE: When the L2TP network server (LNS) is configured with RADIUS authentication, the default behavior is to accept the preferred RADIUS-assigned IP address. Previously, the default behavior was to accept and install the nonzero peer IP address received by the Internet Protocol Control Protocol (IPCP) configuration request packet.

RADIUS Attributes for L2TP

The JUNOS Software supports the following types of RADIUS attributes for L2TP:

- Juniper Networks vendor-specific attributes
- Attribute-value pairs (AVPs) defined by the Internet Engineering Task Force (IETF)
- RADIUS accounting stop and start AVPs

Juniper Networks vendor-specific RADIUS attributes are described in RFC 2865, *Remote Authentication Dial In User Service (RADIUS)*. These attributes are encapsulated with the vendor ID set to the Juniper Networks ID number 2636. Table 32 on page 467 lists the Juniper Networks vendor-specific attributes you can configure for L2TP.

Table 32: Juniper Networks Vendor-Specific RADIUS Attributes for L2TP

Attribute Name	Standard Number	Value
Juniper-Primary-DNS	31	IP address
Juniper-Primary-WINS	32	IP address
Juniper-Secondary-DNS	33	IP address
Juniper-Secondary-WINS	34	IP address

Table 32: Juniper Networks Vendor-Specific RADIUS Attributes for L2TP *(continued)*

Attribute Name	Standard Number	Value
Juniper-Interface-ID	35	String
Juniper-IP-Pool-Name	36	String
Juniper-Keep-Alive	37	Integer

Table 33 on page 468 lists the IETF RADIUS AVPs supported for L2TP.

Table 33: Supported IETF RADIUS Attributes for L2TP

Attribute Name	Standard Number	Value
User-Name	1	String
User-Password	2	String
CHAP-Password	3	String
NAS-IP-Address	4	IP address
NAS-Port	5	Integer
Service-Type	6	Integer
Framed-Protocol	7	Integer
Framed-IP-Address	8	IP address
Framed-IP-Netmask	9	IP address
Framed-MTU	12	Integer
Framed-Route	22	String
Session-Timeout	27	Integer
Idle-Timeout	28	Integer
Called-Station-ID	30	String
Calling-Station-ID	31	String
CHAP-Challenge	60	String
NAS-Port-Type	61	Integer
Framed-Pool	88	Integer

Table 34 on page 469 lists the supported RADIUS accounting start AVPs for L2TP.

Table 34: Supported RADIUS Accounting Start Attributes for L2TP

Attribute Name	Standard Number	Value
User-Name	1	String
NAS-IP-Address	4	IP address
NAS-Port	5	Integer
Service-Type	6	Integer
Framed-Protocol	7	Integer
Framed-IP-Address	8	IP address
Called-Station-ID	30	String
Calling-Station-ID	31	String
Acct-Status-Type	40	Integer
Acct-Delay-Time	41	Integer
Acct-Session-ID	44	String
Acct-Authentic	45	Integer
NAS-Port-Type	61	Integer
Tunnel-Client-Endpoint	66	String
Tunnel-Server-Endpoint	67	String
Acct-Tunnel-Connection	68	String
Tunnel-Client-Auth-ID	90	String
Tunnel-Server-Auth-ID	91	String

Table 35 on page 469 lists the supported RADIUS accounting stop AVPs for L2TP.

Table 35: Supported RADIUS Accounting Stop Attributes for L2TP

Attribute Name	Standard Number	Value
User-Name	1	String
NAS-IP-Address	4	IP address
NAS-Port	5	Integer
Service-Type	6	Integer
Framed-Protocol	7	Integer

Table 35: Supported RADIUS Accounting Stop Attributes for L2TP *(continued)*

Attribute Name	Standard Number	Value
Framed-IP-Address	8	IP address
Called-Station-ID	30	String
Calling-Station-ID	31	String
Acct-Status-Type	40	Integer
Acct-Delay-Time	41	Integer
Acct-Input-Octets	42	Integer
Acct-Output-Octets	43	Integer
Acct-Session-ID	44	String
Acct-Authentic	45	Integer
Acct-Session-Time	46	Integer
Acct-Input-Packets	47	Integer
Acct-Output-Packets	48	Integer
Acct-Terminate-Cause	49	Integer
Acct-Multi-Session-ID	50	String
Acct-Link-Count	51	Integer
NAS-Port-Type	61	Integer
Tunnel-Client-Endpoint	66	String
Tunnel-Server-Endpoint	67	String
Acct-Tunnel-Connection	68	String
Tunnel-Client-Auth-ID	90	String
Tunnel-Server-Auth-ID	91	String

Example: Configuring RADIUS Authentication for L2TP

The following example shows how to configure RADIUS authentication for L2TP:

```
[edit access]
profile sunnyvale_bldg_2 {
  client green {
    chap-secret "$9$24gGiPfz6CuQFu1EyW8VwYgZUik.5z3";
    ppp {
      interface-id west;
```



```

    }
    group-profile sunnyvale_users;
  }
  client red {
    chap-secret "$9$24gGiPfz6CuQFu1EyW8VwYgZUik.5z3";
    group-profile sunnyvale_users;
  }
  authentication-order radius;
}
radius-server {
  192.168.65.213 {
    port 1812;
    accounting-port 1813;
    secret "$9$24gGiPfz6CuQFu1EyW8VwYgZUik.5z3"; # SECRET-DATA
  }
  192.168.65.223 {
    port 1812;
    accounting-port 1813;
    secret "$9$24gGiPfz6CuQFu1EyW8VwYgZUik.5z3"; # SECRET-DATA
  }
}
radius-disconnect-port 2500;
radius-disconnect {
  192.168.65.152 secret "$9$rtkl87ws4ZDkgokPT3tpEcyIWL7-VY4a";
  # SECRET-DATA
  192.168.64.153 secret "$9$gB4UHf5F/A0z30Ihr8Lbs24GDHqmTFn";
  # SECRET-DATA
  192.168.64.157 secret "$9$Hk5FCA0IhruOrv87sYGDikfTFn/t0B";
  # SECRET-DATA
  192.168.64.173 secret "$9$Hk5FCA0IhruOrv87sYGDikfTFn/t0B";
  # SECRET-DATA
}

```

Configuring the RADIUS Disconnect Server for L2TP

To configure the RADIUS disconnect server to listen for disconnect requests from an administrator and process them, include the following statements at the [edit access] hierarchy level:

```

[edit access]
radius-disconnect-port port-number;
radius-disconnect {
  client-address {
    secret password;
  }
}

```

port-number is the server port to which the RADIUS client sends disconnect requests. The L2TP network server, which accepts these disconnect requests, is the server. You can specify a port number on which to contact the RADIUS disconnect server. Most RADIUS servers use port number 1700.



NOTE: The JUNOS Software accepts only disconnect requests from the client address configured at the [edit access radius-disconnect *client-address*] hierarchy level.

client-address is the host sending disconnect requests to the RADIUS server. The client address is a valid IP address configured on one of the router interfaces.

password authenticates the RADIUS client. Passwords can contain spaces. The secret used by the local router must match that used by the server.

For information about how to configure RADIUS authentication for L2TP, see “Configuring RADIUS Authentication for L2TP” on page 466.

The following example shows the statements to be included at the [edit access] hierarchy level to configure the RADIUS disconnect server:

```
[edit access]
radius-disconnect-port 1700;
radius-disconnect {
  192.168.64.153 secret "$9$rtkl87ws4ZDkgokPT3tpEcyIWL7-VY4a";
  # SECRET-DATA
  192.168.64.162 secret "$9$rtkl87ws4ZDkgokPT3tpEcyIWL7-VY4a";
  # SECRET-DATA
}
```

Configuring RADIUS Authentication for an L2TP Client and Profile

On an M10i or M7i router, L2TP supports RADIUS authentication and accounting for users with one set of RADIUS servers under the [edit access] hierarchy. You can also configure RADIUS authentication for each tunnel client or user profile.

To configure the RADIUS authentication for L2TP tunnel clients on an M10i or M7i router, include the `ppp-profile` statement with the `l2tp` attributes for tunnel clients:

```
[edit access profile profile-name client client-name l2tp]
ppp-profile profile-name;
```

`ppp-profile profile-name` specifies the profile used to validate PPP session requests through L2TP tunnels. Clients of the referenced profile must have only PPP attributes. The referenced group profile must be defined.

To configure the RADIUS authentication for a profile, include following statements at the [edit access profile *profile-name*] hierarchy level:

```
[edit access profile profile-name]
radius-server server-address {
  accounting-port port-number;
  port port-number;
  retry attempts;
  routing-instance routing-instance-name;
  secret password;
  source-address source-address;
  timeout seconds;
```

```
}
```

When a PPP user initiates a session and RADIUS authentication is configured for the user profile on the tunnel group, the following priority sequence is used to determine which RADIUS server is used for authentication and accounting:

- If the **ppp-profile** statement is configured under the tunnel client (LAC), the RADIUS servers configured under the specified **ppp-profile** are used.
- If RADIUS servers are configured under the user profile for the tunnel group, those servers will be used.
- If no RADIUS server is configured for the tunnel client (LAC) or user profile, then the RADIUS servers configured at the [edit access] hierarchy level are used.

Example: Configuring RADIUS Authentication for an L2TP Profile

The following example shows statements to be included at the [edit access] hierarchy level to configure RADIUS authentication for an L2TP profile:

```
[edit access]
profile t {
  client LAC_A {
    l2tp {
      ppp-profile u;
    }
  }
}
profile u {
  client client_1 {
    ppp {
    }
  }
  5.5.5.5 {
    port 3333;
    secret $9$dkafeqwrew;
    source-address 1.1.1.1;
    retry 3;
    timeout 3;
  }
  6.6.6.6 secret $9$fe3erqwrez;
  7.7.7.7 secret $9$f34929ftby;
}
```

Configuring an IKE Access Profile

An Internet Key Exchange (IKE) access profile is used to negotiate IKE and IPsec security associations with dynamic peers. You can configure only one tunnel profile per service set for all dynamic peers. The configured preshared key in the profile is used for IKE authentication of all dynamic peers terminating in that service set. Beginning with JUNOS Release 8.2, you can also use the digital certificate method for IKE authentication with dynamic peers. Include the **ike-policy** *policy-name* statement at the [edit access profile *profile-name* client * ike] hierarchy level. *policy-name* is the

name of the IKE policy you define at the [edit services ipsec-vpn ike policy *policy-name*] hierarchy level.

The IKE tunnel profile specifies all the information you need to complete the IKE negotiation. Each protocol has its own statement hierarchy within the client statement to configure protocol-specific attribute value pairs, but only one client configuration is allowed for each profile. The following is the configuration hierarchy.

```
[edit access]
profile profile-name {
  client * {
    ike {
      allowed-proxy-pair {
        remote remote-proxy-address local local-proxy-address;
      }
      pre-shared-key (ascii-text character-string | hexadecimal hexadecimal-digits);
      ike-policy policy-name;
      initiate-dead-peer-detection;
      interface-id string-value;
    }
  }
}
```

For dynamic peers, the JUNOS Software supports only IKE main mode with both the preshared key and digital certificate methods. In this mode, an IPv6 or IPv4 address is used to identify a tunnel peer to obtain the preshared key or digital certificate information. The client value * (wildcard) means that configuration within this profile is valid for all dynamic peers terminating within the service set accessing this profile.

The following statement makes up the IKE profile:

- **allowed-proxy-pair**—During phase 2 IKE negotiation, the remote peer supplies its network address (**remote**) and its peer's network address (**local**). Since multiple dynamic tunnels are authenticated through the same mechanism, this statement must include the list of possible combinations. If the dynamic peer does not present a valid combination, the phase 2 IKE negotiation fails.

By default, **remote 0.0.0.0/0 local 0.0.0.0/0** is used if no values are configured.

- **pre-shared-key**—Key used to authenticate the dynamic peer during IKE phase 1 negotiation. This key is known to both ends through an out-of-band secure mechanism. You can configure the value either in **hexadecimal** or **ascii-text** format. It is a mandatory value.
- **ike-policy**—Name of the IKE policy that defines either the local digital certificate or the pre-shared key used to authenticate the dynamic peer during IKE negotiation. You must include this statement to use the digital certificate method for IKE authentication with a dynamic peer. You define the IKE policy at the [edit services ipsec-vpn ike policy *policy-name*] hierarchy level.
- **initiate-dead-peer-detection**—Detects dead peers on dynamic IPsec tunnels..
- **interface-id**—Interface identifier, a mandatory attribute used to derive the logical service interface information for the session.

Subscriber Access Management

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- RADIUS Authentication and Accounting for Subscriber Access Management Overview on page 476
- Configuring Router Interactions with RADIUS Servers for Subscriber Access on page 476
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Subscriber Access Management Overview

The subscriber access management feature enables you to manage the subscribers that are allowed access to the network server, the services that authorized subscribers can use, and how accounting statistics are collected. The subscriber access management feature uses the AAA Service Framework to support the configuration and management of broadband subscriber access. You can statically configure different client types, such as DHCP-based subscribers or PPP subscribers, and specify the authentication, accounting, and service for the subscribers.

AAA Service Framework Overview

The AAA Service Framework provides a single point of contact for all the authentication, authorization, accounting, and address assignment services that the router supports for network access. The framework supports authentication and authorization through external servers, such as RADIUS, and the Local Authentication Server component of the framework. The framework also supports accounting through external servers, and address assignment through a combination of local address assignment pools and RADIUS.

When interacting with external back-end RADIUS servers, the AAA Service Framework supports standard RADIUS attributes and Juniper Networks vendor specific attributes (VSAs). The AAA Service Framework also includes an integrated RADIUS client that is compatible with RADIUS servers that conform to RFC-2865, RFC-2866, and RFC-3576, and which can initiate requests.

You create the following types of configurations to manage subscriber access.

- Authentication—Authentication parameters defined in the access profile determine the authentication component of the AAA processing. For example, subscribers can be authenticated using a remote authentication service such as RADIUS. You can also use the Local Authentication Server component of the AAA framework, which authenticates subscribers based on preconfigured credentials.
- Accounting—Accounting parameters in the access profile specify the accounting part of the AAA processing. For example, the parameters determine how the router collects and uses subscriber statistics.
- Address assignment—The AAA Service Framework assigns addresses to subscribers based on the configuration of local address assignment pools. For example, the AAA framework collaborates with RADIUS servers to assign addresses from the specified pools. See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.

RADIUS Authentication and Accounting for Subscriber Access Management Overview

To configure the router to use RADIUS authentication and accounting for the subscriber access management feature, you create access profiles that specify the following levels of configuration. Subscriber access management supports access profiles attached at the [edit logical-systems *logical-system-name* routing-instances *routing-instance-name*] hierarchy level.

- Router interaction with RADIUS servers—Specify how the router interacts with RADIUS servers, such as the ports used for authentication and accounting, the number of times the router tries to contact a RADIUS server, and passwords.
- Authentication and accounting parameters—Create the access profile that defines authentication and accounting parameters, such as the authentication or accounting methods to use, and how accounting statistics are collected and used.
- RADIUS parameters—Specify the RADIUS servers and options for authentication and accounting, and define how RADIUS attributes are used.

Configuring Router Interactions with RADIUS Servers for Subscriber Access

To identify the RADIUS servers that the router can use and to configure how the router interacts with the servers, you include the `radius-server` statement at the [edit access] hierarchy level. You can specify multiple RADIUS servers on the network.

```
[edit access]
radius-server server-address {
  accounting-port port-number;
  port port-number;
```

```

    retry attempts;
    secret password;
    source-address source-address;
    timeout seconds;
}

```

The following list describes the **radius-server** configuration statements:

- **server-address**—The address of the RADIUS server to use. To configure more than one RADIUS server, include multiple **server-address** entries.
- **accounting-port**—The RADIUS server accounting port number. The default accounting port number is 1813.
- **port-number**—The port number used to contact the RADIUS server. The default is port number 1812.
- **retry**—The number of times that the router attempts to contact a RADIUS accounting server. You can configure the router to retry from 1 through 16 times. The default setting is 3 retry attempts.
- **secret**—The required secret (password) that the local router passes to the RADIUS client. Secrets can contain spaces.
- **source-address**—A source address for the RADIUS server. Each RADIUS request sent to a RADIUS server uses the specified source address. The source address is a valid IPv4 address configured on one of the router interfaces.
- **timeout**—The length of time that the local router waits to receive a response from a RADIUS server. By default, the router waits 3 seconds. You can configure the timeout to be from 1 to 90 seconds.

Configuring Authentication and Accounting Parameters for Subscriber Access

You use an access profile to configure authentication and accounting support for the subscriber access management feature. The access profile enables you to specify the type of methods used for authentication and accounting. You can also configure how subscriber access management collects and uses accounting statistics.

Tasks to configure authentication and accounting for Subscriber Access Management are:

1. Specifying Authentication and Accounting Methods on page 477
2. Configuring How Accounting Statistics Are Collected on page 478

Specifying Authentication and Accounting Methods

To specify the authentication and accounting methods that subscriber access management uses, you include the **authentication-order** statement and **accounting order** statements at the [edit access profile *profile-name*] hierarchy level.

```

[edit access profile profile-name]
authentication-order [ authentication-methods ]
}
accounting {
    order [ accounting-methods ];
}

```

```
}
```

You can configure multiple authentication and accounting methods—the **authentication-order** and **accounting order** statements specify the order in which the subscriber access management feature uses the methods. For example, an authentication entry of **radius none** specifies that RADIUS authentication is performed first and, if it fails, no authentication (**none**) is done.

```
[edit access profile profile-name]  
authentication-order radius none;
```

You can specify the following authentication methods:

- **none**—No authentication
- **password**—Local authentication
- **radius**—RADIUS-based authentication

You can specify the following accounting methods:

- **radius**—RADIUS-based accounting

Configuring How Accounting Statistics Are Collected

Include the **accounting** statement at the `[edit access profile profile-name]` hierarchy level to specify how the subscriber access management feature collects and uses accounting statistics.

```
[edit access profile profile-name]  
accounting {  
    accounting-stop-on-access-deny;  
    accounting-stop-on-failure;  
    order [ accounting-method ];  
    statistics (time);  
    update-interval minutes;  
}
```

The following list describes the accounting statements:

- **accounting-stop-on-access-deny**—Configures AAA to issue an Acct-Stop message if the AAA server denies access to the subscriber.
- **accounting-stop-on-failure**—Configures the AAA servers to send an Acct-Stop message if the subscriber fails AAA but is granted access by the AAA-server.
- **order**—The order in which multiple accounting methods are used. For example, an entry of **radius** specifies that the router use RADIUS accounting and, if that fails, no accounting is performed.
- **statistics**—The types of statistics to gather. Currently, only time statistics are gathered.
- **update-interval**—Configures the number of minutes between accounting updates. You can configure an interval from 10 to 1440 minutes. If you specify an interval between 10 and 15, the interval is rounded up to 15.

Configuring RADIUS Parameters for AAA Subscriber Management

Include the `radius` statement at the `[edit access profile profile-name]` hierarchy level to specify the RADIUS parameters for the subscriber access manager feature. You can specify the IP addresses of the RADIUS servers used for authentication and accounting, options that provide configuration information for the RADIUS servers, and how RADIUS attributes are used.

Tasks to configure RADIUS parameters for subscriber access management are:

1. Specifying the RADIUS Authentication and Accounting Servers to Use for Subscriber Access Management on page 479
2. Configuring Options for RADIUS Servers on page 479
3. Configuring How RADIUS Attributes Are Used on page 480

Specifying the RADIUS Authentication and Accounting Servers to Use for Subscriber Access Management

To specify one or more RADIUS authentication or accounting servers to use for subscriber access management, include the `authentication-server` and `accounting-server` statements at the `[edit access profile profile-name radius]` hierarchy level. You must specify the IP address for the authentication or accounting server.

```
[edit access profile profile-name radius]
authentication-server [ ip-address ];
accounting-server [ ip-address ];
```

To configure multiple RADIUS authentication or accounting servers, include multiple *ip-address* entries, for example:

```
[edit access profile profile-name radius]
authentication-server 192.168.1.1 192.168.1.2 192.168.1.3;
accounting-server 192.168.1.1 192.168.1.3 192.168.1.4;
```

Configuring Options for RADIUS Servers

Include the `options` statement at the `[edit access profile profile-name radius]` hierarchy level to specify the options used by the RADIUS authentication and accounting servers.

```
[edit access profile profile-name radius]
options {
  accounting-session-id-format (decimal | description);
  ethernet-port-type-virtual;
  interface-description-format [sub-interface | adapter];
  nas-identifier identifier-value;
  nas-port-extended-format {
    adapter-width width;
    port-width width;
    slot-width width;
    stacked-vlan-width width;
    vlan-width width;
  }
}
```

```

    override-nas-information;
    revert-interval interval;
    vlan-nas-port-stacked-format;
}

```

The following list describes the accounting options:

- **accounting-session-id-format**—The format the router uses to identify the accounting session. The identifier can be in one of the following formats. The router uses decimal format by default.
 - **decimal**—For example, 435264
 - **description**—In the format, *jnpr interface-specifier:subscriber-session-id*. For example, *jnpr fastEthernet 3/2.6:1010101010101*
- **ethernet-port-type-virtual**—The physical port type the router uses to authenticate clients. The port type is passed in RADIUS attribute 61 (NAS-Port-Type). This statement specifies a port type of **virtual**; by default the router passes a port type of **ethernet** in RADIUS attribute 61.
- **interface-description-format**—The information that is included in or omitted from the interface description that the router passes to RADIUS for inclusion in the RADIUS attribute 87 (NAS-Port-Id). By default, the router includes both the subinterface and the adapter in the interface description.
- **nas-identifier**—The value for the client RADIUS attribute 32 (NAS-Identifier), which is used for authentication and accounting requests. You can specify a string in the range 1 to 64 characters.
- **nas-port-extended-format**—Configures the RADIUS client to use the extended format for RADIUS attribute 5 (NAS-Port) and specify the width of the fields in the NAS-Port attribute.
 - **adapter-width *width***—Number of bits in the adapter field.
 - **port-width *width***—Number of bits in the port field.
 - **slot-width *width***—Number of bits in the slot field.
 - **stacked-vlan-width *width***—Number of bits in the SVLAN ID field.
 - **vlan-width *width***—Number of bits in the VLAN ID field.
- **revert-interval**—The amount of time that the router waits after a server has become unreachable. The router rechecks the connection to the server when the revert-interval expires. If the server is then reachable, it is used in accordance with the order of the server list.
- **vlan-nas-port-stacked-format**—Configures RADIUS attribute 5 (NAS-Port) to include the S-VLAN ID, in addition to the VLAN ID, for subscribers on Ethernet interfaces.

Configuring How RADIUS Attributes Are Used

Include the **attributes** statement at the [edit access profile *profile-name* radius] hierarchy level to specify attributes that are ignored in RADIUS Access-Accept messages, or that are excluded from particular RADIUS message types.

```
[edit access profile profile-name radius]
attributes {
  ignore {
    framed-ip-netmask;
    input-filter;
    logical-system-routing-instance;
    output-filter;
  }
  exclude
    accounting-authentic [ accounting-on | accounting-off ];
    accounting-delay-time [ accounting-on | accounting-off ];
    accounting-session-id [ access-request | accounting-on | accounting-off |
      accounting-stop ];
    accounting-terminate-cause [ accounting-off ];
    called-station-id [ access-request | accounting-start | accounting-stop ];
    calling-station-id [ access-request | accounting-start | accounting-stop ];
    class [ accounting-start | accounting-stop ];
    dhcp-gi-address [ access-request | accounting-start | accounting-stop ];
    dhcp-mac-address [ access-request | accounting-start | accounting-stop ];
    output-filter [ accounting-start | accounting-stop ];
    event-timestamp [ accounting-on | accounting-off | accounting-start |
      accounting-stop ];
    framed-ip-address [ accounting-start | accounting-stop ];
    framed-ip-netmask [ accounting-start | accounting-stop ];
    input-filter [ accounting-start | accounting-stop ];
    input-gigapackets [ accounting-stop ];
    input-gigawords [ accounting-stop ];
    interface-description [ access-request | accounting-start | accounting-stop ];
    nas-identifier [ access-request | accounting-on | accounting-off | accounting-start
      | accounting-stop ];
    nas-port [ access-request | accounting-start | accounting-stop ];
    nas-port-id [ access-request | accounting-start | accounting-stop ];
    nas-port-type [ access-request | accounting-start | accounting-stop ];
    output-gigapackets [ accounting-stop ];
    output-gigawords [ accounting-stop ];
  }
}
```

The following list describes the **ignore** and **exclude** statements:

- Use the **ignore** statement to configure the router to ignore a particular attribute in RADIUS Access-Accept messages. By default, the router processes the attributes received from the external AAA server. You can specify that the following attributes be ignored:
 - **framed-ip-netmask**—Framed-Ip-Netmask, RADIUS attribute 9
 - **input-filter**—Ingress-Policy-Name, VSA 26-10
 - **logical-system-routing-instance**—Virtual-Router, VSA 26-1
 - **output-filter**—Egress-Policy-Name, VSA 26-11
- Use the **exclude** statement to configure the router to exclude the specified attributes from the specified type of RADIUS message. Not all attributes appear in all types of RADIUS messages—the CLI indicates the RADIUS message type. By default, the router includes the specified attributes in RADIUS Access-Request,

Acct-On, Acct-Off, Acct-Start, and Acct-Stop messages. You can configure the router to exclude the following attributes:

- `accounting-authentic`—RADIUS attribute 45, Acct-Authentic
- `accounting-delay-time`—RADIUS attribute 41, Acct-Delay-Time
- `accounting-session-id`—RADIUS attribute 44, Acct-Session-Id
- `accounting-terminate-cause`—RADIUS attribute 49, Acct-Terminate-Cause
- `called-station-id`—RADIUS attribute 30, Called-Station-Id
- `calling-station-id`—RADIUS attribute 31, Calling-Station-Id
- `class`—RADIUS attribute 25, Class
- `dhcp-gi-address`—Juniper VSA 26-57, DHCP-GI-Address
- `dhcp-mac-address`—Juniper VSA 26-56, DHCP-MAC-Address
- `event-timestamp`—RADIUS attribute 55, Event-Timestamp
- `framed-ip-address`—RADIUS attribute 8, Framed-IP-Address
- `framed-ip-netmask`—RADIUS attribute 9, Framed-IP-Netmask
- `input-filter`—Juniper VSA 26-10, Ingress-Policy-Name
- `input-gigapackets`—Juniper VSA 26-42, Acct-Input-Gigapackets
- `input-gigawords`—RADIUS attribute 52, Acct-Input-Gigawords
- `interface-description`—Juniper VSA 26-53, Interface-Desc
- `nas-identifier`—RADIUS attribute 32, NAS-Identifier
- `nas-port`—RADIUS attribute 5, NAS-Port
- `nas-port-id`—RADIUS attribute 87, NAS-Port-Id
- `nas-port-type`—RADIUS attribute 61, NAS-Port-Type
- `output-filter`—Juniper VSA 26-11, Egress-Policy-Name
- `output-gigapackets`—Juniper VSA 25-43, Acct-Output-Gigapackets
- `output-gigawords`—RADIUS attribute 53, Acct-Output-Gigawords

Example: Configuring RADIUS-Based Subscriber Authentication and Accounting

The following example shows a sample RADIUS-based authentication and accounting configuration:

```
[edit access]
radius-server {
  192.168.1.250 {
```

```

    port 1812;
    accounting-port 1813;
    retry 3;
    secret &tIUeI*7688+;
    source-address 192.168.1.100;
    timeout 45;
}
192.168.1.251 {
    port 1812;
    accounting-port 1813;
    retry 3;
    secret $Dyu*UY(877-;
    source-address 192.168.1.100;
    timeout 30;
}
192.168.1.252 {
    port 1812;
    secret $Dyu*UY(877-;
}
}
profile isp-bos-metro-fiber-basic {
    authentication {
        order radius none;
    }
    accounting {
        order radius;
        accounting-stop-on-access-deny;
        accounting-stop-on-failure;
        immediate-update;
        statistics time;
        update-interval 12;
    }
    radius {
        authentication-server 192.168.1.251 192.168.1.252;
        accounting-server 192.168.1.250 192.168.1.251;
        options {
            accounting-session-id-format decimal;
            nas-identifier 56;
            override-nas-information;
        }
        attributes {
            ignore {
                framed-ip-netmask;
            }
            exclude {
                accounting-delay-time [ accounting-on | accounting-off ];
                accounting-session-id [ access-request | accounting-on | accounting-off
                | accounting-start accounting-stop ];
                dhcp-gi-address [ access-request | accounting-start | accounting-stop ];
                dhcp-mac-address [ access-request | accounting-start | accounting-stop ];
                nas-identifier [ access-request | accounting-start | accounting-stop ];
                nas-port [ access-request | accounting-start | accounting-stop ];
                nas-port-id [ access-request | accounting-start | accounting-stop ];
                nas-port-type [ access-request | accounting-start | accounting-stop ];
            }
        }
    }
}

```

```

    }
  }
[edit logical-systems isp-bos-metro-12 routing-instances isp-cmbrg-12-32]
interfaces {
  lo0 {
    unit 0 {
      family inet {
        address 192.168.1.100/24;
      }
    }
  }
  ge-0/0/0 {
    vlan-tagging;
    unit 0 {
      vlan-id 200;
      family inet {
        unnumbered-address lo0.0;
      }
    }
  }
}

```

RADIUS Attributes and Juniper Networks VSAs Supported by the AAA Service Framework

The AAA Service Framework supports RADIUS attributes and vendor-specific attributes (VSAs)—this support provides tunable parameters that the subscriber access management feature uses when creating subscribers and services.

RADIUS attributes are carried as part of standard RADIUS request and reply messages. The subscriber management access feature uses the RADIUS attributes to exchange specific authentication, authorization and accounting information. VSAs allow the subscriber access management feature to pass implementation-specific information that provide extended capabilities, such as service activation or deactivation, and enabling and disabling filters.

Table 36 on page 484 describes the supported RADIUS IETF attributes. Table 37 on page 487 describes the supported Juniper Networks VSAs.

RADIUS IETF Attributes Supported by the AAA Service Framework

Table 36 on page 484 describes the RADIUS IETF attributes supported by the JUNOS Software AAA Service Framework.

Table 36: Supported RADIUS IETF Attributes

Attribute Number	Attribute Name	Description
1	User-Name	<ul style="list-style-type: none"> Name of user to be authenticated Configurable username override
2	User-Password	<ul style="list-style-type: none"> Password of user to be authenticated by Password Authentication Protocol (PAP) Configurable password override

Table 36: Supported RADIUS IETF Attributes (continued)

Attribute Number	Attribute Name	Description
4	NAS-IP-Address	IP address of the network access server (NAS) that is requesting authentication of the user
5	NAS-Port	Physical port number of the NAS that is authenticating the user
6	Service-Type	Type of service the user has requested or the type of service to be provided
8	Framed-IP-Address	<ul style="list-style-type: none"> ■ IP address to be configured for the user ■ 0.0.0.0 or absence is interpreted as 255.255.255.254
9	Framed-IP-Netmask	<ul style="list-style-type: none"> ■ IP network to be configured for the user when the user is a router to a network ■ Absence implies 255.255.255.255
11	Filter-ID	<ul style="list-style-type: none"> ■ Name of the filter list for the user ■ Interpreted as input policy name
12	Framed-MTU	<ul style="list-style-type: none"> ■ Maximum Transmission Unit to be configured for the user when it is not negotiated by some other means (such as PPP). ■ When sent in an Access-Request with an EAP-Message, indicates the maximum size of the EAP-Message string that the external server supports.
18	Reply-Message	<ul style="list-style-type: none"> ■ Text that may be displayed to the user ■ Only the first instance of this attribute is used
22	Framed-Route	String that provides routing information to be configured for the user on the NAS; in the format: <code><addr>[/<maskLen>] [<nexthop> [<cost>]] (tag <tagValue>) [distance <distValue>]</code>
25	Class	Arbitrary value that the NAS includes in all accounting packets for the user if supplied by the RADIUS server
27	Session-Timeout	Maximum number of consecutive seconds of service to be provided to the user before termination of the session
32	NAS-Identifier	NAS originating the request
40	Acct-Status-Type	Indicates whether this Accounting-Request marks the beginning of the user service (Start), the end (Stop), or the interim (Interim-Update)
41	Acct-Delay-Time	Indicates how many seconds the client has been trying to send a particular record
42	Acct-Input-Octets	Indicates how many octets have been received from the port during the time this service has been provided

Table 36: Supported RADIUS IETF Attributes (continued)

Attribute Number	Attribute Name	Description
43	Acct-Output-Octets	Indicates how many octets have been sent to the port during the time this service has been provided
44	Acct-Session-ID	<p>Unique accounting identifier that makes it easy to match start and stop records in a log file. The identifier can be in one of the following formats:</p> <ul style="list-style-type: none"> ■ decimal—For example, 435264 ■ description—In the generic format, <i>jnpr interface-specifier:subscriber-session-id</i>; For example, <i>jnpr fastEthernet 3/2.6:1010101010101</i>
45	Acct-Authentic	Indicates how the user was authenticated: whether by RADIUS, the NAS itself, or another remote authentication protocol
46	Acct-Session-Time	Indicates how long in seconds that the user has received service
47	Acct-Input-Packets	Indicates how many packets have been received from the port during the time this service has been provided to a framed user
48	Acct-Output-Packets	Indicates how many packets have been sent to the port in the course of delivering this service to a framed user
49	Acct-Terminate-Cause	<p>Contains the reason the service (a PPP session) was terminated. The service can be terminated for the following reasons:</p> <ul style="list-style-type: none"> ■ User Request (1)—User initiated the disconnect (log out) ■ Idle Timeout (4)—Idle timer has expired ■ Session Timeout (5)—Client reached the maximum continuous time allowed on the service or session ■ Admin Reset (6)—System administrator terminated the session ■ Port Error (8)—PVC failed; no hardware or no interface ■ NAS Error (9)—Negotiation failures, connection failures, or address lease expiration ■ NAS Request (10)—PPP challenge timeout, PPP request timeout, tunnel establishment failure, PPP bundle failure, IP address lease expiration, PPP keep-alive failure, Tunnel disconnect, or an unaccounted-for error
52	Acct-Input-Gigawords	Indicates how many times the Acct-Input-Octets counter has wrapped around 2^{32} during the time this service has been provided. Can be present in Accounting-Request records only where the Acct-Status-Type is set to Stop or Interim-Update

Table 36: Supported RADIUS IETF Attributes (continued)

Attribute Number	Attribute Name	Description
53	Acct-Output-Gigawords	Indicates how many times the Acct-Output-Octets counter has wrapped around 2^{32} in the course of delivering this service. Can be present in Accounting-Request records only where the Acct-Status-Type is set to Stop or Interim-Update
55	Event-Timestamp	Records the time that this event occurred on the NAS, in seconds, since January 1, 1970 00:00 UTC
61	NAS-Port-Type	Indicates the type of physical port the NAS is using to authenticate the user
85	Acct-Interim-Interval	Number of seconds between each interim accounting update for this session
87	NAS-Port-ID	Text string that identifies the physical interface of the NAS that is authenticating the user
88	Framed-Pool	Name of an assigned address pool that should be used to assign an address for the user

Juniper Networks VSAs Supported by the AAA Service Framework

Table 37 on page 487 describes Juniper Networks VSAs supported by the JUNOS Software AAA Service Framework. The AAA Service Framework uses vendor ID 4874, which is assigned to Juniper Networks by the Internet Assigned Numbers Authority (IANA).

Table 37: Supported Juniper Networks VSAs

Attribute Number	Attribute Name	Description	Value
26-4	Primary-DNS	Client DNS address negotiated during IPCP	integer: 4-byte primary-dns-address
26-5	Secondary-DNS	Client DNS address negotiated during IPCP	integer: 4-byte secondary-dns-address
26-6	Primary-WINS	Client WINS (NBNS) address negotiated during IPCP	integer: 4-byte primary-wins-address
26-7	Secondary-WINS	Client WINS (NBNS) address negotiated during IPCP	integer: 4-byte secondary-wins-address
26-10	Ingress-Policy-Name	Input policy name to apply to client interface	string: input-policy-name

Table 37: Supported Juniper Networks VSAs (continued)

Attribute Number	Attribute Name	Description	Value
26-11	Egress-Policy-Name	Output policy name to apply to client interface	string: output-policy-name
26-12	Ingress-Statistics	Enable or disable input statistics on client interface	integer: ■ 0 = disable ■ 1 = enable
26-13	Egress-Statistics	Enable or disable output statistics on client interface	integer: ■ 0 = disable ■ 1 = enable
26-23	IGMP-Enable	Enable or disable IGMP on a client interface	integer: ■ 0 = disable ■ 1 = enable
26-34	Framed-IP-Route-Tag	Route tag to apply to returned framed-ip-address	integer: 4-octet
26-42	Input-Gigapackets	Number of times input-packets attribute rolls over its 4-octet field	integer
26-43	Output-Gigapackets	Number of times output-packets attribute rolls over its 4-octet field	integer
26-56	DHCP-MAC-Address	Client MAC address	string: mac-address
26-57	DHCP-GI-Address	DHCP relay agent IP address	integer: 4-octet
26-63	Interface	Text string that identifies the subscriber's access interface	string: interface-description
26-65	Activate-Service	Service to activate for the subscriber	string: service-name
26-66	Deactivate-Service	Service to deactivate for the subscriber	string: service-name
26-70	Ignore-DF-Bit	Enable or disable the ignore don't fragment (DF) bit feature on a client interface	integer: ■ 0 = disable ■ 1 = enable

Table 37: Supported Juniper Networks VSAs (continued)

Attribute Number	Attribute Name	Description	Value
26-71	IGMP-Access-Group-Name	Access List to use for the group (G) filter	string: 32-octet
26-72	IGMP-Access-Source-Group-Name	Access List to use for the source-group (S,G) filter	string: 32-octet
26-74	MLD-Access-Group-Name	Access List to use for the group (G) filter	string: 32-octet
26-75	MLD-Access-Source-Group-Name	Access List to use for the source-group (S,G) filter	string: 32-octet
26-77	MLD-Version	MLD Protocol Version	integer: 1-octet ■ 1 = MLD version ■ 2 = MLD version
26-78	IGMP-Version	IGMP Protocol Version	integer: 1-octet ■ 1 = IGMP version ■ 2 = IGMP version ■ 3 = IGMP version
26-83	Acct-Service-Session	Name of the service (including parameter values) that is associated with service manager statistics	string: service-name
26-97	IGMP-Immediate-Leave	IGMP Immediate Leave	integer: 4-octet ■ 0 = disable ■ 1 = enable
26-100	MLD-Immediate-Leave	MLD Immediate Leave	integer: 4-octet ■ 0 = disable ■ 1 = enable

Attaching Access Profiles with the Routing Instance

Once you have created the access profile that specifies the subscriber access management authentication and accounting parameters, you attach the profile. Subscriber access management supports access profiles attached at the [edit

logical-systems *logical-instance-name* routing-instances *routing-instance-name*] level of this hierarchy.

```
[edit logical-systems logical-system-name routing-instances routing-instance-name]
access-profile profile-name;
```

For example:

```
[edit logical-systems isp22-bos-metro-12 routing-instances isp22-cmbrg-12-32]
access-profile vz-bos-metro-fios-basic;
```

Verifying and Managing Subscriber Access Information

- | | |
|----------------|---|
| Purpose | <ul style="list-style-type: none"> ■ Display subscriber access statistics and information ■ Clear subscriber access statistics and to log out specific subscribers |
| Action | <p>To display subscriber access statistics and information, use the following operational commands:</p> <ul style="list-style-type: none"> ■ show network-access aaa statistics ■ show network-access aaa subscribers <p>To clear subscriber access statistics and to log out specific subscribers, use the following operational command:</p> <ul style="list-style-type: none"> ■ clear network-access aaa subscribers |

For information about using these operational commands, see the *JUNOS System Basics and Services Command Reference*.

Overview of Address-Assignment Pools for Subscriber Access Management

The address-assignment pool feature supports subscriber management functionality by enabling you to create address pools that can be shared by different client applications. For example, multiple client applications, such as DHCP, can use an address-assignment pool to provide addresses for their particular clients. Client applications can acquire addresses for either authenticated or unauthenticated clients.

Address-assignment pools support both dynamic and static address assignment. In dynamic address assignment, a client is automatically assigned an address from the address-assignment pool. In static address assignment, you reserve an address that is then always used by a particular client. Addresses that are reserved for static assignment are removed from the dynamic address pool and cannot be assigned to other clients.

Address-assignment pools support named address ranges, which are subsets of the overall address range. A client application can use named ranges to manage address assignment based on client-specific criteria. For example, you might create a named range that is based on a specific DHCP option 82 value. Then, when a DHCP client request matches the specified option 82 value, an address from the specified range

is assigned to the client. The address lease also contains the DHCP configuration options specified in the `dhcp-attributes` statement.

License Requirements for Address-Assignment Pools

The address-assignment pool feature is part of the JUNOS Subscriber Management Feature Pack license. You must install and properly configure the license to meet the requirements for using the address-assignment pool feature.

Configuring Address-Assignment Pools for Subscriber Access Management

The address-assignment pool feature supports subscriber management functionality by enabling you to create address pools that can be shared by different client applications. For example, multiple client applications, such as DHCP, can use an address-assignment pool to provide addresses for their particular clients. Client applications can acquire addresses for either authenticated or unauthenticated clients.



NOTE: You cannot use address-assignment pools with the J Series router DHCP server. Also, address-assignment pools are completely separate from L2TP address pools, which you create with the `address-pool` statement at the `[edit access]` hierarchy level, and NAT pools, which you create with the `pool` statement at the `[edit services nat]` hierarchy level.

To configure an address-assignment pool, include the `address-assignment` statement at the `[edit access]` hierarchy level. Include the `dhcp-attributes` statement to enable DHCP support for the address-assignment pool.

```
[edit access]
address-assignment {
  pool pool-name family inet {
    network address-or-prefix</subnet-mask>;
    range name {
      low lower-limit high upper-limit;
    }
    host hostname {
      hardware-address mac-address;
      ip-address ip-address;
    }
  }
  dhcp-attributes {
    option-match {
      option-82 {
        circuit-id value range named-range;
        remote-id value range named-range;
      }
    }
  }
  boot-file filename;
  boot-server (address | hostname);
  domain-name domain-name;
  grace-period seconds;
  maximum-lease-time seconds;
  name-server [ server-names ];
```

```

netbios-node-type node-type;
option {
    [ (id-number option-type option-value)
      (id-number array option-type option-value) ];
}
router [ router-names ];
tftp-server address;
wins-server [ server-names ];
}
}
}

```

Tasks for configuring address-assignment pools for subscriber access management are:

1. Configuring an Address-Assignment Pool Name and Network Address on page 492
2. Configuring a Named Address Range for Dynamic Address Assignment on page 492
3. Configuring Static Address Assignment on page 493
4. Configuring DHCP Client-Specific Attributes on page 493

Configuring an Address-Assignment Pool Name and Network Address

To configure an address-assignment pool, include the following mandatory statements at the [edit access] hierarchy level:

```

[edit access]
address-assignment {
    pool pool-name family inet {
        network address-or-prefix</subnet-mask>;
    }
}

```

The address-assignment pool definition must include the pool name and the **network** statement. The **network** statement specifies the network address and prefix length for the addresses in the pool.

The following is an example of an address-assignment pool definition:

```

[edit access]
address-assignment {
    pool isp_1 family inet {
        network 192.168.0.0/16;
    }
}

```

Configuring a Named Address Range for Dynamic Address Assignment

Optionally, you can configure multiple named subsets of addresses within an address-assignment pool. During dynamic address assignment, a client can be assigned an address from a specific named range. To create a named range, use the **range** statement at the [edit access address-assignment pool *pool-name* family inet] hierarchy level to identify the range and configure the lower and upper address boundaries of the range:

```

range name {

```

```
    low lower-limit high upper-limit;
}
```

Configuring Static Address Assignment

You can optionally create a static binding by reserving a specific address for a particular client. When you reserve an address, that address is removed from the address-assignment pool so that it is not assigned to another client. To configure a static address assignment, use the `host` statement at the [edit access address-assignment pool *pool-name* family init] hierarchy level to identify the client and create a binding between the client MAC address and the assigned IP address:

```
host hostname {
    hardware-address mac-address;
    ip-address ip-address;
}
```

The following is an example of a static binding configuration. This configuration specifies that the client with MAC address 90:00:00:01:00:01 is always assigned IP address 192.168.44.12.

```
host svale6.boston.net {
    hardware-address 90:00:00:01:00:01;
    ip-address 192.168.44.12;
}
```

Configuring DHCP Client-Specific Attributes

Use the address-assignment pool feature to include application-specific attributes when clients obtain an address. The client application, such as DHCP, uses the attributes to determine how addresses are assigned, and to also provide optional application-specific characteristics to the client. For example, the DHCP application might specify that a client that matches certain prerequisite information is dynamically assigned an address from a particular named range. Based on which named range is used, DHCP specifies additional DHCP attributes such as the boot-file that the client uses, the lease grace period, and the maximum lease time.

Use the `dhcp-attributes` statement at the [edit access address-assignment pool *pool-name* family inet] hierarchy level to configure client-specific attributes for DHCP clients. Table 38 on page 494 describes the DHCP attributes.

```
dhcp-attributes {
    option-match {
        option-82 {
            circuit-id value range named-range;
            remote-id value range named-range;
        }
    }
    boot-file filename;
    boot-server (address | hostname);
    domain-name domain-name;
    grace-period seconds;
    maximum-lease-time seconds;
    name-server [ server-names ];
}
```

```

netbios-node-type node-type;
option {
    [ (id-number option-type option-value)
      (id-number array option-type option-value) ];
}
router [ router-names ];
tftp-server address;
wins-server [ server-names ];
}

```

DHCP Client-Specific Attributes

Table 38 on page 494 lists the DHCP client-specific attributes and the corresponding DHCP options:

Table 38: DHCP-Attributes Statements

Statement	Description	Corresponding DHCP Option
boot-file	Boot filename advertised to the client, and used by the client to complete configuration.	67
boot-server	Boot server containing the boot file.	66
domain-name	Domain in which clients search for a DHCP server host.	15
grace-period	Grace period offered with the lease.	none
option-match	Maps option 82 value to named address range.	none
maximum-lease-time	Maximum lease time allowed by the DHCP server.	51
name-server	IP address of domain name server.	6
netbios-node-type	NetBIOS node type.	46
option	User-defined options.	–
router	IP address for routers on the subnetwork.	3
tftp-server	Trivial File Transfer Protocol (TFTP) server that the client uses to obtain the client configuration file.	150
wins-server	IP address of the Windows NetBIOS name server.	44

Example: Configuring an Address-Assignment Pool

This topic shows a sample address-assignment pool configuration. The configuration includes the `dhcp-attributes` statement, indicating that the pool is used for DHCP clients.

[edit access]


```

address-assignment {
  pool isp_1 family inet {
    network 192.168.0.0/16;
    range southeast {
      low 192.168.102.2 high 192.168.102.254;
    }
    range northeast {
      low 192.168.119.2 high 192.168.119.250;
    }
    host sval6.boston.net {
      hardware-address 90:00:00:01:00:01;
      ip-address 192.168.44.12;
    }
  }
  dhcp-attributes {
    option-match {
      option-82 {
        circuit-id fiber range northeast;
      }
      option-82 {
        circuit-id cable_net range southeast;
      }
    }
    boot-file boot.client;
    boot-server 192.168.200.100;
    grace-period 3600;
    maximum-lease-time 18000;
    netbios-node-type p-node;
  }
  router 192.168.44.44 192.168.44.45;
}

```

This example creates address-assignment pool **isp-1**, which contains two named address ranges, **southeast** and **northeast**. The address-assignment pool also contains a static binding for client **host sval6.boston.net**. If the option 82 circuit-id entry matches the string **fiber**, then DHCP assigns the client an address from the **northeast** range. If the option 82 circuit-id matches the string **cable_net**, DHCP assigns an address from the **southeast** range.

Tracing Address-Assignment Pool Processes

To trace address-assignment pool processes, you can specify flags in the **traceoptions** statement at the [edit system processes general-authentication-service] hierarchy level. The default tracing behavior is the following:

- Important events are logged in a file called **authd** located in the **/var/log** directory.
- When the file **authd** reaches 128 kilobytes (KB), it is renamed **authd.0**, then **authd.1**, and so on, until there are 3 trace files. Then the oldest trace file (**authd2**) is overwritten. For more information about how log files are created, see the *JUNOS System Log Messages Reference*.
- Log files can be accessed only by the user who configures the tracing operation.

You cannot change the directory (`/var/log`) in which trace files are located. However, you can customize the other trace file settings by including the following statements at the `[edit system processes general-authentication-service]` hierarchy level:

```
[edit system processes general-authentication-service]
traceoptions {
  file filename {
    files number;
    size maximum-file-size;
    world-readable | no-world-readable;
    match regex;
  }
  flag address-assignment;
  flag all;
  flag configuration;
  flag framework;
  flag ldap;
  flag local-authentication;
  flag radius;
}
```

The following topics describe the tasks for configuring tracing operations for address-assignment pools in detail:

1. Configuring the Filename of the Address-Assignment Pool Trace Log on page 496
2. Configuring the Number and Size of Address-Assignment Pool Processes Log Files on page 496
3. Configuring Access to the Log File on page 497
4. Configuring a Regular Expression for Lines to Be Logged on page 497
5. Configuring Trace Operations on page 497

Configuring the Filename of the Address-Assignment Pool Trace Log

By default, the name of the file that records trace output for address-assignment pools is `authd`. You can specify a different name by including the `file` statement at the `[edit system processes general-authentication-service]` hierarchy level:

```
[edit system processes general-authentication-service traceoptions]
file filename;
```

Configuring the Number and Size of Address-Assignment Pool Processes Log Files

By default, when the trace file reaches 128 kilobytes (KB) in size, it is renamed `filename.0`, then `filename.1`, and so on, until there are 3 trace files. Then the oldest trace file (`filename.2`) is overwritten.

You can configure the limits on the number and size of trace files by including the following statement at the `[edit system processes general-authentication-service traceoptions]` hierarchy level:

```
[edit system processes general-authentication-service traceoptions]
```

```
file files number size size;
```

For example, set the maximum file size to 2 MB, and the maximum number of files to 20. When the file that receives the output of the tracing operation (*filename*) reaches 2 MB, *filename* is renamed *filename.0*, and a new file called *filename* is created. When the new *filename* reaches 2 MB, *filename.0* is renamed *filename.1* and *filename* is renamed *filename.0*. This process repeats until there are 20 trace files. Then the oldest file (*filename.19*) is overwritten by the newest file (*filename.0*).

The number of files can be from 2 through 1000 files. The file size of each file can be from 10 KB through 1 gigabyte (GB).

Configuring Access to the Log File

By default, log files can be accessed only by the user who configures the tracing operation.

To specify that any user can read all log files, include the `file world-readable` statement at the `[edit system processes general-authentication-service traceoptions]` hierarchy level:

```
[edit system processes general-authentication-service traceoptions]
file world-readable;
```

To explicitly set the default behavior, include the `file no-world-readable` statement at the `[edit system processes general-authentication-service traceoptions]` hierarchy level:

```
[edit system processes general-authentication-service traceoptions]
file no-world-readable;
```

Configuring a Regular Expression for Lines to Be Logged

By default, the trace operation output includes all lines relevant to the logged events.

You can refine the output by including the `match` statement at the `[edit system processes general-authentication-service file filename]` hierarchy level and specifying a regular expression (regex) to be matched:

```
[edit system processes general-authentication-service traceoptions]
file filename match regex;
```

Configuring Trace Operations

By default, only important events are logged. You can configure the trace operations to be logged by including the following statements at the `[edit system <process-name> traceoptions]` hierarchy level:

```
[edit system <process-name> traceoptions]
flag {
  address-assignment;
  all;
  configuration;
  framework;
```

```
ldap;  
local-authentication;  
no-remote-trace;  
radius;  
}
```

You can specify the following access tracing flags:

- **address-assignment**—All address-assignment events
- **all**—All tracing operations
- **configuration**—Configuration events
- **framework**—Authentication framework events
- **ldap**—LDAP authentication events `local-authentication`
- **local-authentication**—Local authentication events
- **no-remote-trace**—Disable remote tracing for a specific process
- **radius**—RADIUS authentication events

Chapter 14

Summary of Access Configuration Statements

The following sections explain each of the access configuration statements. The statements are organized alphabetically.

accounting

Syntax accounting {
 accounting-stop-on-access-deny;
 accounting-stop-on-failure;
 order [*accounting-method*];
 statistics (time | volume-time);
 update-interval *minutes*;
 }

Hierarchy Level [edit access profile *profile-name*]

Release Information Statement introduced in JUNOS Release 9.1.

Description Configure RADIUS accounting parameters and enable RADIUS accounting for an access profile.

The remaining statements are explained separately.

Usage Guidelines See “RADIUS Authentication and Accounting for Subscriber Access Management Overview” on page 476.

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

accounting-order

Syntax	accounting-order radius;
Hierarchy Level	[edit access profile <i>profile-name</i>]
Release Information	Statement introduced in JUNOS Release 8.0
Description	Enable RADIUS accounting for an L2TP profile.
Options	radius—Use RADIUS accounting method.
Usage Guidelines	See “Configuring the Accounting Order” on page 454.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

accounting-port

Syntax	accounting-port <i>port-number</i> ;
Hierarchy Level	[edit access radius-server <i>server-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the port number on which to contact the accounting server.
Options	<i>port-number</i> —The port number on which to contact the accounting server. Most RADIUS servers use port number 1813 (as specified in RFC 2866).
Usage Guidelines	See “Configuring RADIUS Authentication for L2TP” on page 466.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

accounting-server

Syntax	accounting-server [<i>ip-address</i>];
Hierarchy Level	[edit access profile <i>profile-name</i> radius]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify a list of the RADIUS accounting servers used to for accounting for DHCP, L2TP, and PPP clients.
Options	<i>ip-address</i> —The IP version 4 (IPv4) address.
Usage Guidelines	See “RADIUS Authentication and Accounting for Subscriber Access Management Overview” on page 476.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

accounting-session-id-format

Syntax	accounting-session-id-format (decimal description);
Hierarchy Level	[edit access profile <i>profile-name</i> radius options]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Configure the format the router uses to identify the accounting session.
Options	decimal—Use the decimal format. description—Use the generic format, in the form <i>jnpr interface-specifier:subscriber-session-id</i> . Default: decimal
Usage Guidelines	See “RADIUS Authentication and Accounting for Subscriber Access Management Overview” on page 476.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

accounting-stop-on-access-deny

Syntax	accounting-stop-on-access-deny;
Hierarchy Level	[edit access profile <i>profile-name</i> accounting]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Configure RADIUS accounting to send an Acct-Stop message when the AAA server denies a client access.
Usage Guidelines	See “RADIUS Authentication and Accounting for Subscriber Access Management Overview” on page 476.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

accounting-stop-on-failure

Syntax	accounting-stop-on-failure;
Hierarchy Level	[edit access profile <i>profile-name</i> accounting]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Configure RADIUS accounting to send an Acct-Stop message when client access fails AAA but the AAA server grants access.
Usage Guidelines	See “RADIUS Authentication and Accounting for Subscriber Access Management Overview” on page 476.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

address

Syntax	<code>address <i>address-or-prefix</i>;</code>
Hierarchy Level	<code>[edit access address-pool <i>pool-name</i>]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the IP address or prefix value for clients.
Options	<i>address-or-prefix</i> —An address or prefix value. The remaining statements are explained separately.
Usage Guidelines	See “Configuring the Address Pool for L2TP Network Server IP Address Allocation” on page 448.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

address-assignment

Syntax

```
address-assignment {
  pool pool-name family inet {
    network address-or-prefix</subnet-mask>;
    range range-name {
      low lower-limit high upper-limit;
    }
    host hostname {
      hardware-address mac-address;
      ip-address ip-address;
    }
    dhcp-attributes {
      [ protocol-specific attributes ]
    }
  }
}
```

Hierarchy Level [edit access]

Release Information Statement introduced in JUNOS Release 9.0.

Description Configure address-assignment pools that can be used by different client applications.

Options *pool-name*—Name assigned to an address-assignment pool.

The remaining statements are explained separately.

Usage Guidelines See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.

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

address-pool

Syntax	address-pool <i>pool-name</i> { address <i>address-or-prefix</i> ; address-range <low <i>lower-limit</i> > <high <i>upper-limit</i> >; }
Hierarchy Level	[edit access]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Allocate IP addresses for clients.
Options	<i>pool-name</i> —Name assigned to an address pool. The remaining statements are explained separately.
Usage Guidelines	See “Configuring the Address Pool for L2TP Network Server IP Address Allocation” on page 448.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

address-range

Syntax	address-range <low <i>lower-limit</i> > <upper <i>upper-limit</i> >;
Hierarchy Level	[edit access address-pool <i>pool-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the address range.
Options	<ul style="list-style-type: none"> ■ low <i>lower-limit</i>—The lower limit of an address range. ■ high <i>upper-limit</i>—The upper limit of an address range.
Usage Guidelines	See “Configuring the Address Pool for L2TP Network Server IP Address Allocation” on page 448.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

allowed-proxy-pair

Syntax	allowed-proxy-pair { remote <i>remote-proxy-address</i> local <i>local-proxy-address</i> ; }
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i>]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Specify the network address of the local and remote peer associated with an IKE access profile.
Options	remote <i>remote-proxy-address</i> —Network address of the remote peer. local <i>local-proxy-address</i> —Network address of the local peer. Default: remote 0.0.0.0/0 local 0.0.0.0/0
Usage Guidelines	See “Configuring an IKE Access Profile” on page 473.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

attributes

Syntax

```

attributes {
  ignore {
    framed-ip-netmask;
    input-filter;
    logical-system-routing-instance;
    output-filter;
  }
  exclude
    accounting-authentic [ accounting-on | accounting-off ];
    accounting-delay-time [ accounting-on | accounting-off ];
    accounting-session-id [ access-request | accounting-on | accounting-off |
      accounting-stop ];
    accounting-terminate-cause [ accounting-off ];
    called-station-id [ access-request | accounting-start | accounting-stop ];
    calling-station-id [ access-request | accounting-start | accounting-stop ];
    class [ accounting-start | accounting-stop ];
    dhcp-gi-address [ access-request | accounting-start | accounting-stop ];
    dhcp-mac-address [ access-request | accounting-start | accounting-stop ];
    output-filter [ accounting-start | accounting-stop ];
    event-timestamp [ accounting-on | accounting-off | accounting-start | accounting-stop ];
    framed-ip-address [ accounting-start | accounting-stop ];
    framed-ip-netmask [ accounting-start | accounting-stop ];
    input-filter [ accounting-start | accounting-stop ];
    input-gigapackets [ accounting-stop ];
    input-gigawords [ accounting-stop ];
    interface-description [ access-request | accounting-start | accounting-stop ];
    nas-identifier [ access-request | accounting-on | accounting-off | accounting-start |
      accounting-stop ];
    nas-port [ access-request | accounting-start | accounting-stop ];
    nas-port-id [ access-request | accounting-start | accounting-stop ];
    nas-port-type [ access-request | accounting-start | accounting-stop ];
    output-gigapackets [ accounting-stop ];
    output-gigawords [ accounting-stop ];
  }
}

```

Hierarchy Level [edit access profile *profile-name* radius]

Release Information Statement introduced in JUNOS Release 9.1.

Description Specify how the router processes RADIUS attributes.

The statements are explained separately.

Usage Guidelines See “Configuring How RADIUS Attributes Are Used” on page 480.

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

authentication-order

Syntax	authentication-order [<i>authentication-methods</i>];
Hierarchy Level	[edit access profile <i>profile-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Set the order in which the JUNOS Software tries different authentication methods when verifying that a client can access the router. For each login attempt, the software tries the authentication methods in order, from first to last.
Options	<p>radius—Verify the client using RADIUS authentication services.</p> <p>password—Verify the client using the information configured at the [edit access profile <i>profile-name</i> client <i>client-name</i>] hierarchy level.</p>
Usage Guidelines	See “Example: Configuring CHAP Authentication with RADIUS” on page 441 and “Configuring the Authentication Order” on page 453.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

authentication-server

Syntax	authentication-server [<i>ip-address</i>];
Hierarchy Level	[edit access profile <i>profile-name</i>]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify a list of the RADIUS authentication servers used to authenticate DHCP, L2TP, and PPP clients.
Options	<i>ip-address</i> —The IPv4 address.
Usage Guidelines	See “Configuring RADIUS Parameters for AAA Subscriber Management” on page 479.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

boot-file

Syntax	<code>boot-file filename;</code>
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet dhcp-attributes]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Set the boot file advertised to DHCP clients. After the client receives an IP address and the boot file location from the DHCP server, the client uses the boot image stored in the boot file to complete DHCP setup. This is equivalent to DHCP option 67.
Options	<i>filename</i> —The location of the boot file on the boot server. The filename can include a pathname.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ boot-server

boot-server

Syntax	<code>boot-server (address hostname);</code>
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> dhcp-attributes]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Configure the name of the boot server advertised to DHCP clients. The client uses a boot file located on the boot server to complete DHCP setup. This is equivalent to DHCP option 66.
Options	<ul style="list-style-type: none"> ■ <i>address</i>—The IPv4 address of a boot server. ■ <i>hostname</i>—The fully qualified hostname of a boot server.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ boot-file

cell-overhead

Syntax	cell-overhead;
Hierarchy Level	[edit access group-profile <i>profile-name</i> ppp], [edit access profile <i>profile-name</i> client <i>client-name</i> ppp]
Release Information	Statement introduced in JUNOS Release 8.3.
Description	Configure the session to use Asynchronous Transfer Mode (ATM)-aware egress shaping on the IQ2 PIC.
Usage Guidelines	See “Configuring the PPP Attributes for a Group Profile” on page 450 and “Configuring PPP Properties for a Client-Specific Profile” on page 461.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

chap-secret

Syntax	chap-secret <i>chap-secret</i> ;
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the CHAP secret key associated with a peer.
Options	<i>chap-secret</i> —The secret key associated with a peer.
Usage Guidelines	See “Configuring the CHAP Secret for an L2TP Profile” on page 456.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

circuit-id

Syntax	circuit-id <i>value</i> range <i>named-range</i> ;
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> dhcp-attributes option-matchoption-82]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Configure the address-assignment pool named-range to use for a particular option 82 agent circuit ID value.
Options	<ul style="list-style-type: none"> ■ circuit-id <i>value</i>—The string for the agent circuit ID suboption (suboption 1) of the DHCP relay agent information option (option 82) in DHCP packets. ■ range <i>named-range</i>—The name of the address-assignment pool range to use.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

client

Syntax client *client-name* {
 chap-secret *chap-secret*;
 group-profile *profile-name*;
 ike {
 allowed-proxy-pair {
 remote *remote-proxy-address* local *local-proxy-address*;
 }
 pre-shared-key (ascii-text *character-string* | hexadecimal *hexadecimal-digits*);
 ike-policy *policy-name*;
 interface-id *string-value*;
 }
 l2tp {
 interface-id *interface-id*;
 lcp-renegotiation;
 local-chap;
 maximum-sessions-per-tunnel *number*;
 multilink {
 drop-timeout *milliseconds*;
 fragmentation-threshold *bytes*;
 }
 ppp-authentication (chap | pap);
 ppp-profile *profile-name*;
 shared-secret *shared-secret*;
 }
 pap-password *pap-password*;
 ppp {
 cell-overhead;
 encapsulation-overhead *bytes*;
 framed-ip-address *ip-address*;
 framed-pool *framed-pool*;
 idle-timeout *seconds*;
 interface-id *interface-id*;
 keepalive *seconds*;
 primary-dns *primary-dns*;
 primary-wins *primary-wins*;
 secondary-dns *secondary-dns*;
 secondary-wins *secondary-wins*;
 }
 user-group-profile *profile-name*;
 }

Hierarchy Level [edit access profile *profile-name*]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure the peer identity.

Options *client-name*—A peer identity.

The other options are explained separately.

Usage Guidelines See “Configuring the L2TP Client” on page 455.

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

dhcp-attributes

Syntax

```
dhcp-attributes {
  option-match {
    option-82 {
      circuit-id value range named-range;
      remote-id value range named-range;
    }
  }
  boot-file filename;
  boot-server (address | hostname);
  domain-name domain-name;
  grace-period seconds;
  maximum-lease-time seconds;
  name-server [ server-names ];
  netbios-node-type node-type;
  option {
    [ (id-number option-type option-value)
      (id-number array option-type option-value) ];
  }
  router [ router-names ];
  tftp-server address;
  wins-server [ server-names ];
}
```

Hierarchy Level [edit access address-assignment pool *pool-name* family inet]

Release Information Statement introduced in JUNOS Release 9.0.

Description Configure address pools that can be used by different client applications.

The remaining statements are explained separately.

Usage Guidelines See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.

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

domain-name

Syntax	<code>domain-name <i>domain-name</i>;</code>
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> dhcp-attributes]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Configure the name of the domain in which clients search for a DHCP server host. This is the default domain name that is appended to hostnames that are not fully qualified. This is equivalent to DHCP option 15.
Options	<i>domain-name</i> —Name of the domain.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

drop-timeout

Syntax	<code>drop-timeout <i>milliseconds</i>;</code>
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i> l2tp multilink]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the drop timeout for a multilink bundle.
Options	<i>milliseconds</i> —Number of milliseconds for the timeout that is associated with the first fragment on the reassembly queue. If the timeout expires before all the fragments have been collected, the fragments at the beginning of the reassembly queue are dropped. If the drop timeout is not specified, the JUNOS Software holds on to the fragments. (Fragments may still be dropped if the multilink reassembly algorithm determines that another fragment belonging to the packet on a reassembly queue has been lost.)
Usage Guidelines	See “Configuring L2TP Properties for a Client-Specific Profile” on page 457.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

encapsulation-overhead

Syntax	encapsulation-overhead <i>bytes</i> ;
Hierarchy Level	[edit access group-profile <i>profile-name</i> ppp], [edit access profile <i>profile-name</i> client <i>client-name</i> ppp]
Release Information	Statement introduced in JUNOS Release 8.3.
Description	Configure the encapsulation overhead for class-of-service calculations.
Options	<i>bytes</i> —The number of bytes used as encapsulation overhead for the session.
Usage Guidelines	See “Configuring the PPP Attributes for a Group Profile” on page 450 and “Configuring PPP Properties for a Client-Specific Profile” on page 461.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

ethernet-port-type-virtual

Syntax	ethernet-port-type-virtual;
Hierarchy Level	[edit access profile <i>profile-name</i> radius options]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specifies the physical port type the router uses to authenticate clients. The port type is passed in RADIUS attribute 61 (NAS-Port-Type). This statement specifies a port type of <i>virtual</i> ; by default the router passes a port type of ethernet in RADIUS attribute 61.
Usage Guidelines	See “Configuring RADIUS Parameters for AAA Subscriber Management” on page 479.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

exclude

Syntax `exclude {`
 `accounting-authentic [accounting-on | accounting-off];`
 `accounting-delay-time [accounting-on | accounting-off];`
 `accounting-session-id [access-request | accounting-on | accounting-off |`
 `accounting-stop];`
 `accounting-terminate-cause [accounting-off];`
 `called-station-id [access-request | accounting-start | accounting-stop];`
 `calling-station-id [access-request | accounting-start | accounting-stop];`
 `class [accounting-start | accounting-stop];`
 `dhcp-gi-address [access-request | accounting-start | accounting-stop];`
 `dhcp-mac-address [access-request | accounting-start | accounting-stop];`
 `output-filter [accounting-start | accounting-stop];`
 `event-timestamp [accounting-on | accounting-off | accounting-start |`
 `accounting-stop];`
 `framed-ip-address [accounting-start | accounting-stop];`
 `framed-ip-netmask [accounting-start | accounting-stop];`
 `input-filter [accounting-start | accounting-stop];`
 `input-gigapackets [accounting-stop];`
 `input-gigawords [accounting-stop];`
 `interface-description [access-request | accounting-start | accounting-stop];`
 `nas-identifier [access-request | accounting-on | accounting-off | accounting-start |`
 `accounting-stop];`
 `nas-port [access-request | accounting-start | accounting-stop];`
 `nas-port-id [access-request | accounting-start | accounting-stop];`
 `nas-port-type [access-request | accounting-start | accounting-stop];`
 `output-gigapackets [accounting-stop];`
 `output-gigawords [accounting-stop];`
 `}`

Hierarchy Level [edit access profile *profile-name* radius attributes]

Release Information Statement introduced in JUNOS Release 9.1.

Description Configure the router to exclude the specified attributes from the specified type of RADIUS message.

Not all attributes are available in all types of RADIUS messages. By default, the router includes the specified attributes in RADIUS Access-Request, Acct-On, Acct-Off, Acct-Start, and Acct-Stop messages.

Options RADIUS attribute type—RADIUS attribute or Juniper Networks VSA number and name.

- `accounting-authentic`—RADIUS attribute 45, Acct-Authentic.
- `accounting-delay-time`—RADIUS attribute 41, Acct-Delay-Time.
- `accounting-session-id`—RADIUS attribute 44, Acct-Session-Id.
- `accounting-terminate-cause`—RADIUS attribute 49, Acct-Terminate-Cause.
- `called-station-id`—RADIUS attribute 30, Called-Station-Id.

- calling-station-id—RADIUS attribute 31, Calling-Station-Id.
- class—RADIUS attribute 25, Class.
- dhcp-gi-address—Juniper VSA 26-57, DHCP-GI-Address.
- dhcp-mac-address—Juniper VSA 26-56, DHCP-MAC-Address.
- event-timestamp—RADIUS attribute 55, Event-Timestamp.
- framed-ip-address—RADIUS attribute 8, Framed-IP-Address.
- framed-ip-netmask—RADIUS attribute 9, Framed-IP-Netmask.
- input-filter—Juniper VSA 26-10, Ingress-Policy-Name.
- input-gigapackets—Juniper VSA 26-42, Acct-Input-Gigapackets.
- input-gigawords—RADIUS attribute 52, Acct-Input-Gigawords.
- interface-description—Juniper VSA 26-53, Interface-Desc.
- nas-identifier—RADIUS attribute 32, NAS-Identifier.
- nas-port—RADIUS attribute 5, NAS-Port.
- nas-port-id—RADIUS attribute 87, NAS-Port-Id.
- nas-port-type—RADIUS attribute 61, NAS-Port-Type.
- output-filter—Juniper VSA 26-11, Egress-Policy-Name.
- output-gigapackets—Juniper VSA 25-43, Acct-Output-Gigapackets.
- output-gigawords—RADIUS attribute 53, Acct-Output-Gigawords.

RADIUS message type

- access-request—RADIUS Access-Accept messages.
- accounting-off—RADIUS Accounting-Off messages.
- accounting-on—RADIUS Accounting-On messages.
- accounting-start—RADIUS Accounting-Start messages.
- accounting-stop—RADIUS Accounting-Stop messages.

Usage Guidelines See “Configuring RADIUS Parameters for AAA Subscriber Management” on page 479.

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

fragmentation-threshold

Syntax	fragmentation-threshold <i>bytes</i> ;
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i> l2tp multilink]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the fragmentation threshold for a multilink bundle.
Options	<i>bytes</i> —The maximum number of bytes in a packet. If a packet exceeds the fragmentation threshold, the JUNOS Software fragments it into two or more multilink fragments.
Usage Guidelines	See “Configuring L2TP Properties for a Client-Specific Profile” on page 457. See also multilink.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

framed-ip-address

Syntax	framed-ip-address <i>address</i> ;
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i> ppp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Specify a framed IP address.
Options	<i>address</i> —The IP version 4 (IPv4) prefix.
Usage Guidelines	See “Configuring PPP Properties for a Client-Specific Profile” on page 461.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

framed-pool

Syntax	<code>framed-pool <i>framed-pool</i>;</code>
Hierarchy Level	<code>[edit access group-profile <i>profile-name</i> ppp],</code> <code>[edit access profile <i>profile-name</i> client <i>client-name</i> ppp]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the address pool.
Options	<i>framed-pool</i> —References a configured address pool.
Usage Guidelines	See “Configuring the PPP Attributes for a Group Profile” on page 450 and “Configuring PPP Properties for a Client-Specific Profile” on page 461.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

grace-period

Syntax	<code>grace-period <i>seconds</i>;</code>
Hierarchy Level	<code>[edit access address-assignment pool <i>pool-name</i> family inet dhcp-attributes]</code>
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Configure the amount of time that the client retains the address lease after the lease expires. The address cannot be reassigned to another client during the grace period.
Options	<i>seconds</i> —Number of seconds the lease is retained. Range: 0 through 4,294,967,295 seconds Default: 0 (no grace period)
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

group-profile (Associating with Client)

Syntax	<code>group-profile <i>profile-name</i>;</code>
Hierarchy Level	<code>[edit access profile <i>profile-name</i> client <i>client-name</i>]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Associate a group profile with a client.
Options	<i>profile-name</i> —(Optional) Name assigned to the group profile.
Usage Guidelines	See “Referencing the Group Profile from the L2TP Profile” on page 457.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

group-profile (Group Profile)

Syntax `group-profile profile-name {`
 `l2tp {`
 `interface-id interface-id;`
 `lcp-renegotiation;`
 `local-chap;`
 `maximum-sessions-per-tunnel number;`
 `}`
 `ppp {`
 `cell-overhead;`
 `encapsulation-overhead bytes;`
 `framed-pool pool-id;`
 `idle-timeout seconds;`
 `interface-id interface-id;`
 `keepalive seconds;`
 `primary-dns primary-dns;`
 `primary-wins primary-wins;`
 `secondary-dns secondary-dns;`
 `secondary-wins secondary-wins;`
 `}`
 `}`

Hierarchy Level [edit access]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure the group profile.

Options *profile-name*—Name assigned to the group profile.

The other options are explained separately.

Usage Guidelines See “Configuring the Group Profile for Defining L2TP Attributes” on page 449, “Configuring L2TP for a Group Profile” on page 449, “Configuring the PPP Attributes for a Group Profile” on page 450.

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

hardware-address

Syntax	hardware-address <i>mac-address</i> ;
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet host <i>hostname</i>]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Specify the MAC address of the client. This is the hardware address that identifies the client on the network.
Options	<i>mac-address</i> —The MAC address of the client.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

host

Syntax	host <i>hostname</i> { hardware-address <i>mac-address</i> ; interface-id <i>ip-address</i> ; }
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Configure a static binding for the specified client.
Options	<i>hostname</i> —Name of the client. The remaining statements are explained separately.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

idle-timeout

Syntax	<code>idle-timeout seconds;</code>
Hierarchy Level	[edit access group-profile <i>profile-name</i> ppp], [edit access profile <i>profile-name</i> client <i>client-name</i> ppp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the idle timeout for a user.
Options	<p><i>seconds</i>—The number of seconds a user can remain idle before the session is terminated.</p> <p>Range: 0 through 4,294,967,295 seconds</p> <p>Default: 0</p>
Usage Guidelines	See “Configuring the PPP Attributes for a Group Profile” on page 450 and “Configuring PPP Properties for a Client-Specific Profile” on page 461.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

ignore

Syntax ignore {
 framed-ip-netmask;
 input-filter;
 logical-system-routing-instance;
 output-filter;
 }

Hierarchy Level [edit access profile *profile-name* radius attributes]

Release Information Statement introduced in JUNOS Release 9.1.

Description Configure the router to ignore the specified attributes in RADIUS Access-Accept messages. By default, the router processes the attributes it receives from the external server.

Options framed-ip-netmask—Framed-IP-Netmask (RADIUS attribute 9).

 input-filter—Ingress-Policy-Name (VSA 26-10).

 logical-system-routing-instance—Virtual-Router (VSA 26-1).

 output-filter—Egress-Policy-Name (VSA 26-11).

Usage Guidelines See “Configuring RADIUS Parameters for AAA Subscriber Management” on page 479.

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

ike

Syntax	ike { allowed-proxy-pair { remote <i>remote-proxy-address</i> local <i>local-proxy-address</i> ; } pre-shared-key (ascii-text <i>character-string</i> hexadecimal <i>hexadecimal-digits</i>); ike-policy <i>policy-name</i> ; interface-id <i>string-value</i> ; }
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i>]
Release Information	Statement introduced in JUNOS Release 7.4. ike-policy statement introduced in JUNOS Release 8.2
Description	Configure an IKE access profile. The remaining statements are explained separately.
Usage Guidelines	See “Configuring an IKE Access Profile” on page 473.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

ike-policy

Syntax	ike-policy <i>policy-name</i> ;
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i> ike]
Release Information	Statement introduced in JUNOS Release 8.2.
Description	Specify the IKE policy used to authenticate dynamic peers during IKE negotiation.
Options	<i>policy-name</i> —The name of an IKE policy configured at the [edit services ipsec-vpn ike policy <i>policy-name</i>] hierarchy level. The IKE policy defines either the local digital certificate or the pre-shared key used for IKE authentication with dynamic peers. For more information about how to configure the IKE policy, see the <i>JUNOS Services Interfaces Configuration Guide</i> .
Usage Guidelines	See “Configuring an IKE Access Profile” on page 473.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	<i>JUNOS Services Interfaces Configuration Guide</i> and <i>JUNOS Feature Guide</i>

immediate-update

Syntax	immediate-update;
Hierarchy Level	[edit access profile <i>profile-name</i> accounting]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Configure the router to send an Acct-Update message to the RADIUS accounting server on receipt of a response (for example, an ACK or timeout) to the Acct-Start message.
Usage Guidelines	See “Configuring RADIUS Parameters for AAA Subscriber Management” on page 479.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

initiate-dead-peer-detection

Syntax	initiate-dead-peer-detection;
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i> ike]
Release Information	Statement introduced in JUNOS Release 8.3.
Description	Detect inactive peers on dynamic IPsec tunnels.
Usage Guidelines	See “Configuring an IKE Access Profile” on page 473.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

interface-description-format

Syntax	interface-description-format (adapter sub-interface);
Hierarchy Level	[edit access profile <i>profile-name</i> radius options]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify the information that is included in or omitted from the interface description that the router passes to RADIUS for inclusion in the RADIUS attribute 87 (NAS-Port-Id). By default, the router includes both the subinterface and the adapter in the interface description.
Options	adapter—Specifies the adapter. sub-interface—Specifies the subinterface.
Usage Guidelines	See “Configuring RADIUS Parameters for AAA Subscriber Management” on page 479.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

interface-id

Syntax	interface-id <i>interface-id</i> ;
Hierarchy Level	[edit access group-profile <i>profile-name</i> l2tp], [edit access group-profile <i>profile-name</i> ppp], [edit access profile <i>profile-name</i> client <i>client-name</i> ike], [edit access profile <i>profile-name</i> client <i>client-name</i> l2tp], [edit access profile <i>profile-name</i> client <i>client-name</i> ppp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the interface identifier.
Options	<i>interface-id</i> —The identifier for the interface representing a Layer 2 Tunneling Protocol (L2TP) session configured at the [edit interfaces <i>interface-name</i> unit <i>local-unit-number</i> dial-options] hierarchy level. For more information about the interface ID, see the <i>JUNOS Services Interfaces Configuration Guide</i> .
Usage Guidelines	See “Configuring L2TP for a Group Profile” on page 449, “Configuring the PPP Attributes for a Group Profile” on page 450, “Configuring L2TP Properties for a Client-Specific Profile” on page 457, “Configuring PPP Properties for a Client-Specific Profile” on page 461, and “Configuring an IKE Access Profile” on page 473.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

ip-address

Syntax	<code>ip-address <i>ip-address</i>;</code>
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet host <i>hostname</i>]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Specify the reserved IP address assigned to the client.
Options	<i>ip-address</i> —The IP version 4 (IPv4) address.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

keepalive

Syntax	<code>keepalive <i>seconds</i>;</code>
Hierarchy Level	[edit access group-profile <i>profile-name</i> ppp], [edit access profile <i>profile-name</i> client <i>client-name</i> ppp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the keepalive interval for an L2TP tunnel.
Options	<i>seconds</i> —The time period that must elapse before the JUNOS Software checks the status of the Point-to-Point Protocol (PPP) session by sending an echo request to the peer. Range: 0 through 32,767 seconds
Usage Guidelines	See “Configuring the PPP Attributes for a Group Profile” on page 450 and “Configuring PPP Properties for a Client-Specific Profile” on page 461.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

I2tp (Group Profile)

Syntax	<pre> I2tp { interface-id <i>interface-id</i>; lcp-renegotiation; local-chap; maximum-sessions-per-tunnel <i>number</i>; } </pre>
Hierarchy Level	[edit access group-profile <i>profile-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Configure the Layer 2 Tunneling Protocol for a group profile.</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring L2TP for a Group Profile” on page 449.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

I2tp (Profile)

Syntax	<pre> I2tp { interface-id <i>interface-id</i>; lcp-renegotiation; local-chap; maximum-sessions-per-tunnel <i>number</i>; multilink { drop-timeout <i>milliseconds</i>; fragmentation-threshold <i>bytes</i>; } ppp-authentication (chap pap); ppp-profile <i>profile-name</i>; shared-secret <i>shared-secret</i>; } </pre>
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Configure the L2TP properties for a profile.</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring L2TP Properties for a Client-Specific Profile” on page 457.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

lcp-renegotiation

Syntax	lcp-renegotiation;
Hierarchy Level	[edit access group-profile <i>profile-name</i> l2tp], [edit access profile <i>profile-name</i> client <i>client-name</i> l2tp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the L2TP network server (LNS) so it renegotiates the link control protocol (LCP) with the PPP client.
Usage Guidelines	See “Configuring L2TP for a Group Profile” on page 449 and “Configuring L2TP Properties for a Client-Specific Profile” on page 457.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

local-chap

Syntax	local-chap;
Hierarchy Level	[edit access group-profile <i>profile-name</i> l2tp], [edit access profile <i>profile-name</i> client <i>client-name</i> l2tp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the JUNOS Software so that the LNS ignores proxy authentication attribute-value pairs (AVPs) from the L2TP access concentrator (LAC) and reauthenticates the PPP client using a Challenge Handshake Authentication Protocol (CHAP) challenge. When you do this, the LNS directly authenticates the PPP client.
Usage Guidelines	See “Configuring L2TP for a Group Profile” on page 449 and “Configuring L2TP Properties for a Client-Specific Profile” on page 457.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

maximum-lease-time

Syntax	<code>maximum-lease-time seconds;</code>
Hierarchy Level	<code>[edit access address-assignment pool <i>pool-name</i> family inet dhcp-attributes]</code>
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Specify the maximum length of time, in seconds, that the lease is held for a client if the client does not renew the lease. This is equivalent to DHCP option 51.
Options	<i>seconds</i> —The maximum number of seconds the lease can be held. Range: 30 through 4,294,967,295 seconds Default: 86,400 (24 hours)
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

maximum-sessions-per-tunnel

Syntax	<code>maximum-sessions-per-tunnel number;</code>
Hierarchy Level	<code>[edit access group-profile l2tp],</code> <code>[edit access profile <i>profile-name</i> client <i>client-name</i> l2tp]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the maximum sessions for a Layer 2 tunnel.
Options	<i>number</i> —Maximum number of sessions for a Layer 2 tunnel.
Usage Guidelines	See “Configuring L2TP for a Group Profile” on page 449 and “Configuring L2TP Properties for a Client-Specific Profile” on page 457.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

multilink

Syntax	multilink { drop-timeout <i>milliseconds</i> ; fragmentation-threshold <i>bytes</i> ; }
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i> l2tp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure Multilink PPP for Layer 2 Tunneling Protocol (L2TP).
Options	The statements are explained separately.
Usage Guidelines	See “Configuring L2TP Properties for a Client-Specific Profile” on page 457.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

name-server

Syntax	name-server [<i>server-names</i>];
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet dhcp-attributes]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Configure one or more Domain Name System (DNS) name servers available to the client to resolve hostname-to-client mappings. This is equivalent to DHCP option 6.
Options	<i>server-names</i> —IP addresses of the domain name servers, listed in order of preference.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

nas-identifier

Syntax	<code>nas-identifier <i>identifier-value</i>;</code>
Hierarchy Level	[edit access profile <i>profile-name</i> radius options]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Configure the value for the client RADIUS attribute 32 (NAS-Identifier). This attribute is used for authentication and accounting requests.
Options	<i>identifier-value</i> —A string in the range from 1 to 64 characters.
Usage Guidelines	See “Configuring RADIUS Parameters for AAA Subscriber Management” on page 479.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

nas-port-extended-format

Syntax	<pre> nas-port-extended-format { adapter-width <i>width</i>; port-width <i>width</i>; slot-width <i>width</i>; stacked-vlan-width <i>width</i>; vlan-width <i>width</i>; } </pre>
Hierarchy Level	[edit access profile <i>profile-name</i> radius options]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Configure the RADIUS client to use the extended format for RADIUS attribute 5 (NAS-Port) and specify the width of the fields in the NAS-Port attribute.
Options	<i>adapter-width width</i> —Number of bits in the adapter field. <i>port-width width</i> —Number of bits in the port field. <i>slot-width width</i> —Number of bits in the slot field. <i>stacked-vlan-width width</i> —Number of bits in the SVLAN ID field. <i>vlan-width width</i> —Number of bits in the VLAN ID field.
Usage Guidelines	See “Configuring RADIUS Parameters for AAA Subscriber Management” on page 479.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

netbios-node-type

Syntax	<code>netbios-node-type <i>node-type</i>;</code>
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet dhcp-attributes]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Specify the NetBIOS node type. This is equivalent to DHCP option 46.
Options	<p><i>node-type</i>—You can specify one of the following node types:</p> <ul style="list-style-type: none"> ■ <i>b-node</i>—Broadcast node ■ <i>h-node</i>—Hybrid node ■ <i>m-node</i>—Mixed node ■ <i>p-node</i>—Peer-to-peer node
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

network

Syntax	<code>network <i>address-or-prefix</i> </subnet-mask>;</code>
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Configure subnet information for an address-assignment pool.
Options	<ul style="list-style-type: none"> ■ <i>address-or-prefix</i>—IP version 4 address or prefix value. ■ <i>subnet-mask</i>—Subnet mask.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

option

Syntax	option { [(<i>id-number</i> <i>option-type</i> <i>option-value</i>) (<i>id-number</i> array <i>option-type</i> <i>option-value</i>)]; }
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet dhcp-attributes]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Specify user-defined options that are added to client packets.
Options	<p><i>id-number</i>—Any whole number. The ID number is used to index the option and must be unique across a DHCP server.</p> <p><i>option-type</i>—Any of the following types: flag, byte, string, short, unsigned-short, integer, unsigned-integer, or ip-address.</p> <p>array—An option can include an array of values.</p> <p><i>option-value</i>—Value associated with an option. The option value must be compatible with the option type (for example, an On or Off value for a flag type).</p>
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

options

Syntax options {
 accounting-session-id-format (decimal | description);
 ethernet-port-type-virtual;
 interface-description-format (adapter | sub-interface);
 nas-identifier *identifier-value*;
 nas-port-extended-format {
 adapter-width *width*;
 port-width *width*;
 slot-width *width*;
 stacked-vlan-width *width*;
 vlan-width *width*;
 }
 override-nas-information;
 revert-interval *interval*;
 vlan-nas-port-stacked-format;
 }

Hierarchy Level [edit access profile *profile-name* radius]

Release Information Statement introduced in JUNOS Release 9.1.

Description Configure the options used by RADIUS authentication and accounting servers.
 The statements are explained separately.

Usage Guidelines See “Configuring RADIUS Parameters for AAA Subscriber Management” on page 479.

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

option-82

Syntax	option-82 { circuit-id <i>value range named-range</i> ; remote-id <i>value range named-range</i> ; }
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet dhcp-attributes option-match]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Specify the list of option 82 suboption match criteria used to select the named address range used for the client. The server matches the option 82 value in the user PDU to the specified option 82 match criteria and uses the named address range associated with the string. The remaining statements are explained separately.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

option-match

Syntax	option-match { option-82 { circuit-id <i>value range named-range</i> ; remote-id <i>value range named-range</i> ; } }
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet dhcp-attributes]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Specify a list of match criteria used to determine which named address range in the address-assignment pool to use. The extended DHCP local server matches this information to the match criteria specified in the client PDUs. For example, for option 82 match criteria, the server matches the option 82 value in the user PDU to the specified option 82 string and uses the named range associated with the string. The remaining statements are explained separately.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

order

Syntax	<code>order [accounting-method] [authentication-method]</code>
Hierarchy Level	[edit access profile <i>profile-name</i> accounting], [edit access profile <i>profile-name</i> authentication]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Set the order in which the JUNOS Software tries different accounting or authentication methods for client activity. When a client logs in, the software tries the accounting and authentication methods in the specified order.
Options	<p><i>accounting-method</i>—One or more accounting methods. When a client logs in, the software tries the accounting methods in the following order, from first to last.</p> <ul style="list-style-type: none"> ■ <i>radius</i>—Use RADIUS accounting. <p><i>authentication-method</i>—One or more authentication methods. When a client logs in, the software tries the authentication methods in the following order, from first to last.</p> <ul style="list-style-type: none"> ■ <i>none</i>—Do not perform authentication. ■ <i>password</i>—Verify the client using the information configured at the [edit access profile <i>profile-name</i> client <i>client-name</i>] hierarchy level. ■ <i>radius</i>—Verify the client using RADIUS authentication services.
Usage Guidelines	See “RADIUS Authentication and Accounting for Subscriber Access Management Overview” on page 476.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

override-nas-information

Syntax	override-nas-information;
Hierarchy Level	[edit access profile <i>profile-name</i> radius options]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Specify the information that the RADIUS client includes in broadcast accounting packets. By default, AAA broadcast accounting packets include the NAS-IP-Address and NAS-Identifier attributes of the logical-systems <i>logical-system-name</i> routing-instance <i>routing-instance-name</i> statement that generates the accounting information. This statement configures the RADIUS client to override the default behavior and include RADIUS attribute 4 (NAS-IP-Address) and RADIUS attribute 32 (NAS-Identifier) of the logical-systems <i>logical-system-name</i> routing-instance <i>routing-instance-name</i> statement that authenticates the client.
Usage Guidelines	See “Configuring RADIUS Parameters for AAA Subscriber Management” on page 479.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

pap-password

Syntax	pap-password <i>password</i> ;
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the Password Authentication Protocol (PAP) password.
Options	<i>password</i> —PAP password.
Usage Guidelines	See “Configuring the PAP Password for an L2TP Profile” on page 460.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

pool

Syntax	<code>pool <i>pool-name</i>;</code>
Hierarchy Level	[edit access address-assignment]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Configure the name of an address-assignment pool.
Options	<i>pool-name</i> —The name assigned to the address-assignment pool.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

port

Syntax	<code>port <i>port-number</i>;</code>
Hierarchy Level	[edit access radius-server <i>server-address</i>], [edit access profile <i>profile-name</i> radius-server <i>server-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the port number on which to contact the RADIUS server.
Options	<i>port-number</i> —Port number on which to contact the RADIUS server. Default: 1812 (as specified in RFC 2865)
Usage Guidelines	See “Configuring RADIUS Authentication for L2TP” on page 466, “Configuring the RADIUS Disconnect Server for L2TP” on page 471, and “Example: Configuring CHAP Authentication with RADIUS” on page 441.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

ppp (Group Profile)

Syntax ppp {
 cell-overhead;
 encapsulation-overhead *bytes*;
 framed-pool *framed-pool*;
 idle-timeout *seconds*;
 interface-id *interface-id*;
 keepalive *seconds*;
 primary-dns *primary-dns*;
 primary-wins *primary-wins*;
 secondary-dns *secondary-dns*;
 secondary-wins *secondary-wins*;
 }

Hierarchy Level [edit access group-profile *profile-name*]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure PPP properties for a group profile.

The remaining statements are explained separately.

Usage Guidelines See “Configuring the PPP Attributes for a Group Profile” on page 450.

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

ppp (Profile)

Syntax	<pre> ppp { cell-overhead; encapsulation-overhead <i>bytes</i>; framed-ip-address <i>address</i>; framed-pool <i>framed-pool</i>; idle-timeout <i>seconds</i>; interface-id <i>interface-id</i>; keepalive <i>seconds</i>; primary-dns <i>primary-dns</i>; primary-wins <i>primary-wins</i>; secondary-dns <i>secondary-dns</i>; secondary-wins <i>secondary-wins</i>; }</pre>
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Configure PPP properties for a client profile.</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring PPP Properties for a Client-Specific Profile” on page 461.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

ppp-authentication

Syntax	ppp-authentication (chap pap);
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i> l2tp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure PPP authentication.
Options	<ul style="list-style-type: none"> ■ chap— The Challenge Handshake Authentication Protocol. ■ pap— The Password Authentication Protocol.
Usage Guidelines	See “Configuring L2TP Properties for a Client-Specific Profile” on page 457.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

ppp-profile

Syntax	ppp-profile <i>profile-name</i> ;
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i> l2tp]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Specify the profile used to validate PPP session requests through L2TP tunnels.
Options	<i>profile-name</i> —Identifier for the PPP profile.
Usage Guidelines	See “Configuring RADIUS Authentication for an L2TP Client and Profile” on page 472.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

pre-shared-key

Syntax	pre-shared-key (ascii-text <i>character-string</i> hexadecimal <i>hexadecimal-digits</i>);
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i> ike]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Configure the key used to authenticate a dynamic peer during IKE phase 1 negotiation. Specify the key in either ASCII or hexadecimal format.
Options	ascii-text <i>character-string</i> —Authentication key in ASCII format. hexadecimal <i>hexadecimal-digits</i> —Authentication key in hexadecimal format.
Usage Guidelines	See “Configuring an IKE Access Profile” on page 473.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

primary-dns

Syntax	<code>primary-dns <i>primary-dns</i>;</code>
Hierarchy Level	[edit access group-profile <i>profile-name</i> client <i>client-name</i> ppp], [edit access profile <i>profile-name</i> ppp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the primary Domain Name System (DNS) server.
Options	<i>primary-dns</i> —An IPv4 address.
Usage Guidelines	See “Configuring the PPP Attributes for a Group Profile” on page 450 and “Configuring PPP Properties for a Client-Specific Profile” on page 461.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration

primary-wins

Syntax	<code>primary-wins <i>primary-wins</i>;</code>
Hierarchy Level	[edit access group-profile <i>profile-name</i> client <i>client-name</i> ppp], [edit access profile <i>profile-name</i> ppp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the primary Windows Internet name server.
Options	<i>primary-wins</i> —An IPv4 address.
Usage Guidelines	See “Configuring the PPP Attributes for a Group Profile” on page 450 and “Configuring PPP Properties for a Client-Specific Profile” on page 461.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

profile

Syntax `profile profile-name {`

```

authentication-order [ authentication-methods ];
accounting {
    accounting-stop-on-access-deny;
    accounting-stop-on-failure;
    order [ accounting-method ];
    statistics (time);
    update-interval minutes;
}
authentication-order [ authentication-method ]
client client-name {
    chap-secret chap-secret;
    group-profile profile-name;
    ike {
        allowed-proxy-pair {
            remote remote-proxy-address local local-proxy-address;
        }
        pre-shared-key (ascii-text character-string | hexadecimal hexadecimal-digits);
        ike-policy policy-name;
        interface-id string-value;
    }
    l2tp {
        interface-id interface-id;
        lcp-renegotiation;
        local-chap;
        maximum-sessions-per-tunnel number;
        multilink {
            drop-timeout milliseconds;
            fragmentation-threshold bytes;
        }
        ppp-authentication (chap | pap);
        ppp-profile profile-name;
        shared-secret shared-secret;
    }
    pap-password pap-password;
    ppp {
        cell-overhead;
        encapsulation-overhead bytes;
        framed-ip-address ip-address;
        framed-pool framed-pool;
        idle-timeout seconds;
        interface-id interface-id;
        keepalive seconds;
        primary-dns primary-dns;
        primary-wins primary-wins;
        secondary-dns secondary-dns;
        secondary-wins secondary-wins;
    }
    user-group-profile profile-name;
}
radius {
```

```

authentication-server [ ip-address ];
accounting-server [ ip-address ];
options {
    accounting-session-id-format (decimal | description);
    ethernet-port-type-virtual;
    interface-description-format (adapter | sub-interface);
    nas-identifier identifier-value;
    nas-port-extended-format {
        adapter-width width;
        port-width width;
        slot-width width;
        stacked-vlan-width width;
        vlan-width width;
    }
    override-nas-information;
    revert-interval interval;
    vlan-nas-port-stacked-format;
}
attributes {
    ignore {
        framed-ip-netmask;
        input-filter;
        logical-system-routing-instance;
        output-filter;
    }
    exclude
        accounting-authentic [ accounting-on | accounting-off ];
        accounting-delay-time [ accounting-on | accounting-off ];
        accounting-session-id [ access-request | accounting-on | accounting-off |
            accounting-stop ];
        accounting-terminate-cause [ accounting-off ];
        called-station-id [ access-request | accounting-start | accounting-stop ];
        calling-station-id [ access-request | accounting-start | accounting-stop ];
        class [ accounting-start | accounting-stop ];
        dhcp-gi-address [ access-request | accounting-start | accounting-stop ];
        dhcp-mac-address [ access-request | accounting-start | accounting-stop ];
        output-filter [ accounting-start | accounting-stop ];
        event-timestamp [ accounting-on | accounting-off | accounting-start |
            accounting-stop ];
        framed-ip-address [ accounting-start | accounting-stop ];
        framed-ip-netmask [ accounting-start | accounting-stop ];
        input-filter [ accounting-start | accounting-stop ];
        input-gigapackets [ accounting-stop ];
        input-gigawords [ accounting-stop ];
        interface-description [ access-request | accounting-start | accounting-stop ];
        nas-identifier [ access-request | accounting-on | accounting-off | accounting-start
            | accounting-stop ];
        nas-port [ access-request | accounting-start | accounting-stop ];
        nas-port-id [ access-request | accounting-start | accounting-stop ];
        nas-port-type [ access-request | accounting-start | accounting-stop ];
        output-gigapackets [ accounting-stop ];
        output-gigawords [ accounting-stop ];
    }
}
}
radius-server server-address {

```

```

    accounting-port port-number;
    port port-number;
    retry attempts;
    routing-instance routing-instance-name;
    secret password;
    source-address source-address;
    timeout seconds;
  }
}

```

Hierarchy Level	[edit access]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure PPP CHAP, or a profile and its subscriber access, L2TP, or PPP properties.
Options	<p><i>profile-name</i>—Name of the profile.</p> <p>For CHAP, the name serves as the mapping between peer identifiers and CHAP secret keys. This entity is queried for the secret key whenever a CHAP challenge or response is received.</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring the PPP Authentication Protocol” on page 439, “Configuring Access Profiles for L2TP or PPP Parameters” on page 452, “Configuring L2TP Properties for a Client-Specific Profile” on page 457, “Configuring PPP Properties for a Client-Specific Profile” on page 461, and “Subscriber Access Management Overview” on page 475.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

radius

```

Syntax  radius {
    authentication-server [ ip-address ];
    accounting-server [ ip-address ];
    options {
        accounting-session-id-format (decimal | description);
        ethernet-port-type-virtual;
        interface-description-format (adapter | sub-interface);
        nas-identifier identifier-value;
        nas-port-extended-format {
            adapter-width width;
            port-width width;
            slot-width width;
            stacked-vlan-width width;
            vlan-width width;
        }
        override-nas-information;
        revert-interval interval;
        vlan-nas-port-stacked-format;
    }
    attributes {
        ignore {
            framed-ip-netmask;
            input-filter;
            logical-system-routing-instance;
            output-filter;
        }
        exclude
            accounting-authentic [ accounting-on | accounting-off ];
            accounting-delay-time [ accounting-on | accounting-off ];
            accounting-session-id [ access-request | accounting-on | accounting-off |
                accounting-stop ];
            accounting-terminate-cause [ accounting-off ];
            called-station-id [ access-request | accounting-start | accounting-stop ];
            calling-station-id [ access-request | accounting-start | accounting-stop ];
            class [ accounting-start | accounting-stop ];
            dhcp-gi-address [ access-request | accounting-start | accounting-stop ];
            dhcp-mac-address [ access-request | accounting-start | accounting-stop ];
            output-filter [ accounting-start | accounting-stop ];
            event-timestamp [ accounting-on | accounting-off | accounting-start |
                accounting-stop ];
            framed-ip-address [ accounting-start | accounting-stop ];
            framed-ip-netmask [ accounting-start | accounting-stop ];
            input-filter [ accounting-start | accounting-stop ];
            input-gigapackets [ accounting-stop ];
            input-gigawords [ accounting-stop ];
            interface-description [ access-request | accounting-start | accounting-stop ];
            nas-identifier [ access-request | accounting-on | accounting-off | accounting-start
                | accounting-stop ];
            nas-port [ access-request | accounting-start | accounting-stop ];
            nas-port-id [ access-request | accounting-start | accounting-stop ];
            nas-port-type [ access-request | accounting-start | accounting-stop ];

```

```

        output-gigapackets [ accounting-stop ];
        output-gigawords [ accounting-stop ];
    }
}

```

Hierarchy Level	[edit access profile <i>profile-name</i>]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Configure the RADIUS parameters that the router uses for AAA authentication and accounting for subscribers. The statements are explained separately.
Usage Guidelines	See “Configuring RADIUS Parameters for AAA Subscriber Management” on page 479.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

radius-disconnect

```

Syntax  radius-disconnect {
        client-address {
            secret password;
        }
    }

```

Hierarchy Level	[edit access]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure a disconnect server that listens on a configured User Datagram Protocol (UDP) port for disconnect messages from a configured client and processes these disconnect messages. Options <i>client-address</i> —A valid IP address configured on one of the router interfaces. The remaining statements are explained separately.
Usage Guidelines	See “Configuring the RADIUS Disconnect Server for L2TP” on page 471.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

radius-disconnect-port

Syntax `radius-disconnect-port port-number;`

Hierarchy Level [edit access]

Release Information Statement introduced before JUNOS Release 7.4.

Description Specify a port number on which to contact the RADIUS disconnect server. Most RADIUS servers use port number 1700.

Options *port-number*—The server port to which disconnect requests from the RADIUS client are sent. The L2TP network server, which accepts these disconnect requests, is the server.



NOTE: The JUNOS Software accepts disconnect requests only from the client address configured at the [edit access radius-disconnect client *client-address*] hierarchy level.

The remaining statements are explained separately.

Usage Guidelines See “Configuring the RADIUS Disconnect Server for L2TP” on page 471.

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

radius-server

Syntax	<pre>radius-server server-address { accounting-port port-number; port port-number; retry number; routing-instance routing-instance-name; secret password; source-address source-address; timeout seconds; }</pre>
Hierarchy Level	[edit access], [edit access profile <i>profile-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Configure RADIUS for subscriber access management, L2TP, or PPP.</p> <p>To configure multiple RADIUS servers, include multiple radius-server statements. The servers are tried in order and in a round-robin fashion until a valid response is received from one of the servers or until all the configured retry limits are reached.</p>
Options	<p>server-address—Address of the RADIUS authentication server.</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring RADIUS Authentication for L2TP” on page 466, “Configuring the PPP Authentication Protocol” on page 439, “Configuring RADIUS Authentication” on page 89, and “RADIUS Authentication and Accounting for Subscriber Access Management Overview” on page 476.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

range

Syntax	<code>range range-name { low lower-limit high upper-limit; }</code>
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Configure a named address range used within an address-assignment pool.
Options	<p><i>range-name</i>—The name assigned to the range of addresses.</p> <p>low <i>lower-limit</i>—The lower limit of an address range.</p> <p>high <i>upper-limit</i>—The upper limit of an address range.</p>
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

remote-id

Syntax	<code>remote-id value range named-range;</code>
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet dhcp-attributes option-match option-82]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Specify the address-assignment pool named range to use based on the particular option 82 Agent Remote ID value.
Options	<p><i>remote-id value</i>—The string for Agent Remote ID suboption (suboption 2) of the DHCP relay agent information option (option 82) in DHCP packets.</p> <p>range <i>named-range</i>—Name of the address-assignment pool range to use.</p>
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

retry

Syntax	<code>retry attempts;</code>
Hierarchy Level	[edit access radius-server <i>server-address</i>], [edit access profile <i>profile-name</i> radius-server <i>server-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Number of times that the router is allowed to attempt to contact a RADIUS authentication or accounting server.
Options	<i>attempts</i> —Number of times that the router is allowed to attempt to contact a RADIUS server. Range: 1 through 10 Default: 3
Usage Guidelines	See “Configuring RADIUS Authentication for L2TP” on page 466 or “Example: Configuring CHAP Authentication with RADIUS” on page 441.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ timeout

revert-interval

Syntax	<code>revert-interval interval;</code>
Hierarchy Level	[edit access profile <i>profile-name</i> radius options]
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Configure the amount of time the router waits after a server has become unreachable. The router rechecks the connection to the server when the <code>revert-interval</code> expires. If the server is then reachable, it is used in accordance with the order of the server list.
Options	<i>interval</i> —Amount of time to wait. Range: 60 through 4294967295 seconds Default: 600 seconds
Usage Guidelines	See “RADIUS Authentication and Accounting for Subscriber Access Management Overview” on page 476.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

router

Syntax	<code>router [<i>hostnames</i>];</code>
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet dhcp-attributes]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Specify a list of the routers located on the client's subnet. This statement is the equivalent of DHCP option 3.
Options	<i>hostnames</i> —IP addresses of the routers.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

routing-instance

Syntax	<code>routing-instance <i>routing-instance-name</i>;</code>
Hierarchy Level	[edit access radius-server <i>server-address</i>], [edit access profile <i>profile-name</i> radius-server <i>server-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the routing instance used to send RADIUS packets to the RADIUS server.
Options	<i>routing-instance-name</i> —Routing instance name.
Usage Guidelines	See “Configuring the PPP Authentication Protocol” on page 439.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	<i>JUNOS Network Interfaces Configuration Guide</i>

secondary-dns

Syntax	<code>secondary-dns secondary-dns;</code>
Hierarchy Level	[edit access group-profile <i>profile-name</i> ppp], [edit access profile <i>profile-name</i> client <i>client-name</i> ppp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the secondary DNS server.
Options	<i>secondary-dns</i> —An IPv4 address.
Usage Guidelines	See “Configuring the PPP Attributes for a Group Profile” on page 450 and “Configuring PPP Properties for a Client-Specific Profile” on page 461.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

secondary-wins

Syntax	<code>secondary-wins secondary-wins;</code>
Hierarchy Level	[edit access group-profile <i>profile-name</i> ppp], [edit access profile <i>profile-name</i> client <i>client-name</i> ppp]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the secondary Windows Internet name server.
Options	<i>secondary-wins</i> —An IPv4 address.
Usage Guidelines	See “Configuring the PPP Attributes for a Group Profile” on page 450 and “Configuring PPP Properties for a Client-Specific Profile” on page 461.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

secret

Syntax	<code>secret password;</code>
Hierarchy Level	[edit access profile <i>profile-name</i> radius-server <i>server-address</i>] [edit access radius-disconnect <i>client-address</i>], [edit access radius-server <i>server-address</i>],
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the password to use with the RADIUS server. The secret password used by the local router must match that used by the server.
Options	<i>password</i> —Password to use; can include spaces.
Usage Guidelines	See “Configuring RADIUS Authentication for L2TP” on page 466, “Configuring the RADIUS Disconnect Server for L2TP” on page 471, and “Example: Configuring CHAP Authentication with RADIUS” on page 441.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

shared-secret

Syntax	<code>shared-secret shared-secret;</code>
Hierarchy Level	[edit access profile <i>profile-name</i> client <i>client-name</i> l2tp]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Configure the shared secret.
Options	<i>shared-secret</i> —The shared secret key for authenticating the peer.
Usage Guidelines	See “Configuring L2TP Properties for a Client-Specific Profile” on page 457.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

source-address

Syntax	<code>source-address <i>source-address</i>;</code>
Hierarchy Level	<code>[edit access radius-server <i>server-address</i>],</code> <code>[edit access profile <i>profile-name</i> radius-server <i>server-address</i>]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure a source address for each configured RADIUS server. Each RADIUS request sent to a RADIUS server uses the specified source address.
Options	<i>source-address</i> —A valid IPv4 address configured on one of the router interfaces. On M Series routers only, the source address can be an IPv6 address and the UDP source port is 514.
Usage Guidelines	See “Configuring RADIUS Authentication for L2TP” on page 466 or “Example: Configuring CHAP Authentication with RADIUS” on page 441.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

statistics

Syntax	<code>statistics (time);</code>
Hierarchy Level	<code>[edit access profile <i>profile-name</i> accounting]</code>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Configure the router to collect time statistics for the sessions being managed by AAA.
Options	<i>time</i> —Collect uptime statistics only.
Usage Guidelines	See “RADIUS Authentication and Accounting for Subscriber Access Management Overview” on page 476.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

tftp-server

Syntax	<code>tftp-server ip-address;</code>
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet dhcp-attributes]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Specify the Trivial File Transfer Protocol (TFTP) server that the client uses to obtain the client configuration file. This is equivalent to DHCP option 150.
Options	<i>ip-address</i> —IP address of the TFTP server.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

timeout

Syntax	<code>timeout seconds;</code>
Hierarchy Level	[edit access radius-server <i>server-address</i>], [edit access profile <i>profile-name</i> radius-server <i>server-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the amount of time that the local router waits to receive a response from a RADIUS server.
Options	<i>seconds</i> —Amount of time to wait. Range: 1 through 90 seconds Default: 3 seconds
Usage Guidelines	See “Configuring RADIUS Authentication for L2TP” on page 466 or “Example: Configuring CHAP Authentication with RADIUS” on page 441.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

traceoptions

Syntax traceoptions {
 file *filename* <files *number*> <match *regex*> <size *maximum-file-size*> <world-readable
 | no-world-readable>;
 flag all;
 flag authentication;
 flag chap;
 flag configuration;
 flag kernel;
 flag radius;
 }

Hierarchy Level [edit access]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure access tracing options.

Options file *filename*—Name of the file that receives the output of the tracing operation. Enclose the name within quotation marks. All files are placed in the directory /var/log.

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

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

Range: 2 through 1000

Default: 3 files

flag—Tracing operation to perform. To specify more than one tracing operation, include multiple **flag** statements. You can include the following flags.

- all—All tracing operations
- authentication—All authentication module handling
- chap—All CHAP messages and handling
- configuration—Reading of configuration
- kernel—Send all configuration messages to the kernel
- radius—All RADIUS messages and handling

match *regex*—(Optional) Refine the output to include lines that contain the regular expression.

size *size*—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named *trace-file* reaches this size, it is

renamed *trace-file.0*. When the *trace-file* again reaches its maximum size, *trace-file.0* is renamed *trace-file.1* and *trace-file* is renamed *trace-file.0*. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

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

Syntax: *xk* to specify KB, *xm* to specify MB, or *xg* to specify GB

Range: 10 KB through 1 GB

Default: 128 KB

world-readable—(Optional) Enable unrestricted file access.

Usage Guidelines See “Configuring Tracing Operations for Access Processes” on page 443.

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

update-interval

Syntax `update-interval minutes;`

Hierarchy Level [edit access profile *profile-name* accounting]

Release Information Statement introduced in JUNOS Release 9.1.

Description Configure the amount of time, in minutes, that the router waits before sending a new accounting update.

Options *minutes*—Amount of time between updates, in minutes.

Range: 15 through 1440 minutes

Default: no updates

Usage Guidelines See “RADIUS Authentication and Accounting for Subscriber Access Management Overview” on page 476.

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

user-group-profile

Syntax	<code>user-group-profile <i>profile-name</i>;</code>
Hierarchy Level	<code>[edit access profile <i>profile-name</i>]</code>
Release Information	(M7i and M10i routers only) Statement introduced before JUNOS Release 7.4.
Description	Apply a configured PPP group profile to PPP users.
Options	<i>profile-name</i> —Name of a PPP group profile configured at the <code>[edit access group-profile <i>profile-name</i>]</code> hierarchy level.
Usage Guidelines	See “Applying a Configured PPP Group Profile to a Tunnel” on page 462.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

vlan-nas-port-stacked-format

Syntax	<code>vlan-nas-port-stacked-format;</code>
Hierarchy Level	<code>[edit access profile <i>profile-name</i> radius options]</code>
Release Information	Statement introduced in JUNOS Release 9.1.
Description	Configure RADIUS attribute 5 (NAS-Port) to include the S-VLAN ID, in addition to the VLAN ID, for subscribers on Ethernet interfaces.
Usage Guidelines	See “RADIUS Authentication and Accounting for Subscriber Access Management Overview” on page 476.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

wins-server

Syntax	<code>wins-server [<i>hostnames</i>];</code>
Hierarchy Level	[edit access address-assignment pool <i>pool-name</i> family inet dhcp-attributes]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	Specify one or more NetBIOS name servers (NBNS) that the client uses to resolve NetBIOS names. This is equivalent to DHCP option 44.
Options	<i>server-list</i> —IP addresses of the NetBIOS name servers, listed in order of preference.
Usage Guidelines	See “Configuring Address-Assignment Pools for Subscriber Access Management” on page 491.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

Part 4

Security Services

- Security Services Overview on page 565
- Security Services Configuration Guidelines on page 567
- Summary of Security Services Configuration Statements on page 623

Chapter 15

Security Services Overview

This chapter covers the following topics:

- IPsec Overview on page 565
- Security Associations Overview on page 565
- IKE Key Management Protocol Overview on page 566
- IPsec Requirements for JUNOS-FIPS Overview on page 566

IPsec Overview

IPsec architecture provides a security suite for the IP version 4 (IPv4) and IP version 6 (IPv6) network layers. The suite provides such functionality as authentication of origin, data integrity, confidentiality, replay protection, and nonrepudiation of source. In addition to IPsec, the JUNOS Software also supports the Internet Key Exchange (IKE), which defines mechanisms for key generation and exchange, and manages security associations (SAs).

IPsec also defines a security association and key management framework that can be used with any network layer protocol. The SA specifies what protection policy to apply to traffic between two IP-layer entities. IPsec provides secure tunnels between two peers.

For a complete description of the IPsec security suite, see the “IPsec” chapter of the *JUNOS Feature Guide*.

Security Associations Overview

To use IPsec security services, you create SAs between hosts. An SA is a simplex connection that allows two hosts to communicate with each other securely by means of IPsec. There are two types of SAs: manual and dynamic.

- Manual SAs require no negotiation; all values, including the keys, are static and specified in the configuration. Manual SAs statically define the Security Parameter Index (SPI) values, algorithms, and keys to be used, and require matching configurations on both ends of the tunnel. Each peer must have the same configured options for communication to take place.
- Dynamic SAs require additional configuration. With dynamic SAs, you configure IKE first and then the SA. IKE creates dynamic security associations; it negotiates SAs for IPsec. The IKE configuration defines the algorithms and keys used to establish the secure IKE connection with the peer security gateway. This

connection is then used to dynamically agree upon keys and other data used by the dynamic IPsec SA. The IKE SA is negotiated first and then used to protect the negotiations that determine the dynamic IPsec SAs.

The JUNOS Software implementation of IPsec supports two modes of security (transport and tunnel).

IKE Key Management Protocol Overview

IKE is a key management protocol that creates dynamic SAs; it negotiates SAs for IPsec. An IKE configuration defines the algorithms and keys used to establish a secure connection with a peer security gateway.

IKE does the following:

- Negotiates and manages IKE and IPsec parameters
- Authenticates secure key exchange
- Provides mutual peer authentication by means of shared secrets (not passwords) and public keys
- Provides identity protection (in main mode)

IKE occurs over two phases. In the first phase, it negotiates security attributes and establishes shared secrets to form the bidirectional IKE SA. In the second phase, inbound and outbound IPsec SAs are established. The IKE SA secures the exchanges in the second phase. IKE also generates keying material, provides Perfect Forward Secrecy, and exchanges identities.

IPsec Requirements for JUNOS-FIPS Overview

In a JUNOS-FIPS environment, hardware configurations with two Routing Engines must be configured to use IPsec and a private routing instance for all communications between the Routing Engines. IPsec communication between the Routing Engines and AS II FIPS PICs is also required.

Chapter 16

Security Services Configuration Guidelines

This chapter covers the following topics:

- Security Services Complete Configuration Statements on page 567
- Configuring IPsec for an ES PIC on page 570
- Using Digital Certificates for ES and AS PICs on page 589
- Configuring IPsec Tunnel Traffic on page 609
- ES Tunnel Interface Configuration for a Layer 3 VPN on page 613
- Configuring Tracing Operations for Security Services on page 613
- Configuring Tracing Operations for IPsec Events for Adaptive Services PICs on page 614
- Configuring the Authentication Key Update Mechanism for BGP and LDP Routing Protocols on page 615
- Configuring SSH Host Keys for Secure Copying of Data on page 616
- Importing SSL Certificates for JUNOScript Support on page 618
- Configuring Internal IPsec for JUNOS-FIPS on page 619
- Example: Configuring Internal IPsec on page 621

Security Services Complete Configuration Statements

To configure security services, you can include the following configuration statements at the [edit security] hierarchy level:

```
[edit security]
authentication-key-chains {
  key-chain key-chain-name {
    key key {
      secret secret-data;
      start-time yyyy-mm-dd.hh:mm:ss;
    }
  }
}
certificates {
  cache-size bytes;
  cache-timeout-negative seconds;
```

```

certification-authority ca-profile-name {
    ca-name ca-identity;
    crl file-name;
    encoding (binary | pem);
    enrollment-url url-name;
    file certificate-filename;
    ldap-url url-name;
}
enrollment-retry attempts;
local certificate-filename {
    certificate-key-string;
    load-key-file key-file-name;
}
maximum-certificates number;
path-length certificate-path-length;
}
ike {
    proposal ike-proposal-name {
        authentication-algorithm (md5 | sha1);
        authentication-method (dsa-signatures | pre-shared-keys | rsa-signatures);
        description description;
        dh-group (group1 | group2);
        encryption-algorithm (3des-cbc | des-cbc | ase-128-cbc | ase-192-cbc |
            ase-256-cbc);
        lifetime-seconds seconds;
    }
    policy ike-peer-address {
        description description;
        encoding (binary | pem);
        identity identity-name;
        local-certificate certificate-filename;
        local-key-pair private-public-key-file;
        mode (aggressive | main);
        pre-shared-key (ascii-text key | hexadecimal key);
        proposals [ proposal-names ];
    }
}
ipsec {
    security-association {
        manual {
            direction (bidirectional | inbound | outbound) {
                protocol esp;
                spi spi-value;
                encryption {
                    algorithm 3des-cbc;
                    key ascii-text ascii-text-string;
                }
            }
        }
    }
}
proposal ipsec-proposal-name {
    authentication-algorithm (hmac-md5-96 | hmac-sha1-96);
    description description;
    encryption-algorithm (3des-cbc | des-cbc);
    lifetime-seconds seconds;
    protocol (ah | esp | bundle);
}

```

```

}
policy ipsec-policy-name {
  description description;
  perfect-forward-secrecy {
    keys (group1 | group2);
  }
  proposals [ proposal-names ];
}
security-association sa-name {
  description description;
  dynamic {
    ipsec-policy policy-name;
    replay-window-size (32 | 64);
  }
  manual {
    direction (inbound | outbound | bidirectional) {
      authentication {
        algorithm (hmac-md5-96 | hmac-sha1-96);
        key (ascii-text key | hexadecimal key);
      }
      auxiliary-spi auxiliary-spi;
      encryption {
        algorithm (des-cbc | 3des-cbc);
        key (ascii-text key | hexadecimal key);
      }
      protocol (ah | esp | bundle);
      spi spi-value;
    }
  }
  mode (tunnel | transport);
}
}
pki {
  ca-profile ca-profile-name {
    ca-identity ca-identity;
    enrollment {
      url url-name;
      retry number-of-attempts;
      retry-interval seconds;
    }
    revocation-check {
      disable;
      crl {
        disable on-download-failure;
        refresh-interval number-of-hours;
        url {
          url-name;
          password;
        }
      }
    }
  }
}
}
ssh-known-hosts {
  host {
    dsa-key key;

```

```

        rsa-key key;
        rsa1-key key;
    }
}
traceoptions {
    file filename <files number> < size size>;
    flag all;
    flag database;
    flag general;
    flag ike;
    flag parse;
    flag policy-manager;
    flag routing-socket;
    flag timer;
}

```



NOTE: Most of the configuration statements do not have default values. If you do not specify an identifier for a statement that does not have a default value, you cannot commit the configuration.

For information about IP Security (IPsec) monitoring and troubleshooting, see the *JUNOS System Basics and Services Command Reference*.

Configuring IPsec for an ES PIC

- IPsec Configuration for an ES PIC Overview on page 570
- Configuring Minimum Manual Security Associations for IPsec on an ES PIC on page 571
- Configuring Minimum IKE Requirements for IPsec on an ES PIC on page 571
- Configuring Minimum Digital Certificates Requirements for IKE on an ES PIC on page 571
- Configuring Security Associations for IPsec on an ES PIC on page 572
- Configuring an IKE Proposal for Dynamic SAs on page 579
- Example: Configuring an IKE Proposal on page 582
- Configuring an IKE Policy for Preshared Keys on page 582
- Example: Configuring an IKE Policy on page 584
- Configuring an IPsec Proposal for an ES PIC on page 585
- Configuring the IPsec Policy for an ES PIC on page 587
- Example: Configuring an IPsec Policy on page 588

IPsec Configuration for an ES PIC Overview

IPsec provides a secure way to authenticate senders and encrypt IPv4 and IPv6 traffic between network devices, such as routers and hosts. The following sections show how to configure IPsec for an ES PIC:

The key management process (kmd) provides IPsec authentication services for ES PICs. The key management process starts only when IPsec is configured on the router.

Configuring Minimum Manual Security Associations for IPsec on an ES PIC

To define a manual security association (SA) configuration for an ES PIC, include at least the following statements at the [edit security ipsec] hierarchy level:

```
[edit security ipsec]
security-association sa-name {
  manual {
    direction (inbound | outbound | bidirectional) {
      authentication {
        algorithm (hmac-md5-96 | hmac-sha1-96);
        key (ascii-text key | hexadecimal key);
      }
      encryption {
        algorithm (des-cbc | 3des-cbc);
        key (ascii-text key | hexadecimal key);
      }
      protocol (ah | esp | bundle);
      spi spi-value;
    }
  }
}
```

Configuring Minimum IKE Requirements for IPsec on an ES PIC

To define an IKE configuration for an ES PIC, include at least the following statements at the [edit security] hierarchy level:

```
[edit security ike]
proposal ike-proposal-name {
  authentication-method (dsa-signatures | pre-shared-keys | rsa-signatures);
  dh-group (group1 | group2);
  encryption-algorithm (3des-cbd | des-cbc | ase-128-cbc | ase-192-cbc | ase-256-cbc);
}
policy ike-peer-address {
  proposals [ ike-proposal-names ];
  pre-shared-key (ascii-text key | hexadecimal key);
}
```

Configuring Minimum Digital Certificates Requirements for IKE on an ES PIC

To define a digital certificates configuration for IKE for an encryption interface on M Series and T Series routers, include at least the following statements at the [edit security certificates] and [edit security ike] hierarchy levels:

```
[edit security]
certificates {
  certification-authority ca-profile-name {
    ca-name ca-identity;
```

```

        crl filename;
        enrollment-url url-name;
        file certificate-filename;
        ldap-url url-name;
    }
}
ike {
    policy ike-peer-address {
        local-certificate certificate-filename;
        local-key-pair private-public-key-file;
        proposal [ ike-proposal-names ];
    }
    proposal ike-proposal-name {
        authentication-method rsa-signatures;
    }
}

```

Configuring Security Associations for IPsec on an ES PIC

To use IPsec security services, you create an SA between hosts. An SA is a simplex connection that allows two hosts to communicate with each other securely by means of IPsec. You can configure two types of SAs:

- **Manual**—Requires no negotiation; all values, including the keys, are static and specified in the configuration. As a result, each peer must have the same configured options for communication to take place. For information about how to configure a manual SA, see “Configuring Manual IPsec Security Associations for an ES PIC” on page 574.
- **Dynamic**—Specifies proposals to be negotiated with the tunnel peer. The keys are generated as part of the negotiation and therefore do not need to be specified in the configuration. The dynamic SA includes one or more **proposal** statements, which allow you to prioritize a list of protocols and algorithms to be negotiated with the peer. For information about how to configure a dynamic SA, see “Associating the Configured Security Association with a Logical Interface” on page 599.



NOTE: The JUNOS Software does not perform a commit check when an SA name referenced in the Border Gateway Protocol (BGP) protocol section is not configured at the [edit security ipsec] hierarchy level.

We recommend that you configure no more than 512 dynamic security associations per ES Physical Interface Card (PIC).

To configure an SA for IPsec for an ES PIC, include the **security-association** statement at the [edit security ipsec] hierarchy level:

```

[edit security ipsec]
security-association sa-name;

```



NOTE: You configure a dynamic SA for the AS and MultiServices PICs at the [edit services ipsec-vpn rule *rule-name* term *term-name* then dynamic], [edit services ipsec-vpn ike], and [edit services ipsec-vpn ipsec] hierarchy levels.

For more information, see the “IPsec” chapter of the *JUNOS Feature Guide* and the “IPsec Services Configuration Guidelines” chapter of the *JUNOS Services Interfaces Configuration Guide*.

Tasks to configure SAs for IPsec for an ES PIC are:

1. Configuring the Description for an SA on page 573
2. Configuring IPsec Transport Mode on page 573
3. Configuring IPsec Tunnel Mode on page 574
4. Configuring Manual IPsec Security Associations for an ES PIC on page 574
5. Configuring Dynamic IPsec Security Associations on page 579
6. Enabling Dynamic IPsec Security Associations on page 579

Configuring the Description for an SA

To specify a description for an IPsec SA, include the **description** statement at the **edit security ipsec security-association *sa-name*** hierarchy level:

```
[edit security ipsec security-association sa-name]
description description;
```

Configuring IPsec Transport Mode

In transport mode, the data portion of the IP packet is encrypted, but the IP header is not. Transport mode can be used only when the communication endpoint and cryptographic endpoint are the same. Virtual private network (VPN) gateways that provide encryption and decryption services for protected hosts cannot use transport mode for protected VPN communications. You configure manual SAs, and you must configure static values on both ends of the SA.



NOTE: When you use transport mode, the JUNOS Software supports both BGP and OSPFv3 for manual SAs.

To configure IPsec security for transport mode, include the **mode** statement with the **transport** option at the **edit security ipsec security-association *sa-name*** hierarchy level:

```
[edit security ipsec security-association sa-name]
mode (IPsec) transport;
```

To apply tunnel mode, you configure manual SAs in transport mode and then reference the SA by name at the [edit protocols bgp] hierarchy level to protect a session with a given peer.



NOTE: You can configure BGP to establish a peer relationship over encrypted tunnels.

Configuring IPsec Tunnel Mode

You use tunnel mode when you use preshared keys with IKE to authenticate peers, or digital certificates with IKE to authenticate peers. In tunnel mode, encryption services are performed on an ES PIC.

When you use preshared keys, you manually configure a preshared key, which must match that of its peer. With digital certificates, each router is dynamically or manually enrolled with a certificate authority (CA). When a tunnel is established, the public keys used for IPsec are dynamically obtained through IKE and validated against the CA certificate. This avoids the manual configuration of keys on routers within the topology. Adding a new router to the topology does not require any security configuration changes to existing routers.

To configure the IPsec in tunnel mode, include the **mode** statement with the **tunnel** option at the **edit security ipsec security-association sa-name** hierarchy level:

```
[edit security ipsec security-association sa-name]
mode tunnel;
```



NOTE: Tunnel mode requires the ES PIC.

The JUNOS Software supports both both BGP and OSPFv3 in transport mode.

To enable tunnel mode, follow the steps in these sections:

- Configuring Security Associations for IPsec on an ES PIC on page 572
- Configuring an IKE Proposal for Dynamic SAs on page 579
- Associating the Configured Security Association with a Logical Interface on page 599
- IPsec Tunnel Traffic Configuration Overview on page 609

Configuring Manual IPsec Security Associations for an ES PIC

To use IPsec security services, you create Security Associations (SAs) between hosts. An SA is a simplex connection that allows two hosts to communicate with each other securely by means of IPsec. There are two types of SAs: manual and dynamic.

Manual SAs require no negotiation; all values, including the keys, are static and specified in the configuration. As a result, peers can communicate only when they all share the same configured options.

To configure the manual IPsec SA for an ES PIC, include the **manual** statement at the **edit security ipsec security-association sa-name** hierarchy level:


```
[edit security ipsec security-association sa-name]
manual {
  direction (inbound | outbound | bi-directional) {
    authentication {
      algorithm (hmac-md5-96 | hmac-sha1-96);
      key (ascii-text key | hexadecimal key);
    }
    auxiliary-spi auxiliary-spi-value;
    encryption {
      algorithm (des-cbc | 3des-cbc);
      key (ascii-text key | hexadecimal key);
    }
    protocol (ah | esp | bundle);
    spi spi-value;
  }
}
```

Tasks to configure a manual SA are:

1. Configuring the Processing Direction on page 575
2. Configuring the Protocol for a Manual SA on page 576
3. Configuring the Security Parameter Index on page 576
4. Configuring the Auxiliary Security Parameter Index on page 577
5. Configuring the Authentication Algorithm and Key on page 577
6. Configuring the Encryption Algorithm and Key on page 578

Configuring the Processing Direction

The `direction` statement sets inbound and outbound IPsec processing. If you want to define different algorithms, keys, or security parameter index (SPI) values for each direction, you configure the `inbound` and `outbound` options. If you want the same attributes in both directions, use the `bidirectional` option.

To configure the direction of IPsec processing, include the `direction` statement and specify the direction at the `[edit security ipsec security-association sa-name manual]` hierarchy level:

```
[edit security ipsec security-association sa-name manual]
direction (inbound | outbound | bidirectional);
```

The following example shows how to define different algorithms, keys, and security parameter index values for inbound and outbound processing directions:

```
[edit security ipsec security-association sa-name]
manual {
  direction inbound {
    encryption {
      algorithm 3des-cbc;
      key ascii-text 23456789012345678901234;
    }
    protocol esp;
    spi 16384;
  }
}
```

```

direction outbound {
  encryption {
    algorithm 3des-cbc;
    key ascii-text 12345678901234567890abcd;
  }
  protocol esp;
  spi 24576;
}

```

The following example shows how to define the same algorithms, keys, and security parameter index values for bidirectional processing:

```

[edit security ipsec security-association sa-name manual]
direction bidirectional {
  authentication {
    algorithm hmac-md5-96;
    key ascii-text 123456789012abcd;
  }
  protocol ah;
  spi 20001;
}

```

Configuring the Protocol for a Manual SA

IPsec uses two protocols to protect IP traffic: Encapsulating Security Payload (ESP) and authentication header (AH). For transport mode SAs, both ESP and AH are supported. The AH protocol is used for strong authentication. The **bundle** option uses AH authentication and ESP encryption; it does not use ESP authentication because AH provides stronger authentication of IP packets.



NOTE: The AH protocol is supported only on M Series routers.

To configure the IPsec protocol on an ES PIC, include the **protocol** statement at the **edit security ipsec security-association sa-name manual direction (inbound | outbound | bidirectional)]** hierarchy level and specify the **ah**, **bundle**, or **esp** option:

```

[edit security ipsec security-association sa-name manual direction (inbound |
outbound | bi-directional)]
protocol (ah | bundle | esp);

```

Configuring the Security Parameter Index

An SPI is an arbitrary value that uniquely identifies which SA to use at the receiving host. The sending host uses the SPI to identify and select which SA to use to secure every packet. The receiving host uses the SPI to identify and select the encryption algorithm and key used to decrypt packets.



NOTE: Each manual SA must have a unique SPI and protocol combination.

Use the auxiliary SPI when you configure the **protocol** statement to use the **bundle** option.

To configure the SPI on an ES PIC, include the **spi** statement and specify a value (256 through 16,639) at the [edit security ipsec security-association *sa-name* manual direction (inbound | outbound | bi-directional)] hierarchy level:

```
[edit security ipsec security-association sa-name manual direction (inbound |
outbound | bidirectional)]
spi spi-value;
```

Configuring the Auxiliary Security Parameter Index

When you configure the **protocol** statement to use the **bundle** option, the JUNOS Software uses the auxiliary SPI for the ESP and the SPI for the AH.



NOTE: Each manual SA must have a unique SPI and protocol combination.

To configure the auxiliary SPI, include the **auxiliary-spi** statement at the [edit security ipsec security-association *sa-name* manual direction (inbound | outbound | bi-directional)] hierarchy level and set the value to an integer between 256 and 16,639:

```
[edit security ipsec security-association sa-name manual direction (inbound |
outbound | bidirectional)]
auxiliary-spi auxiliary-spi-value;
```

Configuring the Authentication Algorithm and Key

To configure an authentication algorithm and key, include the **authentication** statement at the [edit security ipsec security-association *sa-name* manual direction (inbound | outbound | bi-directional)] hierarchy level:

```
[edit security ipsec security-association sa-name manual direction (inbound | outbound
| bidirectional)]
authentication {
  algorithm (hmac-md5-96 | hmac-sha1-96);
  key (ascii-text key | hexadecimal key);
}
```

The algorithm can be one of the following:

- **hmac-md5-96**—Hash algorithm that authenticates packet data. It produces a 128-bit authenticator value and 96-bit digest.
- **hmac-sha1-96**—Hash algorithm that authenticates packet data. It produces a 160-bit authenticator value and a 96-bit digest.

The key can be one of the following:

- **ascii-text key**—ASCII text key. With the **hmac-md5-96** option, the key contains 16 ASCII characters. With the **hmac-sha1-96** option, the key contains 20 ASCII characters.
- **hexadecimal key**—Hexadecimal key. With the **hmac-md5-96** option, the key contains 32 hexadecimal characters. With the **hmac-sha1-96** option, the key contains 40 hexadecimal characters.

Configuring the Encryption Algorithm and Key

To configure IPsec encryption, include the **encryption** statement and specify an algorithm and key at the [edit security ipsec security-association *sa-name* manual direction (inbound | outbound | bi-directional)] hierarchy level:

```
[edit security ipsec security-association sa-name manual direction (inbound | outbound
| bi-directional)]
encryption {
  algorithm (des-cbc | 3des-cbc);
  key (ascii-text key | hexadecimal key);
}
```

The algorithm can be one of the following:

- **des-cbc**—Encryption algorithm that has a block size of 8 bytes; its key size is 64 bits long.
- **3des-cbc**—Encryption algorithm that has a block size of 24 bytes; its key size is 192 bits long.



NOTE: For a list of Data Encryption Standard (DES) encryption algorithm weak and semiweak keys, see RFC 2409. For **3des-cbc**, we recommend that the first 8 bytes not be the same as the second 8 bytes, and that the second 8 bytes be the same as the third 8 bytes.

The key can be one of the following:

- **ascii-text**—ASCII text key. With the **des-cbc** option, the key contains 8 ASCII characters. With the **3des-cbc** option, the key contains 24 ASCII characters.
- **hexadecimal**—Hexadecimal key. With the **des-cbc** option, the key contains 16 hexadecimal characters. With the **3des-cbc** option, the key contains 48 hexadecimal characters.



NOTE: You cannot configure encryption when you use the AH protocol.

Configuring Dynamic IPsec Security Associations

You configure dynamic SAs with a set of proposals that are negotiated by the security gateways. The keys are generated as part of the negotiation and do not need to be specified in the configuration. The dynamic SA includes one or more proposals, which allow you to prioritize a list of protocols and algorithms to be negotiated with the peer.

To configure a dynamic SA, include the `dynamic` statement at the `[edit security ipsec security-association sa-name]` hierarchy level. Specify an IPsec policy name, and optionally, a 32-packet or 64-packet replay window size.

```
[edit security ipsec security-association sa-name ]
dynamic {
    ipsec-policy policy-name ;
    replay-window-size (32 | 64);
}
```

Enabling Dynamic IPsec Security Associations

To enable a dynamic SA, follow these steps:

1. Configure IKE proposals and IKE policies associated with these proposals.
2. Configure IPsec proposals and an IPsec policy associated with these proposals.
3. Associate an SA with an IPsec policy.



NOTE: Dynamic tunnel SAs require an ES PIC. If you want to establish a dynamic SA, the attributes in at least one configured IPsec and IKE proposal must match those of its peer.

The replay window is not used with manual SAs.

Configuring an IKE Proposal for Dynamic SAs

Dynamic Security Associations (SAs) require IKE configuration. The IKE configuration defines the algorithms and keys used to establish the secure IKE connection with the peer security gateway.

You can configure one or more IKE proposals. Each proposal is a list of IKE attributes to protect the IKE connection between the IKE host and its peer.

To configure an IKE proposal and define its properties, include the following statements at the `[edit security ike]` hierarchy level:

```
[edit security ike]
proposal ike-proposal-name {
    authentication-algorithm (md5 | sha1);
    authentication-method (dsa-signatures | pre-shared-keys | rsa-signatures);
}
```

```

description description ;
dh-group (group1 | group2);
encryption-algorithm (3des-cbc | des-cbc | ase-128-cbc | ase-192-cbc | ase-256-cbc);
lifetime-seconds seconds;
}

```

For information about associating an IKE proposal with an IKE policy, see “Associating Proposals with an IKE Policy” on page 584.

Tasks for configuring the IKE Proposal are:

1. Configuring the Authentication Algorithm for an IKE Proposal on page 580
2. Configuring the Authentication Method for an IKE Proposal on page 580
3. Configuring the Description for an IKE Proposal on page 581
4. Configuring the Diffie-Hellman Group for an IKE Proposal on page 581
5. Configuring the Encryption Algorithm for an IKE Proposal on page 581
6. Configuring the Lifetime for an IKE SA on page 582

Configuring the Authentication Algorithm for an IKE Proposal

To configure an IKE authentication algorithm, include the `authentication-algorithm` statement at the `[edit security ike proposal ike-proposal-name]` hierarchy level:

```

[edit security ike proposal ike-proposal-name]
authentication-algorithm (md5 | sha1);

```

The authentication algorithm can be one of the following:

- `md5`—Produces a 128-bit digest.
- `sha1`—Produces a 160-bit digest.

Configuring the Authentication Method for an IKE Proposal

To configure an IKE authentication method, include the `authentication-method` statement at the `[edit security ike proposal ike-proposal-name]` hierarchy level:

```

[edit security ike proposal ike-proposal-name]
authentication-method (dsa-signatures | pre-shared-keys | rsa-signatures);

```

The authentication method can be one of the following:

- `dsa-signatures`—Digital Signature Algorithm (DSA)
- `pre-shared-keys`—Preshared keys; a key derived from an out-of-band mechanism is used to authenticate an exchange
- `rsa-signatures`—Public key algorithm that supports encryption and digital signatures

Configuring the Description for an IKE Proposal

To specify a description for an IKE proposal, include the **description** statement at the [edit security ike proposal *ike-proposal-name*] hierarchy level:

```
[edit security ike proposal ike-proposal-name]
description description;
```

Configuring the Diffie-Hellman Group for an IKE Proposal

Diffie-Hellman is a public-key cryptography scheme that allows two parties to establish a shared secret over an insecure communications channel. It is also used within IKE to establish session keys.

To configure an IKE Diffie-Hellman group, include the **dh-group** statement at the [edit security ike proposal *ike-proposal-name*] hierarchy level:

```
[edit security ike proposal ike-proposal-name ]
dh-group (group1 | group2);
```

The group can be one of the following:

- **group1**—Specifies that IKE use the 768-bit Diffie-Hellman prime modulus group when performing the new Diffie-Hellman exchange.
- **group2**—Specifies that IKE use the 1024-bit Diffie-Hellman prime modulus group when performing the new Diffie-Hellman exchange.

group2 provides more security but requires more processing time.

Configuring the Encryption Algorithm for an IKE Proposal

To configure an IKE encryption algorithm, include the **encryption-algorithm** statement at the [edit security ike proposal *ike-proposal-name*] hierarchy level:

```
[edit security ike proposal ike-proposal-name ]
encryption-algorithm (3des-cbc | des-cbc);
```

The encryption algorithm can be one of the following:

- **3des-cbc**—Encryption algorithm that has a key size of 24 bytes; its key size is 192 bits long.
- **des-cbc**—Encryption algorithm that has a key size of 8 bytes; its key size is 56 bits long.
- **aes-128-cbc**—Advanced encryption algorithm that has a key size of 16 bytes; its key size is 128 bits long.
- **aes-192-cbc**—Advanced encryption algorithm that has a key size of 24 bytes; its key size is 192 bits long.
- **aes-256-cbc**—Advanced encryption algorithm that has a key size of 32 bytes; its key size is 256 bits long.

Configuring the Lifetime for an IKE SA

The IKE lifetime sets the lifetime of an IKE SA. When the IKE SA expires, it is replaced by a new SA (and SPI) or is terminated. The default value IKE lifetime is 3600 seconds.

To configure the IKE lifetime, include the `lifetime-seconds` statement and specify the number of seconds (180 through 86,400) at the `[edit security ike proposal ike-proposal-name]` hierarchy level:

```
[edit security ike proposal ike-proposal-name ]
lifetime-seconds seconds;
```

Example: Configuring an IKE Proposal

The following example shows how to configure an IKE proposal:

```
[edit security ike]
proposal ike-proposal {
  authentication-method pre-shared-keys;
  dh-group group1;
  authentication-algorithm sha1;
  encryption-algorithm 3des-cbc;
}
```

Configuring an IKE Policy for Preshared Keys

An IKE policy defines a combination of security parameters (IKE proposals) to be used during IKE negotiation. It defines a peer address, the preshared key for the given peer, and the proposals needed for that connection. During the IKE negotiation, IKE looks for an IKE policy that is the same on both peers. The peer that initiates the negotiation sends all its policies to the remote peer, and the remote peer tries to find a match.

A match is made when both policies from the two peers have a proposal that contains the same configured attributes. If the lifetimes are not identical, the shorter lifetime between the two policies (from the host and peer) is used. The configured preshared key must also match its peer.

You can create multiple, prioritized proposals at each peer to ensure that at least one proposal will match a remote peer's proposal.

First, you configure one or more IKE proposals; then you associate these proposals with an IKE policy. You can also prioritize a list of proposals used by IKE in the `policy` statement by listing the proposals you want to use, from first to last.

To configure an IKE policy, include the `policy` statement at the `[edit security ike]` hierarchy level and specify a peer address:

```
[edit security ike]
policy ike-peer-address;
```




NOTE: The IKE policy peer address must be an IPsec tunnel destination address.

Tasks for configuring an IKE policy are:

1. Configuring the Description for an IKE Policy on page 583
2. Configuring the Mode for an IKE Policy on page 583
3. Configuring the Preshared Key for an IKE Policy on page 583
4. Associating Proposals with an IKE Policy on page 584

Configuring the Description for an IKE Policy

To specify a description for an IKE policy, include the **description** statement at the [edit security ike policy *ike-peer-address*] hierarchy level:

```
[edit security ike policy ike-peer-address]
description description;
```

Configuring the Mode for an IKE Policy

IKE policy has two modes: aggressive and main. By default, main mode is enabled. Main mode uses six messages, in three exchanges, to establish the IKE SA. (These three steps are IKE SA negotiation, a Diffie-Hellman exchange, and authentication of the peer.) Main mode also allows a peer to hide its identity.

Aggressive mode also establishes an authenticated IKE SA and keys. However, aggressive mode uses half the number of messages, has less negotiation power, and does not provide identity protection. The peer can use the aggressive or main mode to start IKE negotiation; the remote peer accepts the mode sent by the peer.

To configure IKE policy mode, include the **mode** statement and specify **aggressive** or **main** at the [edit security ike policy *ike-peer-address*] hierarchy level:

```
[edit security ike policy ike-peer-address ]
mode (aggressive | main);
```

Configuring the Preshared Key for an IKE Policy

IKE policy preshared keys authenticate peers. You must manually configure a preshared key, which must match that of its peer. The preshared key can be an ASCII text (alphanumeric) key or a hexadecimal key.

A local certificate is an alternative to the preshared key. Commit will fail if either pre-shared key or local certificate is not configured.

To configure an IKE policy preshared key, include the **pre-shared-key** statement at the [edit security ike policy *ike-peer-address*] hierarchy level:

```
[edit security ike policy ike-peer-address]
pre-shared-key (ascii-text key | hexadecimal key);
```

Associating Proposals with an IKE Policy

The IKE policy proposal is a list of one or more proposals associated with an IKE policy.

To configure an IKE policy proposal, include the **proposals** statement at the [edit security ike policy *ike-peer-address*] hierarchy level and specify one or more proposal names:

```
[edit security ike policy ike-peer-address]  
proposals [ proposal-names ];
```

Example: Configuring an IKE Policy

Define two IKE policies: policy 10.1.1.2 and policy 10.1.1.1. Each policy is associated with proposal-1 and proposal-2.

```
[edit security]  
ike {  
  proposal proposal-1 {  
    authentication-method pre-shared-keys;  
    dh-group group1;  
    authentication-algorithm sha1;  
    encryption-algorithm 3des-cbc;  
    lifetime-seconds 1000;  
  }  
  proposal proposal-2 {  
    authentication-method pre-shared-keys;  
    dh-group group2;  
    authentication-algorithm md5;  
    encryption-algorithm des-cbc;  
    lifetime-seconds 10000;  
  }  
  proposal proposal-3 {  
    authentication-method rsa-signatures;  
    dh-group group2;  
    authentication-algorithm md5;  
    encryption-algorithm des-cbc;  
    lifetime-seconds 10000;  
  }  
  policy 10.1.1.2 {  
    mode main;  
    proposals [ proposal-1 proposal-2 ];  
    pre-shared-key ascii-text example-pre-shared-key;  
  }  
  policy 10.1.1.1 {  
    local-certificate certificate-filename;  
    local-key-pair private-public-key-file;  
    mode aggressive;  
    proposals [ proposal-2 proposal-3 ]  
    pre-shared-key hexadecimal 0102030abcbd;  
  }  
}
```



NOTE: Updates to the current IKE proposal and policy configuration are not applied to the current IKE SA; updates are applied to new IKE SAs.

If you want the new updates to take immediate effect, you must clear the existing IKE security associations so that they will be reestablished with the changed configuration. For information about how to clear the current IKE security association, see the *JUNOS System Basics and Services Command Reference*.

Configuring an IPsec Proposal for an ES PIC

An IPsec proposal lists protocols and algorithms (security services) to be negotiated with the remote IPsec peer.

To configure an IPsec proposal and define its properties, include the following statements at the [edit security ipsec] hierarchy level:

```
[edit security ipsec]
proposal ipsec-proposal-name {
  authentication-algorithm (hmac-md5-96 | hmac-sha1-96);
  description description ;
  encryption-algorithm (3des-cbc | des-cbc);
  lifetime-seconds seconds;
  protocol (ah | esp | bundle);
}
```

Tasks to configure an IPsec proposal for an ES PIC are:

- Configuring the Authentication Algorithm for an IPsec Proposal on page 585
- Configuring the Description for an IPsec Proposal on page 586
- Configuring the Encryption Algorithm for an IPsec Proposal on page 586
- Configuring the Lifetime for an IPsec SA on page 586
- Configuring the Protocol for a Dynamic IPsec SA on page 587

Configuring the Authentication Algorithm for an IPsec Proposal

To configure an IPsec authentication algorithm, include the `authentication-algorithm` statement at the [edit security ipsec proposal *ipsec-proposal-name*] hierarchy level:

```
[edit security ipsec proposal ipsec-proposal-name]
authentication-algorithm (IPsec) (hmac-md5-96 | hmac-sha1-96);
```

The authentication algorithm can be one of the following:

- **hmac-md5-96**—Hash algorithm that authenticates packet data. It produces a 128-bit digest. Only 96 bits are used for authentication.
- **hmac-sha1-96**—Hash algorithm that authenticates packet data. It produces a 160-bit digest. Only 96 bits are used for authentication.

Configuring the Description for an IPsec Proposal

To specify a description for an IPsec proposal, include the **description** statement at the [edit security ipsec proposal *ipsec-proposal-name*] hierarchy level:

```
[edit security ike policy ipsec-proposal-name]
description description;
```

Configuring the Encryption Algorithm for an IPsec Proposal

To configure the IPsec encryption algorithm, include the **encryption-algorithm** statement at the [edit security ipsec proposal *ipsec-proposal-name*] hierarchy level:

```
[edit security ipsec proposal ipsec-proposal-name ]
encryption-algorithm (3des-cbc | des-cbc);
```

The encryption algorithm can be one of the following:

- **3des-cbc**—Encryption algorithm that has a block size of 24 bytes; its key size is 192 bits long.
- **des-cbc**—Encryption algorithm that has a block size of 8 bytes; its key size is 48 bits long.



NOTE: We recommend that you use the triple DES cipher block chaining (3DES-CBC) encryption algorithm.

Configuring the Lifetime for an IPsec SA

The IPsec lifetime option sets the lifetime of an IPsec SA. When the IPsec SA expires, it is replaced by a new SA (and SPI) or is terminated. A new SA has new authentication and encryption keys, and SPI; however, the algorithms may remain the same if the proposal is not changed. If you do not configure a lifetime and a lifetime is not sent by a responder, the lifetime is 28,800 seconds.

To configure the IPsec lifetime, include the **lifetime-seconds** statement and specify the number of seconds (180 through 86,400) at the [edit security ipsec proposal *ipsec-proposal-name*] hierarchy level:

```
[edit security ipsec proposal ipsec-proposal-name]
lifetime-seconds seconds;
```



NOTE: When a dynamic SA is created, two types of lifetimes are used: hard and soft. The hard lifetime specifies the lifetime of the SA. The soft lifetime, which is derived from the hard lifetime, informs the IPsec key management system that the SA is about to expire. This allows the key management system to negotiate a new SA before the hard lifetime expires. When you specify the lifetime, you specify a hard lifetime.

Configuring the Protocol for a Dynamic IPsec SA

The **protocol** statement sets the protocol for a dynamic SA. The ESP protocol can support authentication, encryption, or both. The AH protocol is used for strong authentication. AH also authenticates the IP packet. The **bundle** option uses AH authentication and ESP encryption; it does not use ESP authentication because AH provides stronger authentication of IP packets.

To configure the protocol for a dynamic SA, include the **protocol** statement at the [edit security ipsec proposal *ipsec-proposal-name*] hierarchy level:

```
[edit security ipsec proposal ipsec-proposal-name ] protocol (ah | esp | bundle);
```

Configuring the IPsec Policy for an ES PIC

An IPsec policy defines a combination of security parameters (IPsec proposals) used during IPsec negotiation. It defines Perfect Forward Secrecy (PFS) and the proposals needed for the connection. During the IPsec negotiation, IPsec looks for an IPsec proposal that is the same on both peers. The peer that initiates the negotiation sends all its policies to the remote peer, and the remote peer tries to find a match.

A match is made when both policies from the two peers have a proposal that contains the same configured attributes. If the lifetimes are not identical, the shorter lifetime between the two policies (from the host and peer) is used.

You can create multiple, prioritized IPsec proposals at each peer to ensure that at least one proposal will match a remote peer's proposal.

First, you configure one or more IPsec proposals; then you associate these proposals with an IPsec policy. You can prioritize the proposals in the list by listing them in the order in which the IPsec policy uses them (first to last).

To configure an IPsec policy, include the **policy** statement at the [edit security ipsec] hierarchy level, specifying the policy name and one or more proposals you want to associate with this policy:

```
[edit security ipsec]
policy ipsec-policy-name {
  proposals [ proposal-names ];
```

```
}
```

Configuring Perfect Forward Secrecy

PFS provides additional security by means of a Diffie-Hellman shared secret value. With PFS, if one key is compromised, previous and subsequent keys are secure because they are not derived from previous keys. This statement is optional.

To configure PFS, include the `perfect-forward-secrecy` statement and specify a Diffie-Hellman group at the `[edit security ipsec policy ipsec-policy-name]` hierarchy level:

```
[edit security ipsec policy ipsec-policy-name]
perfect-forward-secrecy {
    keys (group1 | group2);
}
```

The key can be one of the following:

- **group1**—Specifies that IKE use the 768-bit Diffie-Hellman prime modulus group when performing the new Diffie-Hellman exchange.
- **group2**—Specifies that IKE use the 1024-bit Diffie-Hellman prime modulus group when performing the new Diffie-Hellman exchange.

group2 provides more security than **group1**, but requires more processing time.

Example: Configuring an IPsec Policy

The following example shows how to configure an IPsec policy:

```
[edit security ipsec]
proposal dynamic-1 {
    protocol esp;
    authentication-algorithm hmac-md5-96;
    encryption-algorithm 3des-cbc;
    lifetime-seconds 6000;
}
proposal dynamic-2 {
    protocol esp;
    authentication-algorithm hmac-sha1-96;
    encryption-algorithm 3des-cbc;
    lifetime-seconds 6000;
}
policy dynamic-policy-1 {
    perfect-forward-secrecy {
        keys group1;
    }
    proposals [ dynamic-1 dynamic-2 ];
}
security-association dynamic-sa1 {
    dynamic {
        replay-window-size 64;
        ipsec-policy dynamic-policy-1;
    }
}
```

}



NOTE: Updates to the current IPsec proposal and policy configuration are not applied to the current IPsec SA; updates are applied to new IPsec SAs.

If you want the new updates to take immediate effect, you must clear the existing IPsec security associations so that they will be reestablished with the changed configuration. For information about how to clear the current IPsec security association, see the *JUNOS System Basics and Services Command Reference*.

Using Digital Certificates for ES and AS PICs

- Complete Configuration Statements for Configuring Digital Certificates for an ES PIC on page 589
- Digital Certificates Overview on page 590
- Obtaining a Certificate from a Certificate Authority for an ES PIC on page 591
- Requesting a CA Digital Certificate for an ES PIC on an M Series or T Series Router on page 591
- Example: Requesting a CA Digital Certificate on page 592
- Generating a Private and Public Key Pair for Digital Certificates for an ES PIC on page 592
- Configuring Digital Certificates for an ES PIC on page 592
- Configuring an IKE Policy for Digital Certificates for an ES PIC on page 597
- Obtaining a Signed Certificate from the CA for an ES PIC on page 599
- Associating the Configured Security Association with a Logical Interface on page 599
- Configuring Digital Certificates for Adaptive Services Interfaces on page 600

Complete Configuration Statements for Configuring Digital Certificates for an ES PIC

To define the digital certificate configuration for an encryption service interface, include the following statements at the [edit security certificates] and [edit security ike] hierarchy levels:

```
[edit security]
certificates {
  cache-size bytes;
  cache-timeout-negative seconds;
  certification-authority ca-profile-name {
    ca-name ca-identity;
    crl filename;
    encoding (binary | pem);
    enrollment-url url-name;
    file certificate-filename;
    ldap-url url-name;
  }
}
```

```

    enrollment-retry attempts;
    local certificate-filename {
        certificate-key-string;
        load-key-file key-file-name;
    }
    maximum-certificates number;
    path-length certificate-path-length;
}
ike {
    policy ike-peer-address {
        description policy;
        encoding (binary | pem);
        identity identity-name;
        local-certificate certificate-filename;
        local-key-pair private-public-key-file;
        mode (aggressive | main);
        pre-shared-key (ascii-text key | hexadecimal key);
        proposals [ proposal-names ];
    }
}

```

The statements for configuring digital certificates differ for the AS and MultiServices PICs and the ES PIC.

For information about how to configure the **description** and **mode** statements, see “Configuring the Description for an IKE Policy” on page 583 and “Configuring the Mode for an IKE Policy” on page 583. For information about how to configure the IKE proposal, see “Associating Proposals with an IKE Policy” on page 584



NOTE: For digital certificates, the JUNOS Software supports only VeriSign CAs for the ES PIC.

Digital Certificates Overview

Digital certificates provide a way of authenticating users through a trusted third party called a certificate authority (CA). The CA validates the identity of a certificate holder and “signs” the certificate to attest that it has not been forged or altered.

A certificate includes the following information:

- The distinguished name (DN) of the owner. A DN is a unique identifier and consists of a fully qualified name including not only the common name (CN) of the owner, the owner’s organization, and other distinguishing information.
- The public key of the owner.
- The date on which the certificate was issued.
- The date on which the certificate expires.
- The distinguished name of the issuing CA.
- The digital signature of the issuing CA.

The additional information in a certificate allows recipients to decide whether to accept the certificate. The recipient can determine if the certificate is still valid based on the expiration date. The recipient can check whether the CA is trusted by the site based on the issuing CA.

With a certificate, a CA takes the owner's public key, signs that public key with the its own private key, and returns this to the owner as a certificate. The recipient can extract the certificate (containing the CA's signature) with the owner's public key. By using the CA's public key and the CA's signature on the extracted certificate, the recipient can validate the CA's signature and owner of the certificate.

When you use digital certificates, your first send in a request to obtain a certificate from your CA. You then configure digital certificates and a digital certificate IKE policy. Finally, you obtain a digitally signed certificate from a CA.



NOTE: Certificates without an alternate subject name are not appropriate for IPsec services.

Obtaining a Certificate from a Certificate Authority for an ES PIC

Certificate authorities manage certificate requests and issue certificates to participating IPsec network devices. When you create a certificate request, you need to provide the information about the owner of the certificate. The required information and its format vary across certificate authorities.

Certificates use names in the X.500 format, a directory access protocol that provides both read and update access. The entire name is called a DN (distinguished name). It consists of a set of components, which often includes a CN (common name), an organization (O), an organization unit (OU), a country (C), a locality (L), and so on.



NOTE: For the dynamic registration of digital certificates, the JUNOS Software supports only the Simple Certificate Enrollment Protocol (SCEP).

Requesting a CA Digital Certificate for an ES PIC on an M Series or T Series Router

For an encryption interface on an M Series or T Series router, issue the following command to obtain a public key certificate from a CA. The results are saved in the specified file in the `/var/etc/ikecert` directory. The CA public key verifies certificates from remote peers.

```
user@host> request security certificate enroll filename filename ca-name ca-name
parameters parameters
```

Example: Requesting a CA Digital Certificate

Specify a URL to the SCEP server and the name of the certification authority whose certificate you want: `mycompany.com`. `filename 1` is name of the file that stores the result. The output, "Received CA certificate:" provides the signature for the certificate, which allows you to verify (offline) that the certificate is genuine.

```
user@host> request security certificate enroll filename ca_verisign ca-file verisign
ca-name xyzcompany url
http://hostname/path/filename
URL: http://hostname/path/filename name: juniper.net CA file: verisign Encoding:
binary
Certificate enrollment has started. To see the certificate enrollment status, check the
key management process (kmd) log file at /var/log/kmd. <-----
```



NOTE: Each router is initially manually enrolled with a certificate authority.

Generating a Private and Public Key Pair for Digital Certificates for an ES PIC

To generate a private and public key, issue the following command:

```
user@host> request security key-pair name size key-size type ( rsa | dsa )
```

name specifies the filename in which to store the public and private keys.

key-size can be 512, 1024, 1596, or 2048 bytes. The default key size is 1024 bytes.

type can be `rsa` or `dsa`. The default is RSA.



NOTE: When you use SCEP, the JUNOS Software only supports RSA.

The following example shows how to generate a private and public key pair:

```
user@host> request security key-pair batt
Generated key pair, key size 1024, file batt Algorithm RSA
```

Configuring Digital Certificates for an ES PIC

Digital certificates provide a way of authenticating users through a trusted third party called a certificate authority (CA). The CA validates the identity of a certificate holder and “signs” the certificate to attest that it has not been forged or altered.

To define the digital certificate configuration for an encryption service interface, include the following statements at the `[edit security certificates]` and `[edit security ike]` hierarchy levels:

```
[edit security]
certificates {
    cache-size bytes;
```

```

cache-timeout-negative seconds;
certification-authority ca-profile-name {
    ca-name ca-identity;
    crl filename;
    encoding (binary | pem);
    enrollment-url url-name;
    file certificate-filename;
    ldap-url url-name;
}
enrollment-retry attempts ;
local certificate-filename {
    certificate-key-string;
    load-key-file key-file-name;
}
maximum-certificates number;
path-length certificate-path-length;
}
ike {
    policy ike-peer-address {
        description policy;
        encoding (binary | pem);
        identity identity-name;
        local-certificate certificate-filename;
        local-key-pair private-public-key-file;
        mode (aggressive | main);
        pre-shared-key (ascii-text key | hexadecimal key);
        proposals [ proposal-names ];
    }
}

```

Tasks to configure digital certificates for ES PICs are:

- Configuring the Certificate Authority Properties for an ES PIC on page 593
- Configuring the Cache Size on page 595
- Configuring the Negative Cache on page 596
- Configuring the Number of Enrollment Retries on page 596
- Configuring the Maximum Number of Peer Certificates on page 596
- Configuring the Path Length for the Certificate Hierarchy on page 597

Configuring the Certificate Authority Properties for an ES PIC

A CA is a trusted third-party organization that creates, enrolls, validates, and revokes digital certificates.

To configure a certificate authority and its properties for an ES PIC, include the following statements at the [edit security certificates] hierarchy level:

```

[edit security certificates]
certification-authority ca-profile-name {
    ca-name ca-identity;
    crl filename;
    encoding (binary | pem);
    enrollment-url url-name;

```

```

    file certificate-filename;
    ldap-url url-name;
}

```

ca-profile-name is the CA profile name.

Tasks for configuring the CA properties are:

1. Specifying the Certificate Authority Name on page 594
2. Configuring the Certificate Revocation List on page 594
3. Configuring the Type of Encoding Your CA Supports on page 594
4. Specifying an Enrollment URL on page 595
5. Specifying a File to Read the Digital Certificate on page 595
6. Specifying an LDAP URL on page 595

Specifying the Certificate Authority Name

If you are enrolling with a CA using simple certificate enrollment protocols (SCEP), you need to specify the CA name (CA identity) that is used in the certificate request, in addition to the URL for the SCEP server.

To specify the name of the CA identity, include the *ca-name* statement at the [edit security certificates certification-authority *ca-profile-name*] hierarchy level:

```

[edit security certificates certification-authority ca-profile-name]
ca-name ca-identity;

```

ca-identity specifies the CA identity to use in the certificate request. It is typically the CA domain name.

Configuring the Certificate Revocation List

A certificate revocation list (CRL) contains a list of digital certificates that have been canceled before their expiration date. When a participating peer uses a digital certificate, it checks the certificate signature and validity. It also acquires the most recently issued CRL and checks that the certificate serial number is not on that CRL.

To configure the CA certificate revocation list, include the *crl* statement and specify the file from which to read the CRL at the [edit security certificates certification-authority *ca-profile-name*] hierarchy level:

```

[edit security certificates certification-authority ca-profile-name]
crl filename;

```

Configuring the Type of Encoding Your CA Supports

By default, encoding is set to binary. Encoding specifies the file format used for the *local-certificate* and *local-key-pair* statements. By default, the binary (distinguished encoding rules) format is enabled. Privacy-enhanced mail (PEM) is an ASCII base 64 encoded format. Check with your CA to determine which file formats it supports.

To configure the file format that your CA supports, include the `encoding` statement and specify a binary or PEM format at the `[edit security certificates certification-authority ca-profile-name]` hierarchy level:

```
[edit security certificates certification-authority ca-profile-name]
  encoding (binary | pem);
```

Specifying an Enrollment URL

You specify the CA location where your router should send SCEP-based certificate enrollment requests. To specify the CA location by naming the CA URL, include the `enrollment-url` statement at the `[edit security certificates certification-authority ca-profile-name]` hierarchy level:

```
[edit security certificates certification-authority ca-profile-name]
  enrollment-url url-name;
```

url-name is the CA location. The format is `http://CA_name`, where *CA_name* is the CA host DNS name or IP address.

Specifying a File to Read the Digital Certificate

To specify the file from which to read the digital certificate, include the `file` statement and specify the certificate filename at the `[edit security certificates certification-authority ca-profile-name]` hierarchy level:

```
[edit security certificates certification-authority ca-profile-name]
  file certificate-filename;
```

Specifying an LDAP URL

If your CA stores its current CRL at its Lightweight Directory Access Protocol (LDAP) server, you can optionally check your CA CRL list before using a digital certificate. If the digital certificate appears on the CA CRL, your router cannot use it. To access your CA CRL, include the `ldap-url` statement at the `[edit security certificates certification-authority ca-profile-name]` hierarchy level:

```
[edit security certificates certification-authority ca-profile-name]
  ldap-url url-name;
```

url-name is the certification authority LDAP server name. The format is `ldap://server-name`, where *server-name* is the CA host DNS name or IP address.

Configuring the Cache Size

By default, the cache size is 2 megabytes (MB). To configure total cache size for digital certificates, include the `cache-size` statement at the `[edit security certificates]` hierarchy level:

```
[edit security certificates]
  cache-size bytes;
```

bytes is the cache size for digital certificates. The range can be from 64 through 4,294,967,295 bytes.



NOTE: We recommend that you limit your cache size to 4 MB.

Configuring the Negative Cache

Negative caching stores negative results and reduces the response time for negative answers. It also reduces the number of messages that are sent to the remote server. Maintaining a negative cache state allows the system to quickly return a failure condition when a lookup attempt is retried. Without a negative cache state, a retry would require waiting for the remote server to fail to respond, even though the system already “ knows” that remote server is not responding.

By default, the negative cache is 20 seconds. To configure the negative cache, include the `cache-timeout-negative` statement at the `[edit security certificates]` hierarchy level:

```
[edit security certificates]
  cache-timeout-negative seconds;
```

seconds is the amount of time for which a failed CA or router certificate is present in the negative cache. While searching for certificates with a matching CA identity (domain name for certificates or CA domain name and serial for CRLs), the negative cache is searched first. If an entry is found in the negative cache, the search fails immediately.



NOTE: Configuring a large negative cache value can make you susceptible to a denial-of-service (DoS) attack.

Configuring the Number of Enrollment Retries

By default, the number of enrollment retries is set to 0, an infinite number of retries. To specify how many times a router will resend a certificate request, include the `enrollment-retry` statement at the `[edit security certificates]` hierarchy level:

```
[edit security certificates]
  enrollment-retry attempts;
```

attempts is the number of enrollment retries (0 through 100).

Configuring the Maximum Number of Peer Certificates

By default, the maximum number of peer certificates to be cached is 1024. To configure the maximum number of peer certificates to be cached, include the `maximum-certificates` statement at the `[edit security certificates]` hierarchy statement level:

```
[edit security certificates]
  maximum-certificates number;
```

number is the maximum number of peer certificates to be cached. The range is from 64 through 4,294,967,295 peer certificates.

Configuring the Path Length for the Certificate Hierarchy

Certification authorities can issue certificates to other CAs. This creates a tree-like certification hierarchy. The highest trusted CA in the hierarchy is called the *trust anchor*. Sometimes the trust anchor is the root CA, which is usually signed by itself. In the hierarchy, every certificate is signed by the CA immediately above it. An exception is the root CA certificate, which is usually signed by the root CA itself. In general, a chain of multiple certificates may be needed, comprising a certificate of the public key owner (the end entity) signed by one CA, and zero or more additional certificates of CAs signed by other CAs. Such chains, called certification paths, are required because a public key user is only initialized with a limited number of assured CA public keys.

Path length refers to a path of certificates from one certificate to another certificate, based on the relationship of a CA and its “children.” When you configure the **path length** statement, you specify the maximum depth of the hierarchy to validate a certificate from the trusted root CA certificate to the certificate in question. For more information about the certificate hierarchy, see RFC 3280, *Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile*.

By default, the maximum certificate path length is set to 15. The root anchor is 1.

To configure path length, include the **path-length** statement at the [edit security certificates] hierarchy level:

```
[edit security certificates]
  path-length certificate-path-length;
```

certificate-path-length is the maximum number certificates for the certificate path length. The range is from 2 through 15 certificates.

Configuring an IKE Policy for Digital Certificates for an ES PIC

An IKE policy for digital certificates defines a combination of security parameters (IKE proposals) to be used during IKE negotiation. It defines a peer address and the proposals needed for that connection. During the IKE negotiation, IKE looks for an IKE policy that is the same on both peers. The peer that initiates the negotiation sends all its policies to the remote peer, and the remote peer tries to find a match.

To configure an IKE policy for digital certificates for an ES PIC, include the following statements at the [edit security ike policy *ike-peer-address*] hierarchy level:

```
[edit security ike]
  policy ike-peer-address{
    encoding (binary | pem);
    identity identity-name;
    local-certificate certificate-filename;
    local-key-pair private-public-key-file;
  }
```

Tasks for configuring an IKE policy for Digital Certificates are:

1. Configuring the Type of Encoding Your CA Supports on page 598
2. Configuring the Identity to Define the Remote Certificate Name on page 598
3. Specifying the Certificate Filename on page 598
4. Specifying the Private and Public Key File on page 598

Configuring the Type of Encoding Your CA Supports

By default, the encoding is set to binary. Encoding specifies the file format used for the `local-certificate` and `local-key-pair` statements. By default, the binary (distinguished encoding rules) format is enabled. PEM is an ASCII base 64 encoded format. Check with your CA to determine which file formats it supports.

To configure the file format that your CA supports, include the `encoding` statement and specify a binary or PEM format at the `[edit security ike policy ike-peer-address]` hierarchy level:

```
[edit security ike policy ike-peer-address ]
encoding (binary | pem);
```

Configuring the Identity to Define the Remote Certificate Name

To define the remote certificate name, include the `identity` statement at the `[edit security ike policy ike-peer-address]` hierarchy level:

```
[edit security ike policy ike-peer-address]
identity identity-name;
```

identity-name defines the identity of the remote certificate name if the identity cannot be learned through IKE (ID payload or IP address).

Specifying the Certificate Filename

To configure the certificate filename from which to read the local certificate, include the `local-certificate` statement at the `[edit security ike policy ike-peer-address]` hierarchy level:

```
[edit security ike policy ike-peer-address]
local-certificate certificate-filename;
```

certificate-filename specifies the file from which to read the local certificate.

Specifying the Private and Public Key File

To specify the filename from which to read the public and private key, include the `local-key-pair` statement at the `[edit security ike policy ike-peer-address]` hierarchy level:

```
[edit security ike policy ike-peer-address ]
local-key-pair private-public-key-file;
```

private-public-key-file specifies the file from which to read the pair key.

Obtaining a Signed Certificate from the CA for an ES PIC

To obtain signed certificate from the CA, issue the following command:

```
user@host> request security certificate enroll filename filename subject c=us,o=x
alternative-subject certificate-ip-address certification-authority certificate-authority
key-filekey-file-name domain-name domain-name
```

The results are saved in a specified file to the /var/etc/ikecert directory.

The following example shows how to obtain a CA signed certificate by referencing the configured certification-authority statement local . This statement is referenced by the request security certificate enroll filename m subject c=us,O=x alternative subject 1.1.1.1 certification-authority command.

```
[edit]
security {
  certificates {
    certification-authority local {
      ca-name xyz.company.com;
      file l;
      enrollment-url "http://www.xyzcompany.com";
    }
  }
}
```

To obtain a signed certificate from the CA, issue the following command:

```
user@host> request security certificate enroll filename l subject c=uk,o=london
alternative-subject 10.50.1.4 certification-authority verisign key-file host-1.prv
domain-name host.xyzcompany.com
CA name: xyz.company.com CA file: ca_verisign
local pub/private key pair: host.prv
subject: c=uk,o=london domain name: host.juniper.net
alternative subject: 10.50.1.4
Encoding: binary
Certificate enrollment has started. To see the certificate enrollment status, check the
key management process (kmd) log file at /var/log/kmd. <————
```

For information about how to use the operational mode commands to obtain a signed certificate, see the *JUNOS System Basics and Services Command Reference*.

Another way to obtain a signed certificate from the CA is to reference the configured statements such as the URL, CA name, and CA certificate file by means of the certification-authority statement:

```
user@host> request security certificate enroll filename m subject c=us ,o=x
alternative-subject 1.1.1.1 certification-authority local key-file y domain-name
abc.company.com
```

Associating the Configured Security Association with a Logical Interface

Configuring the ES PIC associates the configured SA with a logical interface. This configuration defines the tunnel itself (logical subunit, tunnel addresses, maximum

transmission unit [MTU], optional interface addresses, and the name of the SA to apply to traffic).

The addresses configured as the tunnel source and destination are the addresses in the outer IP header of the tunnel.



NOTE: The tunnel source address must be configured locally on the router, and the tunnel destination address must be a valid address for the security gateway terminating the tunnel.

The M5, M10, M20, and M40 routers support the ES PIC.

The SA must be a valid tunnel-mode SA. The interface address and destination address listed are optional. The destination address allows the user to configure a static route to encrypt traffic. If a static route uses that destination address as the next hop, traffic is forwarded through the portion of the tunnel in which encryption occurs.

The following example shows how to configure an IPsec tunnel as a logical interface on the ES PIC. The logical interface specifies the tunnel through which the encrypted traffic travels. The `ipsec-sa` statement associates the security profile with the interface.

```
[edit interfaces]
es-0/0/0 {
  unit 0 {
    tunnel {
      source tunnel 10.5.5.5; # tunnel source address
      destination 10.6.6.6; # tunnel destination address
    }
    family inet {
      ipsec-sa ipsec-sa; # name of security association to apply to packet
      address 10.1.1.8/32 { # local interface address inside local VPN
        destination 10.2.2.254; # destination address inside remote VPN
      }
    }
  }
}
```

Configuring Digital Certificates for Adaptive Services Interfaces

A digital certificate implementation uses the public key infrastructure (PKI), which requires you to generate a key pair consisting of a public key and a private key. The keys are created with a random number generator and are used to encrypt and decrypt data. In networks that do not use digital certificates, an IPsec-enabled device encrypts data with the private key and IPsec peers decrypt the data with the public key.

With digital certificates, the key sharing process requires an additional level of complexity. First, you and your IPsec peers request a certificate authority (CA) to send you a CA certificate that contains the public key of the CA. Next you request the CA to enroll a local digital certificate that contains the public key and some additional information. When the CA processes your request, it signs your local certificate with the private key of the CA. Then you install the CA certificate and the

local certificate in your router and load the CA in the remote devices before you can establish IPsec tunnels with your peers.



NOTE: For digital certificates, the JUNOS Software supports VeriSign, Entrust, Cisco Systems, and Microsoft Windows CAs for the AS and MultiServices PICs.

To define digital certificates configuration for J Series Services Routers and Adaptive Services (AS) and MultiServices PICs installed on M Series and T Series routers, include the following statements at the `[edit security pki]` hierarchy level:

```
[edit security]
pki {
  ca-profile ca-profile-name {
    ca-identity ca-identity;
    enrollment {
      url-name;
      retry number-of-enrollment-attempts;
      retry-interval seconds;
    }
    revocation-check {
      disable;
    }
    crl {
      disable on-download-failure;
      refresh-interval number-of-hours;
      url {
        url-name;
        password;
      }
    }
  }
}
```

The following tasks enable you to implement digital certificates on J Series Services Routers and AS and MultiServices PICs installed on M Series and T Series routers:

1. Configuring the Certificate Authority Properties on page 601
2. Configuring the Certificate Revocation List on page 603
3. Managing Digital Certificates on page 604
4. Configuring the Auto-Reenrollment Properties for Automatic Renewal of the Router Certificate from the CA on page 606

Configuring the Certificate Authority Properties

A CA is a trusted third-party organization that creates, enrolls, validates, and revokes digital certificates.

To configure a certificate authority and its properties for the AS and MultiServices PICs, include the following statements at the `[edit security pki]` hierarchy level:

```
[edit security pki]
```

```

ca-profile ca-profile-name {
  ca-identity ca-identity;
  enrollment {
    url url-name;
    retry number-of-attempts;
    retry-interval seconds;
  }
}

```

Tasks for configuring the Certificate Authority properties are:

1. Specifying the CA Profile Name on page 602
2. Specifying an Enrollment URL on page 602
3. Specifying the Enrollment Properties on page 602

Specifying the CA Profile Name

The CA profile contains the name and URL of the CA or RA, as well as some retry-timer settings. CA certificates issued by Entrust, VeriSign, Cisco Systems, and Microsoft are compatible with the J Series Services Routers and AS and MultiServices PICs installed in the M Series and T Series routers.

To specify the CA profile name, include the **ca-profile** statement at the [edit security pki] security level:

```

[edit security pki]
ca-profile ca-profile-name;

```

You also need to specify the name of the CA identity used in the certificate request. This name is typically the domain name. To specify the name of the CA identity, include the **ca-identity** statement at the [edit security pki ca-profile *ca-profile-name*] level:

```

[edit security pki ca-profile ca-profile-name]
ca-identity ca-identity;

```

Specifying an Enrollment URL

You specify the CA location where your router should send the SCEP-based certificate enrollment requests. To specify the CA location by naming the CA URL, include the **url** statement at the [edit security pki enrollment] hierarchy level:

```

[edit security pki ca-profile ca-profile-name enrollment]
url url-name;

```

url-name is the CA location. The format is `http://CA_name`, where *CA_name* is the CA host DNS name or IP address.

Specifying the Enrollment Properties

You can specify the number of times a router will resend a certificate request and the amount of time, in seconds, the router should wait between enrollment attempts.

By default, the number of enrollment retries is set to 0, an infinite number of retries. To specify how many times a router will resend a certificate request, include the `retry number-of-attempts` statement at the `[edit security pki ca-profile ca-profile-name enrollment]` hierarchy level:

```
[edit security pki ca-profile ca-profile-name enrollment]
  retry number-of-attempts;
```

The range for *number-of-attempts* is from 0 through 100.

To specify the amount of time, in seconds that a router should wait between enrollment attempts, include the `retry-interval seconds` statement at the `[edit security pki ca-profile ca-profile-name enrollment]` hierarchy level:

```
[edit security pki ca-profile ca-profile-name enrollment]
  retry-interval seconds;
```

The range for *seconds* is from 0 through 3600.

Configuring the Certificate Revocation List

Tasks to configure the certificate revocation list are:

1. Specifying an LDAP URL on page 603
2. Configuring the Interval Between CRL Updates on page 604
3. Overriding Certificate Verification if CRL Download Fails on page 604

Specifying an LDAP URL

You can specify the URL for the Lightweight Directory Access Protocol (LDAP) server where your CA stores its current CRL. If the CA includes the Certificate Distribution Point (CDP) in the digital certificate, you do not need to specify a URL for the LDAP server. The CDP is a field within the certificate that contains information about how to retrieve the CRL for the certificate. The router uses this information to download the CRL automatically.

Configure an LDAP URL if you want to use a different CDP from the one specified in the certificate. Any LDAP URL you configure takes precedence over the CDP included in the certificate.

You can configure up to three URLs for each CA profile.

If the LDAP server requires a password to access the CRL, you need to include the `password` statement.

To configure the router to retrieve the CRL from the LDAP server, include the `url` statement and specify the URL name at the `[edit security pki ca-profile ca-profile-name revocation-check crl]` hierarchy level:

```
[edit security pki ca-profile ca-profile-name revocation-check crl]
  url {
    url-name;
  }
```

url-name is the certificate authority LDAP server name. The format is `ldap://server-name`, where *server-name* is the CA host DNS name or IP address.

To specify to use a password to access the CRL, include the `password` statement at the `[edit security pki ca-profile ca-profile-name revocation-check crl url]` hierarchy level:

```
[edit security pki ca-profile ca-profile-name revocation-check crl url]
password password;
```

password is the secret password that the LDAP server requires for access.

Configuring the Interval Between CRL Updates

By default, the time interval between CRL updates is 24 hours. To configure the amount of time between CRL updates, include the `refresh-interval` statement at the `[edit security pki ca-profile ca-profile-name revocation-check crl]` hierarchy level:

```
[edit security pki ca-profile ca-profile-name revocation-check crl]
refresh-interval number-of-hours;
```

The range for number of hours is from 0 through 8784.

Overriding Certificate Verification if CRL Download Fails

By default, if the router either cannot access the LDAP URL or retrieve a valid certificate revocation list, certificate verification fails and the IPsec tunnel is not established. To override this behavior and permit the authentication of the IPsec peer when the CRL is not downloaded, include the `disable on-download-failure` statement at the `[edit security pki ca-profile ca-profile-name revocation-check crl]` hierarchy level:

```
[edit security pki ca-profile ca-profile-name revocation-check crl]
disable on-download-failure;
```

Managing Digital Certificates

After you configure the CA profile, you can request a CA certificate from the trusted CA. Next, you must generate a public/private key pair. When the key pair is available, you can generate a local certificate either online or manually.

Tasks to manage Digital Certificates are:

1. Requesting a CA Digital Certificate for AS and MultiServices PICs installed on M Series and T Series Routers on page 604
2. Generating a Public/Private Key Pair on page 605
3. Generating and Enrolling a Local Digital Certificate on page 605

Requesting a CA Digital Certificate for AS and MultiServices PICs installed on M Series and T Series Routers

For J Series Services Routers and AS and MultiServices PICs installed on M Series and T Series routers, issue the following command to obtain a digital certificate from

a CA. Specify a configured *ca-profile-name* to request a CA certificate from the trusted CA.

```
user@host>request security pki ca-certificate enroll ca-profile ca-profile-name
```

For information about how to configure a CA profile see, “Configuring the Certificate Authority Properties” on page 601.

In this example, the certificate is enrolled online and installed into the router automatically.

```
user@host> request security pki ca-certificate enroll ca-profile entrust
```

Received following certificates:

Certificate: C=us, O=juniper

Fingerprint:00:8e:6f:58:dd:68:bf:25:0a:e3:f9:17:70:d6:61:f3:53:a7:79:10

Certificate: C=us, O=juniper, CN=First Officer

Fingerprint:bc:78:87:9b:a7:91:13:20:71:db:ac:b5:56:71:42:ad:1a:b6:46:17

Certificate: C=us, O=juniper, CN=First Officer

Fingerprint:46:71:15:34:f0:a6:41:76:65:81:33:4f:68:47:c4:df:78:b8:e3:3f

Do you want to load the above CA certificate ? [yes,no] (no) yes



NOTE: If you obtain the CA certificate directly from the CA (for example, as an e-mail attachment or Web site download), you can install it with the **request security pki ca-certificate load** command. For more information, see the *JUNOS System Basics and Services Command Reference*.

Generating a Public/Private Key Pair

After obtaining a certificate for an AS PIC or MultiServices PIC, you must generate a public-private key before you can generate a local certificate. The public key is included in the local digital certificate and the private key is used to decrypt data received from peers. To generate a public-private key pair, issue the **request security pki generate-key-pair certificate-id *certificate-id-name*** command.

The following example shows how to generate a public-private key for an AS PIC or MultiServices PIC:

```
user@host>request security pki generate-key-pair certificate-id local-entrust2
Generated key pair local-entrust2, key size 1024 bits
```

Generating and Enrolling a Local Digital Certificate

You can generate and enroll local digital certificates either online or manually. To generate and enroll a local certificate online by using the Simple Certificate Enrollment Protocol (SCEP) for an AS PIC or MultiServices PIC, issue the **request security pki local-certificate enroll** command. To generate a local certificate request manually in the PKCS-10 format, issue the **request security pki generate-certificate-request** command.

If you create the local certificate request manually, you must also load the certificate manually. To manually install a certificate in your router, issue the `request security pki local-certificate load` command.

The following example shows how to generate a local certificate request manually and send it to the CA for processing:

```
user@host> request security pki generate-certificate-request certificate-id
local-entrust2 domain-name router2.juniper.net filename entrust-req2
subject cn=router2.juniper.net
```

```
Generated certificate request
-----BEGIN CERTIFICATE REQUEST-----
MIIBoTCCAQoCAQAwGjEYMBYGA1UEAxMPdHAXLmp1bm1wZXIubmV0MIGfMAOGCSqG
SIb3DQEBAQUAA4GNADCBiQKBgQCiUFk1Qws1Ud+AqN5DDxRs2kVyKEhh9qoVFnz+
Hz4c9v3B8E1wTJ1kmIt2cB3yifB6zePd+6WYpf57Crwre7YqPkIXM31F6z3YjX
H+1BPNbCxNWYvyrnSyVYDbFj8o0Xyqog8ACDfVL2JBWrPNBYy7imq/K9soDBbAs6
5hZqqwIDAQABoEcwRQYJKoZIhvcNAQkOMTgnNjA0BgnVHQ8BAf8EBAMCB4AwJAYD
VR0RAQH/BBowGIIWdHAXLmVuZ2xhYi5qdW5pcGVyLm5ldANBgkqhkiG9w0BAQQF
AA0BgQBc2rq1v5S0QXH7LCb/FdqAL8ZM6GoaNs5d6cGwq4bB6a7UQFgt0H406gQ3G
3iH0Zfz4xMIBpJYuGd1dkqgvcDoH3AgTsLkfn7Wi3x5H2qeQVs9bvL4P5nvEZLND
EIMUHwteo1ZCiZ70f09Fer9cXWHSQs1UtXtgPqQJy2xIeImLgw==
-----END CERTIFICATE REQUEST-----
Fingerprint:
0d:90:b8:d2:56:74:fc:84:59:62:b9:78:71:9c:e4:9c:54:ba:16:97 (sha1)
1b:08:d4:f7:90:f1:c4:39:08:c9:de:76:00:86:62:b8 (md5)
```

The trusted CA digitally signs the local certificate and returns it to you. Copy the certificate file into the router and load the certificate:

```
user@host> request security pki local-certificate load filename /tmp/router2-cert
certificate-id local-entrust2
Local certificate local-entrust2 loaded successfully
```



NOTE: The name of the file sent to you by the CA might not match the name of the certificate identifier. However, the `certificate-id` name must always match the name of the key pair you generated for the router.

After the local and CA certificates have been loaded, you can reference them in your IPsec configuration. Using default values in the AS and MultiServices PICs, you do not need to configure an IPsec proposal or an IPsec policy. However, you must configure an IKE proposal that specifies the use of digital certificates, reference the IKE proposal and locate the certificate in an IKE policy, and apply the CA profile to the service set.

Configuring the Auto-Reenrollment Properties for Automatic Renewal of the Router Certificate from the CA

Use the `auto-re-enrollment` statement to configure automatic reenrollment of a specified existing router certificate before its existing expiration date. This function automatically reenrolls the router certificate. The reenrollment process requests the certificate authority (CA) to issue a new router certificate with a new expiration date. The date of auto-reenrollment is determined by the following parameters:

- **re-enroll-trigger-time**—The percentage of the difference between the router certificate start date/time (when the certificate was generated) and the validity period; used to specify how long auto-reenrollment should be initiated before expiration.
- **validity-period**—The number of days after issuance when the router certificate will expire, as set when a certificate is generated.



NOTE: By default, this feature is not enabled unless configured explicitly. This means that a certificate that does not have auto-reenrollment configured will expire on its normal expiration date.

The **ca-profile** statement specifies which CA will be contacted to reenroll the expiring certificate. This is the CA that issued the original router certificate.

The **challenge-password** statement provides the issuing CA with the router certificate's password, as set by the administrator and normally obtained from the SCEP enrollment Web page of the CA. The password is 16 characters in length.

Optionally, the router certificate key pair can be regenerated by using the **re-generate-keypair** statement.

To configure the **auto-re-enrollment** statement and its properties, include the following statements at the **[edit security pki]** hierarchy level:

```
[edit security pki]
auto-re-enrollment {
  certificate-id {
    ca-profile ca-profile-name;
    challenge-password password;
    re-enroll-trigger-time percentage;
    re-generate-keypair;
    validity-period days;
  }
}
```

percentage is the percentage for the reenroll trigger time. The range can be from 1 through 99 percent.

days is the number of days for the validity period. The range can be from 1 through 4095.

Tasks to configure automatic reenrollment of certificates are:

1. Specify the Certificate ID on page 608
2. Specify the CA Profile on page 608
3. Specify the Challenge Password on page 608
4. Specify the Reenroll Trigger Time on page 608
5. Specify the Regenerate Key Pair on page 608
6. Specify the Validity Period on page 609

Specify the Certificate ID

Use the `certificate-id` statement to specify the name of the router certificate to configure for auto-reenrollment. To specify the certificate ID, include the statement at the `[edit security pki auto-re-enrollment]` hierarchy level:

```
[edit security pki auto-re-enrollment]
certificate-id certificate-name;
```

Specify the CA Profile

Use the `ca-profile` statement to specify the name of the CA profile from the router certificate previously specified by certificate ID. To specify the CA profile, include the statement at the `[edit security pki auto-re-enrollment certificate-id certificate-name]` hierarchy level:

```
[edit security pki auto-re-enrollment certificate-id certificate-name]
ca-profile ca-profile-name;
```



NOTE: The referenced `ca-profile` must have an enrollment URL configured at the `[edit security pki ca-profile ca-profile-name enrollment url]` hierarchy level.

Specify the Challenge Password

The challenge password is used by the CA specified by the PKI certificate ID for reenrollment and revocation. To specify the challenge password, include the following statement at the `[edit security pki auto-re-enrollment certificate-id certificate-name]` hierarchy level:

```
[edit security pki auto-re-enrollment certificate-id certificate-name]
challenge-password password;
```

Specify the Reenroll Trigger Time

Use the `re-enroll-trigger-time` statement to set the percentage of the validity period before expiration at which reenrollment occurs. To specify the reenroll trigger time, include the following statement at the `[edit security pki auto-re-enrollment certificate-id certificate-name]` hierarchy level:

```
[edit security pki auto-re-enrollment certificate-id certificate-name]
re-enroll-trigger-time percentage;
```

percentage is the percentage for the reenroll trigger time. The range can be from 1 through 99 percent.

Specify the Regenerate Key Pair

When a regenerate key pair is configured, a new key pair is generated during reenrollment. On successful reenrollment, a new key pair and new certificate replace

the old certificate and key pair. To generate a new key pair, include the following statement at the [edit security pki auto-re-enrollment certificate-id *certificate-name*] hierarchy level:

```
[edit security pki auto-re-enrollment certificate-id certificate-name]  
re-generate-keypair;
```

Specify the Validity Period

The `validity-period` statement specifies the router certificate validity period, in number of days, that the specified router certificate remains valid. To specify the validity period, include the statement at the [edit security pki auto-re-enrollment certificate-id *certificate-name*] hierarchy level:

```
[edit security pki auto-re-enrollment certificate-id certificate-name]  
validity-period days;
```

days is the number of days for the validity period. The range can be from 1 through 4095.

Configuring IPsec Tunnel Traffic

This section covers the following topics:

- IPsec Tunnel Traffic Configuration Overview on page 609
- Example: Configuring an Outbound Traffic Filter on page 611
- Example: Applying an Outbound Traffic Filter on page 611
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- Example: Applying an Inbound Traffic Filter to an ES PIC for a Policy Check on page 612

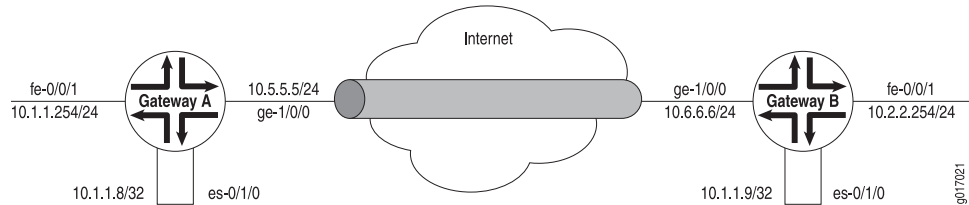
IPsec Tunnel Traffic Configuration Overview

Traffic configuration defines the traffic that must flow through the IPsec tunnel. You configure outbound and inbound firewall filters, which identify and direct traffic to be encrypted and confirm that decrypted traffic parameters match those defined for the given tunnel. The outbound filter is applied to the LAN or WAN interface for the incoming traffic you want to encrypt off of that LAN or WAN. The inbound filter is applied to the ES PIC to check the policy for traffic coming in from the remote host. Because of the complexity of configuring a router to forward packets, no automatic checking is done to ensure that the configuration is correct. Make sure that you configure the router very carefully.



NOTE: The valid firewall filters statements for IPsec are `destination-port`, `source-port`, `protocol`, `destination-address`, and `source-address`.

In Figure 8 on page 610, Gateway A protects the network 10.1.1.0/24, and Gateway B protects the network 10.2.2.0/24. The gateways are connected by an IPsec tunnel.

Figure 8: Example: IPsec Tunnel Connecting Security Gateways

The SA and ES interface for security Gateway A are configured as follows:

```
[edit security ipsec]
security-association manual-sa1 {
  manual {
    direction bidirectional {
      protocol esp;
      spi 2312;
      authentication {
        algorithm hmac-md5-96;
        key ascii-text 1234123412341234;
      }
      encryption {
        algorithm 3des-cbc;
        key ascii-text 123456789009876543211234;
      }
    }
  }
}
[edit interfaces es-0/1/0]
unit 0 {
  tunnel {
    source 10.5.5.5;
    destination 10.6.6.6;
  }
  family inet {
    ipsec-sa manual-sa1;
    address 10.1.1.8/32 {
      destination 10.1.1.9;
    }
  }
}
```

The SA and ES interface for security Gateway B are configured as follows:

```
[edit security ipsec]
security-association manual-sa1 {
  manual {
    direction bidirectional {
      protocol esp;
      spi 2312;
      authentication {
        algorithm hmac-md5-96;
        key ascii-text 1234123412341234;
      }
      encryption {
```

```

        algorithm 3des-cbc;
        key ascii-text 123456789009876543211234;
    }
}
}
[edit interfaces es-0/1/0]
unit 0 {
    tunnel {
        source 10.6.6.6;
        destination 10.5.5.5;
    }
    family inet {
        ipsec-sa manual-sa1;
        address 10.1.1.9/32; {
            destination 10.1.1.8;
        }
    }
}
}

```

Example: Configuring an Outbound Traffic Filter

Firewall filters for outbound traffic direct the traffic through the desired IPsec tunnel and ensure that the tunneled traffic goes out the appropriate interface (see Figure 8 on page 610). Here, an outbound firewall filter is created on security Gateway A; it identifies the traffic to be encrypted and adds it to the input side of the interface that carries the internal VPN traffic:

```

[edit firewall]
filter ipsec-encrypt-policy-filter {
    term term1 {
        from {
            source-address { # local network
                10.1.1.0/24;
            }
            destination-address { # remote network
                10.2.2.0/24;
            }
        }
    }
    then ipsec-sa manual-sa1; # apply SA name to packet
    term default {
        then accept;
    }
}

```



NOTE: The source address, port, and protocol on the outbound traffic filter must match the destination address, port, and protocol on the inbound traffic filter. The destination address, port, and protocol on the outbound traffic filter must match the source address, port, and protocol on the inbound traffic filter.

Example: Applying an Outbound Traffic Filter

After you have configured the outbound firewall filter, you apply it:

```
[edit interfaces]
fe-0/0/1 {
  unit 0 {
    family inet {
      filter {
        input ipsec-encrypt-policy-filter;
      }
      address 10.1.1.254/24;
    }
  }
}
```

The outbound filter is applied on the Fast Ethernet interface at the [edit interfaces fe-0/0/1 unit 0 family inet] hierarchy level. Any packet matching the IPsec action term (term 1) on the input filter (ipsec-encrypt-policy-filter), configured on the Fast Ethernet interface, is directed to the ES PIC interface at the [edit interfaces es-0/1/0 unit 0 family inet] hierarchy level. If a packet arrives from the source address 10.1.1.0/24 and goes to the destination address 10.2.2.0/24, the Packet Forwarding Engine directs the packet to the ES PIC interface, which is configured with the manual-sa1 SA. The ES PIC receives the packet, applies the manual-sa1 SA, and sends the packet through the tunnel.

The router must have a route to the tunnel endpoint; add a static route if necessary.

Example: Configuring an Inbound Traffic Filter for a Policy Check

Here, an inbound firewall filter, which performs the final IPsec policy check, is created on security Gateway A. This check ensures that only packets that match the traffic configured for this tunnel are accepted.

```
filter ipsec-decrypt-policy-filter {
  term term1 { # perform policy check
    from {
      source-address { # remote network
        10.2.2.0/24;
      }
      destination-address { # local network
        10.1.1.0/24;
      }
    }
  }
  then accept;
}
```

Example: Applying an Inbound Traffic Filter to an ES PIC for a Policy Check

After you create the inbound firewall filter, apply it to the ES PIC. Here, the inbound firewall filter (ipsec-decrypt-policy-filter) is applied on the decrypted packet to perform the final policy check. The IPsec manual-sa1 SA is referenced at the [edit interfaces es-1/2/0 unit 0 family inet] hierarchy level and decrypts the incoming packet.

```
[edit interfaces]
es-1/2/0 {
  unit 0 {
    tunnel {
      source 10.5.5.5; # tunnel source address
      destination 10.6.6.6; # tunnel destination address
    }
  }
}
```

```

    }
    family inet {
        filter {
            input ipsec-decrypt-policy-filter;
        }
        ipsec-sa manual-sa1; # SA name applied to packet
        address 10.1.1.8/32 { # local interface address inside local VPN
            destination 10.2.2.254; # destination address inside remote VPN
        }
    }
}

```

The Packet Forwarding Engine directs IPsec packets to the ES PIC. It uses the packet's SPI, protocol, and destination address to look up the SA configured on one of the ES interfaces. The IPsec `manual-sa1` SA is referenced at the `[edit interfaces es-1/2/0 unit 0 family inet]` hierarchy level and is used to decrypt the incoming packet. When the packets are processed (decrypted, authenticated, or both), the input firewall filter (`ipsec-decrypt-policy-filter`) is applied on the decrypted packet to perform the final policy check. Term1 defines the decrypted (and verified) traffic and performs the required policy check.



NOTE: The inbound traffic filter is applied after the ES PIC has processed the packet, so the decrypted traffic is defined as any traffic that the remote gateway is encrypting and sending to this router. IKE uses this filter to determine the policy required for a tunnel. This policy is used during the negotiation with the remote gateway to find the matching SA configuration.

ES Tunnel Interface Configuration for a Layer 3 VPN

To configure an ES tunnel interface for a Layer 3 VPN, you need to configure an ES tunnel interface on the provider edge (PE) router and on the customer edge (CE) router. You also need to configure IPsec on the PE and CE routers.

Configuring Tracing Operations for Security Services

To configure trace options for security services, specify flags using the `traceoptions` statement:

```

[edit security]
traceoptions {
    file filename <files number> <size size>;
    flag all;
    flag database;
    flag general;
    flag ike;
    flag parse;
    flag policy-manager;
    flag routing-socket;
    flag timer;
}

```

You can include these statements at the following hierarchy levels:

- [edit security]
- [edit services ipsec-vpn]

You can specify one or more of the following security tracing flags:

- all—Trace all security events
- database—Trace database events
- general—Trace general events
- ike—Trace IKE module processing
- parse—Trace configuration processing
- policy-manager—Trace policy manager processing
- routing-socket—Trace routing socket messages
- timer—Trace internal timer events

Configuring Tracing Operations for IPsec Events for Adaptive Services PICs

To configure trace options to trace IPsec events for Adaptive Services PICs, include the following statements at the [edit services ipsec-vpn] hierarchy level:

```
[edit services ipsec-vpn]
traceoptions {
  file filename <files number> <size size>;
  flag all;
  flag database;
  flag general;
  flag ike;
  flag parse;
  flag policy-manager;
  flag routing-socket;
  flag timer;
}
```

Trace option output is recorded in the `/var/log/kmd` file.

You can specify one or more of the following security tracing flags:

- all—Trace all security events
- database—Trace database events
- general—Trace general events
- ike—Trace IKE module processing
- parse—Trace configuration processing
- policy-manager—Trace policy manager processing

- `routing-socket`—Trace routing socket messages
- `timer`—Trace internal timer events

Configuring the Authentication Key Update Mechanism for BGP and LDP Routing Protocols

You can configure an authentication key update mechanism for the Border Gateway Protocol (BGP) and Label Distribution Protocol (LDP) routing protocols. This mechanism allows you to update authentication keys without interrupting associated routing and signaling protocols such as Open Shortest Path First (OSPF) and Resource Reservation Setup Protocol (RSVP).

To configure this feature, include the `authentication-key-chains` statement at the `[edit security]` level, and include the `authentication-key-chain` statement for the BGP or LDP routing protocols at the `[edit protocols]` level.

The following topics provide more details about configuring authentication key updates for BGP and LDP Routing Protocols:

1. Configuring Authentication Key Updates on page 615
2. Configuring BGP and LDP for Authentication Key Updates on page 616

Configuring Authentication Key Updates

To configure the authentication key update mechanism, include the `key-chain` statement at the `[edit security authentication-key-chains]` hierarchy level, and specify the `key` option to create a key-chain consisting of several authentication keys.

```
[edit security authentication-key-chains]
key-chain key-chain-name {
  key key {
    secret secret-data;
    start-time yyyy-mm-dd.hh:mm:ss;
  }
}
```

key-chain—Assigns a name to the key-chain mechanism. This name is also configured at the `[edit protocols bgp]` or the `[edit protocols ldp]` hierarchy levels to associate unique authentication key-chain attributes as specified using the following options:

- **key**—Each key within a key-chain is identified by a unique integer value. The range is from 0 through 63.
- **secret**—Each key must specify a secret in encrypted text or plain text format. Even if you enter the secret data in plain-text format, the secret always appears in encrypted format.
- **start-time**—Start times for authentication key updates are specified in UTC (Coordinated Universal Time), and must be unique within the key-chain.

Configuring BGP and LDP for Authentication Key Updates

To configure the authentication key update mechanism for the BGP and LDP routing protocols, include the `authentication-key-chain` statement at the `[edit protocols (bgp | ldp)]` hierarchy level to associate each routing protocol with the `[edit security authentication-key-chains]` authentication keys.

```
[edit protocols (bgp | ldp)]
group groupname {
  neighbor address {
    authentication-key-chain key-chain-name;
  }
}
```



NOTE: Beginning with JUNOS Release 7.6, when configuring the authentication key update mechanism for BGP, you cannot commit the `0.0.0.0/allow` statement with authentication keys or key chains. The CLI issues a warning and fails to commit such configurations.

For information about the BGP protocol, see the *JUNOS Routing Protocols Configuration Guide*.

Configuring SSH Host Keys for Secure Copying of Data

Secure Shell (SSH) uses encryption algorithms to generate a host, server, and session key system that ensures secure data transfer. You can configure SSH host keys to support secure copy (SCP) as an alternative to FTP for the background transfer of data such as configuration archives and event logs. To configure SSH support for SCP, you must complete the following tasks:

- Specify SSH known hosts by including hostnames and host key information in the Routing Engine configuration hierarchy.
- Set an SCP URL to specify the host from which to receive data. Setting this attribute automatically retrieves SSH host key information from the SCP server.
 - Verify that the host key is authentic.
 - Accept the secure connection. Accepting this connection automatically stores host key information in the local host key database. Storing host key information in the configuration hierarchy automates the secure handshake and allows background data transfer using SCP.

Tasks to configure SSH Hostkeys for secure copying of data are:

1. Configuring SSH Known Hosts on page 617
2. Configuring Support for SCP File Transfer on page 617
3. Updating SSH Host Key Information on page 618

Configuring SSH Known Hosts

To configure SSH known hosts, include the `host` statement, and specify hostname and host key options for trusted servers at the `[edit security ssh-known-hosts]` hierarchy level:

```
[edit security ssh-known-hosts]
host corporate-archive-server, ip-address {
    dsa-key key;
}
host archive-server-url {
    rsa-key key;
}
host server-with-ssh-version-1, ip-address {
    rsa1-key key;
}
```

Host keys are one of the following:

- `dsa-key`—Base64 encoded Digital Signature Algorithm (DSA) key.
- `rsa-key`—Base 64 encoded Rivest, Shamir and Adleman (RSA) public key algorithm, which supports encryption and digital signatures.
- `rsa1-key`—Base64 encoded RSA public key algorithm, which supports encryption and digital signatures for SSH version 1 and SSH version 2.

Configuring Support for SCP File Transfer

To configure a known host to support background SCP file transfers, include the `archive-sites` statement at the `[edit system archival configuration]` hierarchy level.

```
[edit system archival configuration]
archive-sites {
    scp://username<:password>@host<:port>/url-path;
}
```



NOTE: When specifying a URL in a JUNOS statement using an IPv6 host address, you must enclose the entire URL in quotation marks (" ") and enclose the IPv6 host address in brackets ([]). For example,
`"scp://username<:password>@[host]<:port>/url-path";`

Setting the `archive-sites` statement to point to an SCP URL triggers automatic host key retrieval. At this point, the JUNOS system software connects to the SCP host to fetch the SSH public key, displays the host key message digest or fingerprint as output to the console, and terminates the connection to the server.

```
user@host# set system archival configuration archive-sites "<scp-url-path>"
```

The authenticity of host `<my-archive-server (<server_ip_address>)>` can't be established.
 RSA key fingerprint is `<ascii-text key>`. Are you sure you want to continue connecting (yes/no)?

To verify that the host key is authentic, compare this fingerprint with a fingerprint that you obtain from the same host using a trusted source. If the fingerprints are identical, accept the host key by entering **yes** at the prompt. The host key information is then stored in the Routing Engine configuration and supports background data transfers using SCP.

Updating SSH Host Key Information

Typically, SSH host key information is automatically retrieved when you set a URL attribute for SCP using the **archival configuration archive-sites** statement at the **[edit system]** hierarchy level. However, if you need to manually update the host key database, use one of the following methods.

1. Retrieving Host Key Information Manually on page 618
2. Importing Host Key Information from a File on page 618

Retrieving Host Key Information Manually

To manually retrieve SSH public host key information, use the **fetch-from-server** option with the **set security ssh-known-hosts** command. You must include a hostname attribute with the **set security ssh-known-hosts fetch-from-server** command to specify the host from which to retrieve the SSH public key.

```
user@host# set security ssh-known-hosts fetch-from-server <hostname>
```

Importing Host Key Information from a File

To manually import SSH host key information from the known-hosts file located at **/var/tmp/known-hosts** on the server, include the **load-key-file** option with the **set security ssh-known-hosts** command. You must include the path to the known-hosts file with the **set security ssh-known-hosts load-key-file** command to specify the location from which to import host key information.

```
user@host# set security ssh-known-hosts load-key-file /var/tmp/known-hosts
```

Importing SSL Certificates for JUNOScript Support

A JUNOScript client application can use one of four protocols to connect to the JUNOScript server on a router: clear-text (a JUNOScript-specific protocol for sending unencrypted text over a TCP connection), SSH, SSL, or Telnet. For clients to use the SSL protocol, you must copy an X.509 authentication certificate onto the router, as described in this topic. You must also include the **xnm-ssl** statement at the **[edit system services]** hierarchy level.



NOTE: The **xnm-ssl** statement does not apply to standard IPsec services.

After obtaining an X.509 authentication certificate and private key, copy it to the router by including the **local** statement at the **[edit security certificates]** hierarchy level:

```
[edit security certificates]
local certificate-name {
  load-key-file (filename | url);
}
```

certificate-name is a name you choose to identify the certificate uniquely (for example, `junoscript-ssl-client-hostname`, where *hostname* is the computer where the client application runs).

filename is the pathname of the file on the local disk that contains the paired certificate and private key (assuming you have already used another method to copy them to the router's local disk).

url is the URL to the file that contains a paired certificate and private key (for instance, on the computer where the JUNOScript client application runs).



NOTE: The CLI expects the private key in the *URL-or-path* file to be unencrypted. If the key is encrypted, the CLI prompts you for the passphrase associated with it, decrypts it, and stores the unencrypted version.

The `load-key-file` statement acts as a directive that copies the contents of the certificate file into the configuration. When you view the configuration, the CLI displays the string of characters that constitute the private key and certificate, marking them as `SECRET-DATA`. The `load-key-file` keyword is not recorded in the configuration.

Configuring Internal IPsec for JUNOS-FIPS

In a JUNOS-FIPS environment, routers with two Routing Engines must use IPsec for internal communication between the Routing Engines. You configure internal IPsec after you install JUNOS-FIPS. You must be a Crypto Officer to configure internal IPsec.

To configure internal IPsec, include the `security-association` statement at the `[edit security]` hierarchy level:

```
[edit security]
ipsec {
  internal {
    security-association {
      manual {
        direction (bidirectional | inbound | outbound) {
          protocol esp;
          spi spi-value;
          encryption {
            algorithm 3des-cbc;
            key ascii-text ascii-text-string;
          }
        }
      }
    }
  }
}
```

```
}
```

Tasks for configuring internal IPsec for JUNOS FIPS are:

1. Configuring the SA Direction on page 620
2. Configuring the IPsec SPI on page 621
3. Configuring the IPsec Key on page 621

Configuring the SA Direction

To configure the IPsec SA direction, include the `direction` statement at the `[edit security ipsec internal security-association manual]` hierarchy level:

```
direction (bidirectional | inbound | outbound);
```

The value can be one of the following:

- **bidirectional**—Apply the same SA values in both directions between Routing Engines.
- **inbound**—Apply these SA properties only to the inbound IPsec tunnel.
- **outbound**—Apply these SA properties only to the outbound IPsec tunnel.

If you do not configure the SA to be bidirectional, you must configure SA parameters for IPsec tunnels in both directions. The following example uses an inbound and outbound IPsec tunnel:

```
[edit security]
ipsec {
  internal {
    security-association {
      manual {
        direction inbound {
          protocol esp;
          spi 512;
          encryption {
            algorithm 3des-cbc;
            key ascii-text "$.KL3rngIH7,theOPcn87Ixfpe9GJKdme";
          }
        }
        direction outbound {
          protocol esp;
          spi 513;
          encryption {
            algorithm 3des-cbc;
            key ascii-text ".n87IngIH7,thxefpe9GJKdme.KL3rOPc";
          }
        }
      }
    }
  }
}
```

Configuring the IPsec SPI

A security parameter index (SPI) is a 32-bit index identifying a security context between a pair of Routing Engines. To configure the IPsec Security Parameter Index (SPI) value, include the `spi` statement at the `[edit security ipsec internal security-association manual direction]` hierarchy level:

```
spi value;
```

The value must be from 256 through 16639.

Configuring the IPsec Key

To configure the ASCII text key, include the `key` statement at the `[edit security ipsec internal security-association manual direction encryption]` hierarchy level:

```
key ascii-text ascii-text-string;
```

The value must be from 256 through 16639. You must enter the key ASCII value twice and the strings entered must match, or the key will not be set. The ASCII text key is never displayed in plain text.

Example: Configuring Internal IPsec

Configure a bidirectional IPsec SA with an SPI value of 512 and a key value conforming to the FIPS 140-2 rules:

```
[edit security]
ipsec {
  internal {
    security-association {
      manual {
        direction bidirectional {
          protocol esp;
          spi 512;
          encryption {
            algorithm 3des-cbc;
            key ascii-text "$9$90j.COlek8X7VevbYgoji1rh";
          }
        }
      }
    }
  }
}
```


Chapter 17

Summary of Security Services Configuration Statements

The following configuration statement references explain each of the security services configuration statements. The statement references are organized alphabetically.

algorithm

Syntax	algorithm 3des-cbc;
Hierarchy Level	[edit security ipsec internal security-association manual direction encryption]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Select the encryption algorithm for the internal Routing-Engine-to-Routing-Engine IPsec security association (SA) configuration.
Options	Only 3des-cbc is supported.
Usage Guidelines	See “Configuring Internal IPsec for JUNOS-FIPS” on page 619.
Required Privilege Level	Crypto Officer—To add and view this statement in the configuration.
Related Topics	<i>Secure Configuration Guide for Common Criteria and JUNOS-FIPS</i>

authentication

Syntax	<pre>authentication { algorithm (hmac-md5-96 hmac-sha1-96); key (ascii-text <i>key</i> hexadecimal <i>key</i>); }</pre>
Hierarchy Level	[edit security ipsec security-association <i>sa-name</i> manual direction (inbound outbound bi-directional)]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure IP Security (IPsec) authentication parameters for manual security association (SA).
Options	<p>algorithm—Hash algorithm that authenticates packet data. It can be one of the following:</p> <ul style="list-style-type: none"> ■ hmac-md5-96—Produces a 128-bit digest. ■ hmac-sha1-96—Produces a 160-bit digest. <p>key—Type of authentication key. It can be one of the following:</p> <ul style="list-style-type: none"> ■ ascii-text key—ASCII text key. For hmac-md5-96, the key is 16 ASCII characters; for hmac-sha1-96, the key is 20 ASCII characters. ■ hexadecimal key—Hexadecimal key. For hmac-md5-96, the key is 32 hexadecimal characters; for hmac-sha1-96, the key is 40 hexadecimal characters.
Usage Guidelines	See “Configuring Manual IPsec Security Associations for an ES PIC” on page 574.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

authentication-algorithm (IKE)

Syntax	authentication-algorithm (md5 sha1);
Hierarchy Level	[edit security ike proposal <i>ike-proposal-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the Internet Key Exchange (IKE) authentication algorithm.
Options	<p>authentication-algorithm—Hash algorithm that authenticates packet data. It can be one of two algorithms:</p> <ul style="list-style-type: none"> ■ md5—Produces a 128-bit digest. ■ sha1—Produces a 160-bit digest.
Usage Guidelines	See “Configuring the Authentication Algorithm for an IKE Proposal” on page 580.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

authentication-algorithm (IPsec)

Syntax	authentication-algorithm (hmac-md5-96 hmac-sha1-96);
Hierarchy Level	[edit security ipsec proposal <i>ipsec-proposal-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the IPsec authentication algorithm.
Options	<p>authentication-algorithm—Hash algorithm that authenticates packet data. It can be one of two algorithms:</p> <ul style="list-style-type: none"> ■ hmac-md5-96—Produces a 128-bit digest. ■ hmac-sha1-96—Produces a 160-bit digest.
Usage Guidelines	See “Configuring the Authentication Algorithm for an IPsec Proposal” on page 585.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

authentication-key-chains

Syntax

```
authentication-key-chains {
  key-chain key-chain-name {
    description text-string;
    key key {
      secret secret-data;
      start-time yyyy-mm-dd.hh:mm:ss;
    }
    tolerance seconds;
  }
}
```

Hierarchy Level [edit security]

Release Information Statement introduced in JUNOS Release 7.6.
Support for the BFD protocol introduced in JUNOS Release 9.6.

Description Configure authentication key updates for the Border Gateway Protocol (BGP), the Label Distribution Protocol (LDP) routing protocols, and the Bidirectional Forwarding Detection (BFD) protocol. When the **authentication-key-chains** statement is configured at the [edit security] hierarchy level, and is associated with the BGP and LDP protocols at the [edit protocols] hierarchy level or with the BFD protocol using the **bfd-liveness-detection** statement, authentication key updates can occur without interrupting routing and signaling protocols such as Open Shortest Path First (OSPF), and Resource Reservation Setup Protocol (RSVP).

Options **key-chain**—Keychain name. This name is configured at the [edit protocols bgp] or the [edit protocols ldp] hierarchy level to associate unique **authentication key-chain** attributes with each protocol as specified using the following options:

- **description**—A text description of the **authentication-key-chain**. Put the text-string in quotes (“text description”).
- **key**—Each key within a keychain is identified by a unique integer value.

Range: 0 through 63

- **secret**—Each key must specify a secret in encrypted text or plain text format. The secret always appears in encrypted format.
- **start-time**—Start times are specified in UTC (Coordinated Universal Time), and must be unique within the keychain.
- **tolerance**—Specify the clock skew tolerance, in seconds.

Range: 0 through 999999999

Usage Guidelines See “Configuring Authentication Key Updates” on page 615 and “Configuring BFD Authentication for Static Routes” in the *JUNOS Software Routing Protocols and Policies Configuration Guide*.

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

admin-control—To add this statement to the configuration.

authentication-method

Syntax	authentication-method (dsa-signatures pre-shared-keys rsa-signatures);
Hierarchy Level	[edit security ike proposal <i>ike-proposal-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the IKE authentication method.
Options	<p>dsa-signatures—Digital Signature Algorithm (DSA)</p> <p>rsa-signatures—A public key algorithm, which supports encryption and digital signatures</p> <p>pre-shared-keys—A key derived from an out-of-band mechanism; the key authenticates the exchange</p>
Usage Guidelines	See “Configuring Manual IPsec Security Associations for an ES PIC” on page 574.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

auto-re-enrollment

Syntax auto-re-enrollment {
 certificate-id {
 ca-profile *ca-profile-name*;
 challenge-password *password*;
 re-enroll-trigger-time *percentage*;
 re-generate-keypair;
 validity-period *days*;
 }
 }

Hierarchy Level [edit security pki]

Release Information Statement introduced in JUNOS Release 8.5.

Description Specify auto-reenrollment parameters for a certificate authority (CA) issued router certificate. Auto-reenrollment requests that the issuing CA replace a router certificate before its specified expiration date.

Options The remaining statements are explained separately.

Usage Guidelines See “Configuring the Auto-Reenrollment Properties for Automatic Renewal of the Router Certificate from the CA” on page 606.

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

Related Topics ■ Configuring Digital Certificates for Adaptive Services Interfaces on page 600

auxiliary-spi

Syntax	<code>auxiliary-spi <i>auxiliary-spi-value</i>;</code>
Hierarchy Level	[edit security ipsec security-association <i>sa-name</i> manual direction (inbound outbound bi-directional)]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the auxiliary Security Parameter Index (SPI) for a manual SA. Use the auxiliary SPI when you configure the protocol statement to use the bundle option.
Options	<i>auxiliary-spi-value</i> —Arbitrary value that uniquely identifies which SA to use at the receiving host (the destination address in the packet). Range: 256 through 16,639
Usage Guidelines	See “Configuring Manual IPsec Security Associations for an ES PIC” on page 574. For information about SPI, see “Configuring Manual IPsec Security Associations for an ES PIC” on page 574 and spi .
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

ca-identity

Syntax	<code>ca-identity <i>ca-identity</i>;</code>
Hierarchy Level	[edit security pki ca-profile <i>ca-profile-name</i>]
Release Information	Statement introduced in JUNOS Release 7.5.
Description	Specify the certificate authority (CA) identity to use in requesting digital certificates for J Series Services Routers and Adaptive Services (AS) and MultiServices PICs installed in M Series and T Series routers.
Options	<i>ca-identity</i> —The name of the CA identity. This name is typically the domain name of the CA.
Usage Guidelines	See “Specifying the CA Profile Name” on page 602.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

ca-name

Syntax	ca-name <i>ca-identity</i> ;
Hierarchy Level	[edit security certificates certification-authority]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Encryption interface on M Series and T Series routers only) Specify the certificate authority (CA) identity to use in the certificate request.
Usage Guidelines	See “Specifying the Certificate Authority Name” on page 594.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

ca-profile

Syntax

```
ca-profile ca-profile-name {
  ca-identity ca-identity;
  enrollment {
    url url-name;
    retry number-of-enrollment-attempts;
    retry-interval seconds;
  }
  revocation-check {
    disable:
    crl {
      disable on-download-failure;
      refresh-interval number-of-hours;
      url {
        url-name;
        password;
      }
    }
  }
}
```

Hierarchy Level [edit security pki]

Release Information Statement introduced in JUNOS Release 7.5.
revocation-check and crl statements added in JUNOS Release 8.1.

Description Specify the name of the certificate authority (CA) profile for J Series Services Routers and Adaptive Services (AS) and MultiServices PICs installed on M Series and T Series routers.

The remaining statements are explained separately.

Options *ca-profile-name*—Name of trusted CA.

Usage Guidelines See “Specifying the CA Profile Name” on page 602.

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

cache-size

Syntax	cache-size <i>bytes</i> ;
Hierarchy Level	[edit security certificates]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Encryption interface on M Series and T Series routers only) Configure the cache size for digital certificates.
Options	<i>bytes</i> —Cache size for digital certificates. Range: 64 through 4,294,967,295 Default: 2 megabytes (MB)



NOTE: We recommend that you limit your cache size to 4 MB.

Usage Guidelines	See “Configuring the Cache Size” on page 595.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration

cache-timeout-negative

Syntax	cache-timeout-negative <i>seconds</i> ;
Hierarchy Level	[edit security certificates]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Encryption interface on M Series and T Series routers only) Configure a negative cache for digital certificates.
Options	<i>seconds</i> —Negative time to cache digital certificates, in seconds. Range: 10 through 4,294,967,295 Default: 20



CAUTION: Configuring a large negative cache value can lead to a denial-of-service attack.

Usage Guidelines	See “Configuring the Negative Cache” on page 596.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration

certificate-id

Syntax certificate-id {
 ca-profile *ca-profile-name*;
 challenge-password *password*;
 re-enroll-trigger-time *percentage*;
 re-generate-keypair;
 validity-period *days*;
 }

Hierarchy Level [edit security auto-re-enrollment]

Release Information Statement introduced in JUNOS Release 8.5.

Description Specify a router certificate for auto-reenrollment. The ID is the same as that used to get the end entity's certificate from the issuing certificate authority.

Usage Guidelines See “Configuring the Auto-Reenrollment Properties for Automatic Renewal of the Router Certificate from the CA” on page 606

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

Related Topics ■ auto-re-enrollment

certificates

Syntax

```

certificates {
  cache-size bytes;
  cache-timeout-negative seconds;
  certification-authority ca-profile-name {
    ca-name ca-identity;
    crl file-name;
    encoding (binary | pem);
    enrollment-url url-name;
    file certificate-filename;
    ldap-url url-name;
  }
  enrollment-retry attempts;
  local certificate-name {
    certificate-key-string;
    load-key-file URL-or-path;
  }
  maximum-certificates number;
  path-length certificate-path-length;
}

```

Hierarchy Level [edit security]

Release Information Statement introduced before JUNOS Release 7.4.

Description (Encryption interface on M Series and T Series routers only) Configure the digital certificates for IPsec.

Usage Guidelines See “Configuring Digital Certificates for an ES PIC” on page 592.

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

certification-authority

Syntax `certification-authority ca-profile-name {
 ca-name ca-identity;
 crl file-name;
 encoding (binary | pem);
 enrollment-url url-name;
 file certificate-filename;
 ldap-url url-name;
 }`

Hierarchy Level [edit security certificates]

Release Information Statement introduced before JUNOS Release 7.4.

Description (Encryption interface on M Series and T Series routers only) Configure a certificate authority profile name. The remaining statements are explained separately.

Usage Guidelines See “Configuring the Certificate Authority Properties for an ES PIC” on page 593.

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

challenge-password

Syntax	<code>challenge-password password;</code>
Hierarchy Level	[edit security pki auto-re-enrollment certificate-id]
Release Information	Statement introduced in JUNOS Release 8.5.
Description	Specify the challenge password used by the certificate authority (CA) for router certificate enrollment and revocation. This challenge password must be the same used when the router certificate was originally configured.
Options	<i>password</i> —The password required by the CA.
Usage Guidelines	See “Configuring the Auto-Reenrollment Properties for Automatic Renewal of the Router Certificate from the CA” on page 606.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ auto-re-enrollment

crl (Encryption Interface on M Series and T Series Routers Only)

Syntax	<code>crl file-name;</code>
Hierarchy Level	[edit security certificates]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the certificate revocation list (CRL). A CRL is a time-stamped list identifying revoked certificates, which is signed by a CA and made available to the participating IPsec peers on a regular periodic basis.
Options	<i>file-name</i> —Specifies the file from which to read the CRL.
Usage Guidelines	See “Configuring the Certificate Authority Properties for an ES PIC” on page 593.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration

crl (Adaptive Services Interfaces Only)

Syntax

```
crl {
  disable on-download-failure;
  refresh-interval number-of-hours;
  url {
    url-name;
    password;
  }
}
```

Hierarchy Level [edit security pki ca-profile *ca-profile-name* revocation-check]

Release Information Statement introduced in JUNOS Release 8.1.

Description Configure the certificate revocation list (CRL). A CRL is a time-stamped list identifying revoked certificates, which is signed by a CA and made available to the participating IPsec peers on a regular periodic basis.

Options **disable on-download-failure**—Permits the authentication of the IPsec peer when the CRL is not downloaded.

refresh-interval *hours*—Time interval, in hours, between CRL updates.

Range: 0 through 8784

Default: 24

url *url-name*—Location from which to retrieve the CRL through the Lightweight Directory Access Protocol (LDAP). You can configure as many as three URLs for each configured CA profile.

Usage Guidelines See “Configuring the Certificate Revocation List” on page 603.

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

description

Syntax	<code>description <i>description</i>;</code>
Hierarchy Level	[edit security ike policy <i>ike-peer-address</i>], [edit security ike proposal <i>ike-proposal-name</i>], [edit security ipsec policy <i>ipsec-policy-name</i>], [edit security ipsec proposal <i>ipsec-proposal-name</i>], [edit security ipsec security-association <i>sa-name</i>]
Description	Specify a text description for an IKE proposal or policy, or an IPsec proposal, policy, or SA.
Usage Guidelines	See “Configuring Security Associations for IPsec on an ES PIC” on page 572, “Configuring the Description for an IKE Proposal” on page 581, “Configuring the Description for an IKE Policy” on page 583, “Configuring an IPsec Proposal for an ES PIC” on page 585, and “Configuring the IPsec Policy for an ES PIC” on page 587.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

dh-group

Syntax	<code>dh-group (group1 group2);</code>
Hierarchy Level	[edit security ike proposal <i>ike-proposal-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the IKE Diffie-Hellman group.
Options	<p>dh-group—Type of Diffie-Hellman prime modulus group when performing the new Diffie-Hellman exchange. It can be one of the following:</p> <ul style="list-style-type: none"> ■ group1—768-bit. ■ group2—1024-bit.
Usage Guidelines	See “Configuring the Diffie-Hellman Group for an IKE Proposal” on page 581.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

direction (JUNOS Software)

Syntax	<pre> direction (inbound outbound bidirectional) { authentication { algorithm (hmac-md5-96 hmac-sha1-96); key (ascii-text <i>key</i> hexadecimal <i>key</i>); } auxiliary-spi <i>auxiliary-spi-value</i>; encryption { algorithm (des-cbc 3des-cbc); key (ascii-text <i>key</i> hexadecimal <i>key</i>); } protocol (ah esp bundle); spi <i>spi-value</i>; } </pre>
Hierarchy Level	[edit security ipsec security-association <i>sa-name</i> manual]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define the direction of IPsec processing.
Options	<p>inbound—Inbound SA.</p> <p>outbound—Outbound SA.</p> <p>bidirectional—Bidirectional SA.</p>
Usage Guidelines	See “Configuring Manual IPsec Security Associations for an ES PIC” on page 574.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

direction (JUNOS-FIPS Software)

Syntax direction (bidirectional | inbound | outbound) {
 protocol esp;
 spi *spi-value*;
 encryption {
 algorithm 3des-cbc;
 key ascii-text *ascii-text-string*;
 }
 }

Hierarchy Level [edit security ipsec internal security-association manual]

Description Establish a manual security association (SA) for internal Routing-Engine-to-Routing-Engine communication.

Options bidirectional—Apply the same SA values in both directions between Routing Engines.

 inbound—Apply these SA properties only to the inbound IPsec tunnel.

 outbound—Apply these SA properties only to the outbound IPsec tunnel.

 The remaining statements are explained separately.

Usage Guidelines See “Configuring Internal IPsec for JUNOS-FIPS” on page 619.

Required Privilege Level Crypto Officer—To view and add this statement in the configuration.

Related Topics *Secure Configuration Guide for Common Criteria and JUNOS-FIPS*

dynamic

Syntax	dynamic { ipsec-policy <i>ipsec-policy-name</i> ; replay-window-size (32 64); }
Hierarchy Level	[edit security ipsec security-association <i>name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define a dynamic IPsec SA.
Options	<p>ipsec-policy <i>ipsec-policy-name</i>—Name of the IPsec policy.</p> <p>replay-window-size—(Optional) Antireplay window size. It can be one of the following values:</p> <ul style="list-style-type: none"> ■ 32—32-packet window size. ■ 64—64-packet window size.
Usage Guidelines	See “Configuring Dynamic IPsec Security Associations” on page 579 and “Associating the Configured Security Association with a Logical Interface” on page 599.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

encoding

Syntax	encoding (binary pem);
Hierarchy Level	<p>[edit security ike policy <i>ike-peer-address</i>],</p> <p>[edit security certificates certification-authority <i>ca-profile-name</i>]</p>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Encryption interface on M Series and T Series routers only) Specify the file format used for the local-certificate and local-key-pair statements.
Options	<p>binary—Binary file format.</p> <p>pem—Privacy-enhanced mail (PEM), an ASCII base 64 encoded format. Default: :binary</p>
Usage Guidelines	See “Configuring the Type of Encoding Your CA Supports” on page 594 and “Configuring the Type of Encoding Your CA Supports” on page 598.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

encryption (JUNOS Software)

Syntax encryption {
 algorithm (des-cbc | 3des-cbc);
 key (ascii-text *key* | hexadecimal *key*);
 }

Hierarchy Level [edit security ipsec security-association *sa-name* manual direction (inbound | outbound | bidirectional)]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure an encryption algorithm and key for manual SA.

Options algorithm—Type of encryption algorithm. It can be one of the following:

- des-cbc—Has a block size of 8 bytes (64 bits); its key size is 48 bits long.
- 3des-cbc—Has block size of 8 bytes (64 bits); its key size is 192 bits long.



NOTE: For 3des-cbc, we recommend that the first 8 bytes be different from the second 8 bytes, and the second 8 bytes be the same as the third 8 bytes.

key—Type of encryption key. It can be one of the following:

- ascii-text—ASCII text key. For the des-cbc option, the key contains 8 ASCII characters; for 3des-cbc, the key contains 24 ASCII characters.
- hexadecimal—Hexadecimal key. For the des-cbc option, the key contains 16 hexadecimal characters; for the 3des-cbc option, the key contains 48 hexadecimal characters.

Usage Guidelines See “Configuring Manual IPsec Security Associations for an ES PIC” on page 574.

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

encryption (JUNOS-FIPS Software)

Syntax	encryption { algorithm 3des-cbc; key ascii-text <i>ascii-text-string</i> ; }
Hierarchy Level	[edit security ipsec internal security-association manual direction]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define the encryption parameters for internal Routing-Engine-to-Routing-Engine communication. The remaining statements are explained separately.
Usage Guidelines	See “Configuring Internal IPsec for JUNOS-FIPS” on page 619.
Required Privilege Level	Crypto Officer—To view and add this statement in the configuration.
Related Topics	<i>Secure Configuration Guide for Common Criteria and JUNOS-FIPS</i>

encryption-algorithm

Syntax	encryption-algorithm (3des-cbc des-cbc ase-128-cbc ase-192-cbc ase-256-cbc);
Hierarchy Level	[edit security ike proposal <i>ike-proposal-name</i>], [edit security ipsec proposal <i>ipsec-proposal-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure an IKE or IPsec encryption algorithm.
Options	<p>3des-cbc—Encryption algorithm with key size of 24 bytes; its key size is 192 bits long.</p> <p>des-cbc—Encryption algorithm with key size of 8 bytes; its key size is 48 bits long.</p> <p>aes-128-cbc—Advanced encryption algorithm that has a key size of 16 bytes; its key size is 128 bits long.</p> <p>aes-192-cbc—Advanced encryption algorithm that has a key size of 24 bytes; its key size is 192 bits long.</p> <p>aes-256-cbc—Advanced encryption algorithm that has a key size of 32 bytes; its key size is 256 bits long.</p>
Usage Guidelines	See “Configuring an IKE Proposal for Dynamic SAs” on page 579 and “Configuring an IPsec Proposal for an ES PIC” on page 585.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

enrollment

Syntax	<pre> enrollment { url <i>url-name</i>; retry <i>number-of-enrollment-attempts</i>; retry-interval <i>seconds</i>; } </pre>
Hierarchy Level	[edit security pki ca-profile <i>ca-profile-name</i>]
Release Information	Statement introduced in JUNOS Release 7.5.
Description	Specify the URL and enrollment parameters of the certificate authority (CA) for J Series Services Routers and Adaptive Services (AS) and MultiServices PICs installed on M Series and T Series routers.
Options	<p>url <i>url-name</i>—Location of CA to which the router sends the Simple Certificate Enrollment Protocol-based (SCEP-based) certificate enrollment requests for the configured CA profile. Use the CA host DNS name or IP address.</p> <p>retry <i>number-of-enrollment-attempts</i>—Number of enrollment retries. Range: 0 through 100 Default: 0</p> <p>retry-interval <i>seconds</i>—Amount of time, in seconds, a router should wait between enrollment attempts. Range: 0 through 3600 Default: 0</p>
Usage Guidelines	See “Specifying an Enrollment URL” on page 602 and “Specifying the Enrollment Properties” on page 602.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

enrollment-retry

Syntax	enrollment-retry <i>attempts</i> ;
Hierarchy Level	[edit security certificates]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Encryption interface on M Series and T Series routers only) Specify how many times a router can resend a digital certificate request.
Options	<i>attempts</i> —Number of enrollment retries. Range: 0 through 100 Default: 0
Usage Guidelines	See “Configuring the Number of Enrollment Retries” on page 596.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

enrollment-url

Syntax	enrollment-url <i>url-name</i> ;
Hierarchy Level	[edit security certificates certification-authority <i>ca-profile-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Encryption interface on M Series and T Series routers only) Specify where your router should send Simple Certificate Enrollment Protocol-based (SCEP-based) certificate enrollment requests (certificate authority URL).
Options	<i>url-name</i> —Certificate authority URL.
Usage Guidelines	See “Specifying an Enrollment URL” on page 595.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

file

Syntax	<code>file <i>certificate-filename</i>;</code>
Hierarchy Level	[edit security certificates certification-authority <i>ca-profile-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Encryption interface on M Series and T Series routers only) Specify the file from which to read the digital certificate.
Options	<i>certificate-filename</i> —File from which to read the digital certificate.
Usage Guidelines	See “Specifying a File to Read the Digital Certificate” on page 595.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

identity

Syntax	<code>identity <i>identity-name</i>;</code>
Hierarchy Level	[edit security ike]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define the identity of the remote certificate name if the identity cannot be learned through IKE (ID payload or IP address).
Usage Guidelines	See “Configuring the Identity to Define the Remote Certificate Name” on page 598.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

ike

Syntax ike {
 policy *ike-peer-address* {
 description *policy-description*;
 encoding (binary | pem);
 identity *identity-name*;
 local-certificate *certificate-filename*;
 local-key-pair *private-public-key-file*;
 mode (aggressive | main);
 pre-shared-key (ascii-text *key* | hexadecimal *key*);
 proposals [*proposal-names*];
 }
 proposal *ike-proposal-name* {
 authentication-algorithm (md5 | sha1);
 authentication-method (dsa-signatures | pre-shared-keys | rsa-signatures);
 dh-group (group1 | group2);
 encryption-algorithm (3des-cbc | des-cbc);
 lifetime-seconds *seconds*;
 }
 }

Hierarchy Level [edit security]

Release Information Statement introduced before JUNOS Release 7.4.

Description (Encryption interface on M Series and T Series routers only) Configure IKE.

The statements are explained separately.

Usage Guidelines See “Configuring an IKE Proposal for Dynamic SAs” on page 579 and “Configuring an IKE Policy for Preshared Keys” on page 582.

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

internal

Syntax

```

internal {
  security-association {
    manual {
      direction (bidirectional | inbound | outbound) {
        protocol esp;
        spi spi-value;
        encryption {
          algorithm 3des-cbc;
          key ascii-text ascii-text-string;
        }
      }
    }
  }
}

```

Hierarchy Level [edit security ipsec]

Release Information Statement introduced before JUNOS Release 7.4.

Description (JUNOS-FIPS only) Define an internal security association (SA) for internal Routing-Engine-to-Routing-Engine communication. The remaining statements are explained separately.

Usage Guidelines See “Configuring Internal IPsec for JUNOS-FIPS” on page 619.

Required Privilege Level Crypto Officer—To view and add this statement in the configuration.

Related Topics *Secure Configuration Guide for Common Criteria and JUNOS-FIPS*

ipsec

```

Syntax  ipsec {
            security-association {
                manual {
                    direction (bidirectional | inbound | outbound) {
                        protocol esp;
                        spi spi-value;
                        encryption {
                            algorithm 3des-cbc;
                            key ascii-text ascii-text-string;
                        }
                    }
                }
            }
            policy ipsec-policy-name {
                perfect-forward-secrecy {
                    keys (group1 | group2);
                }
                proposals [ proposal-names ];
            }
            proposal ipsec-proposal-name {
                authentication-algorithm (IPsec) (hmac-md5-96 | hmac-sha1-96);
                encryption-algorithm (3des-cbc | des-cbc);
                lifetime-seconds seconds;
                protocol (ah | esp | bundle);
            }
            security-association name {
                dynamic {
                    ipsec-policy policy-name;
                    replay-window-size (32 | 64);
                }
                manual {
                    direction (inbound | outbound | bi-directional) {
                        authentication {
                            algorithm (hmac-md5-96 | hmac-sha1-96);
                            key (ascii-text key | hexadecimal key);
                        }
                        auxiliary-spi auxiliary-spi-value;
                        encryption {
                            algorithm (des-cbc | 3des-cbc);
                            key (ascii-text key | hexadecimal key);
                        }
                        protocol (ah | esp | bundle);
                        spi spi-value;
                    }
                }
                mode (tunnel | transport);
            }
            traceoptions {
                file <files number> < size size>;
                flag all;
                flag database;
            }
        }

```

```

    flag general;
    flag ike;
    flag parse;
    flag policy-manager;
    flag routing-socket;
    flag timer;
  }
}

```

Hierarchy Level	[edit security]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Encryption interface on M Series and T Series routers only) Configure IPsec. The statements are explained separately.
Usage Guidelines	See “Configuring Security Associations for IPsec on an ES PIC” on page 572.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

key

Syntax	key ascii-text <i>ascii-text-string</i> ;
Hierarchy Level	[edit security ipsec internal security-association manual direction encryption]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	The key used for the internal Routing-Engine-to-Routing-Engine IPsec security association (SA) configuration.
Options	Only ascii-text is supported. <i>ascii-text-string</i> —The encrypted ASCII text key.
Usage Guidelines	See “Configuring Internal IPsec for JUNOS-FIPS” on page 619.
Required Privilege Level	Crypto Officer—To add and view this statement in the configuration.
Related Topics	<i>Secure Configuration Guide for Common Criteria and JUNOS-FIPS</i>

ldap-url

Syntax	ldap-url <i>url-name</i> ;
Hierarchy Level	[edit security certificates certification-authority <i>ca-profile-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Encryption interface on M Series and T Series router only) (Optional) Specify the Lightweight Directory Access Protocol (LDAP) URL for digital certificates.
Options	<i>url-name</i> —Name of the LDAP URL.
Usage Guidelines	See “Specifying an LDAP URL” on page 595.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

lifetime-seconds

Syntax	lifetime-seconds <i>seconds</i> ;
Hierarchy Level	[edit security ike proposal <i>ike-proposal-name</i>], [edit security ipsec proposal <i>ipsec-proposal-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Optional) Configure the lifetime of IKE or IPsec SA. When the SA expires, it is replaced by a new SA (and SPI) or terminated.
Options	<i>seconds</i> —Lifetime, in seconds. Range: 180 through 86,400
Usage Guidelines	See “Configuring the Lifetime for an IKE SA” on page 582 and “Configuring the Lifetime for an IPsec SA” on page 586.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

local

Syntax	local <i>certificate-name</i> { <i>certificate-key-string</i> ; load-key-file <i>URL-or-path</i> ; }
Hierarchy Level	[edit security certificates]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Import a paired X.509 private key and authentication certificate, to enable JUNOScript client applications to establish Secure Sockets Layer (SSL) connections to the router.
Options	<p><i>certificate-key-string</i>—String of alphanumeric characters that constitute the private key and certificate.</p> <p><i>certificate-name</i>—Name that uniquely identifies the certificate.</p> <p>load-key-file—File that contains the private key and certificate. It can be one of two types of values:</p> <ul style="list-style-type: none"> ■ Pathname of a file on the local disk (assuming you have already used another method to copy the certificate file to the router's local disk) ■ URL to the certificate file location (for instance, on the computer where the JUNOScript client application runs)
Usage Guidelines	See “Importing SSL Certificates for JUNOScript Support” on page 618.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

local-certificate

Syntax	local-certificate <i>certificate-filename</i> ;
Hierarchy Level	[edit security ike policy <i>ike-peer-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the certificate filename from which to read the local certificate.
Options	<i>certificate-filename</i> —File from which to read the local certificate.
Usage Guidelines	See “Specifying the Certificate Filename” on page 598.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

local-key-pair

Syntax	<code>local-key-pair <i>private-public-key-file</i>;</code>
Hierarchy Level	<code>[edit security ike policy <i>ike-peer-address</i>]</code>
Release Information	Statement introduced before JUNOS 7.4.
Description	Specify private and public keys.
Options	<i>private-public-key-file</i> —Specifies the file from which to read the private and public key pair.
Usage Guidelines	See “Specifying the Private and Public Key File” on page 598.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

manual (JUNOS Software)

Syntax	<pre> manual { direction (inbound outbound bi-directional) { authentication { algorithm (hmac-md5-96 hmac-sha1-96); key (ascii-text <i>key</i> hexadecimal <i>key</i>); } auxiliary-spi <i>auxiliary-spi-value</i>; encryption { algorithm (des-cbc 3des-cbc); key (ascii-text <i>key</i> hexadecimal <i>key</i>); } protocol (ah esp bundle); spi <i>spi-value</i>; } } </pre>
Hierarchy Level	<code>[edit security ipsec security-association]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Define a manual IPsec SA.</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring Manual IPsec Security Associations for an ES PIC” on page 574.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

manual (JUNOS-FIPS Software)

Syntax	<pre> manual { direction (bidirectional inbound outbound) { protocol esp; spi <i>spi-value</i>; encryption { algorithm 3des-cbc; key ascii-text <i>ascii-text-string</i>; } } } </pre>
Hierarchy Level	[edit security ipsec internal security-association]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define a manual security association (SA) for internal Routing-Engine-to-Routing-Engine communication.
Options	The remaining statements are explained separately.
Usage Guidelines	See “Configuring Internal IPsec for JUNOS-FIPS” on page 619.
Required Privilege Level	Crypto Officer—To view and add this statement in the configuration.
Related Topics	<i>Secure Configuration Guide for Common Criteria and JUNOS-FIPS</i>

maximum-certificates

Syntax	maximum-certificates <i>number</i> ;
Hierarchy Level	[edit security certificates]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Encryption interface on M Series and T Series routers only) Configure the maximum number of peer digital certificates to be cached.
Options	<i>number</i> —Maximum number of peer digital certificates to be cached. Range: 64 through 4,294,967,295 peer certificates Default: 1024 peer certificates
Usage Guidelines	See “Configuring the Maximum Number of Peer Certificates” on page 596.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

mode (IKE)

Syntax	mode (aggressive main);
Hierarchy Level	[edit security ike policy <i>ike-peer-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define the IKE policy mode.
Default	main
Options	<p>aggressive—Takes half the number of messages of main mode, has less negotiation power, and does not provide identity protection.</p> <p>main—Uses six messages, in three peer-to-peer exchanges, to establish the IKE SA. These three steps include the IKE SA negotiation, a Diffie-Hellman exchange, and authentication of the peer. Also provides identity protection.</p>
Usage Guidelines	See “Configuring the Mode for an IKE Policy” on page 583.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

mode (IPsec)

Syntax	mode (transport tunnel);
Hierarchy Level	[edit security ipsec security-association <i>name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define the mode for the IPsec security association.
Default	tunnel
Options	<p>transport— Protects traffic when the communication endpoint and cryptographic endpoint are the same. The data portion of the IP packet is encrypted, but the IP header is not. Virtual Private Network (VPN) gateways that provide encryption and decryption services for protected hosts cannot use transport mode for protected VPN communications.</p> <p>tunnel—Protects traffic using preshared keys with IKE to authenticate peers or digital certificates with IKE to authenticate peers.</p>



NOTE: Tunnel mode requires the ES Physical Interface Card (PIC).

The JUNOS Software supports only encapsulating security payload (ESP) when you use tunnel mode.

In transport mode, the JUNOS Software does not support authentication header (AH) and ESP header bundles.

In transport mode, the JUNOS Software supports only Border Gateway Protocol (BGP).

Usage Guidelines	See “Configuring IPsec Tunnel Mode” on page 574 and “Configuring IPsec Transport Mode” on page 573.
Required Privilege Level	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>

path-length

Syntax	<code>path-length <i>certificate-path-length</i>;</code>
Hierarchy Level	[edit security certificates]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Encryption interface on M Series and T Series router only) Configure the digital certificate path length.
Options	<i>certificate-path-length</i> —Digital certificate path length. Range: 2 through 15 certificates Default: 15 certificates
Usage Guidelines	See “Configuring the Path Length for the Certificate Hierarchy” on page 597.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

perfect-forward-secrecy

Syntax	<pre>perfect-forward-secrecy { keys (group1 group2); }</pre>
Hierarchy Level	[edit security ipsec policy <i>ipsec-policy-name</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Optional) Define the Perfect Forward Secrecy (PFS) protocol. Creates single-use keys.
Options	keys—Type of Diffie-Hellman prime modulus group that IKE uses when performing the new Diffie-Hellman exchange. The key can be one of the following: <ul style="list-style-type: none"> ■ group1—768-bit. ■ group2—1024-bit.
Usage Guidelines	See “Configuring Perfect Forward Secrecy” on page 588.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

pki

```

Syntax  pki {
            ca-profile ca-profile-name {
              ca-identity ca-identity;
              enrollment {
                url url-name;
                retry number-of-enrollment-attempts;
                retry-interval seconds;
              }
              revocation-check {
                disable;
                crl {
                  disable on-download-failure;
                  refresh-interval hours;
                  url {
                    url-name;
                    password;
                  }
                }
              }
            }
          }

```

Hierarchy Level [edit security]

Release Information Statement introduced in JUNOS Release 7.5.
revocation-check and crl statements added in JUNOS Release 8.1.

Description Configure an IPsec profile to request digital certificates for J Series Services Routers and Adaptive Services (AS) and MultiServices PICs installed in M Series and T Series routers.

The statements are explained separately.

Usage Guidelines See “Configuring Digital Certificates for Adaptive Services Interfaces” on page 600.

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

Related Topics *JUNOS Feature Guide* and the *JUNOS System Basics and Services Command Reference*

policy (IKE)

Syntax `policy ike-peer-address {
 description policy-description;
 encoding (binary | pem);
 identity identity-name;
 local-certificate certificate-filename;
 local-key-pair private-public-key-file;
 mode (aggressive | main);
 pre-shared-key (ascii-text key | hexadecimal key);
 proposals [proposal-names];
 }`

Hierarchy Level [edit security ike]

Release Information Statement introduced before JUNOS Release 7.4.

Description Define an IKE policy.

Options *ike-peer-address*—A tunnel address configured at the [edit interfaces es] hierarchy level.

The remaining statements are explained separately.

Usage Guidelines See “Configuring an IKE Policy for Preshared Keys” on page 582 and “Configuring an IKE Policy for Digital Certificates for an ES PIC” on page 597.

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

policy (IPsec)

Syntax	<pre> policy ipsec-policy-name { perfect-forward-secrecy { keys (group1 group2); } proposals [<i>proposal-names</i>]; } </pre>
Hierarchy Level	[edit security ipsec]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define an IPsec policy.
Options	<p><i>ipsec-policy-name</i>—Specify an IPsec policy name.</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring the IPsec Policy for an ES PIC” on page 587.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

pre-shared-key

Syntax	pre-shared-key (ascii-text <i>key</i> hexadecimal <i>key</i>);
Hierarchy Level	[edit security ike policy <i>ike-peer-address</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the key used to authenticate a dynamic peer during IKE phase 1 negotiation. Specify the key in either ASCII or hexadecimal format.
Options	<p>ascii-text <i>key</i>—Authentication key in ASCII format.</p> <p>hexadecimal <i>key</i>—Authentication key in hexadecimal format.</p>
Usage Guidelines	See “Configuring the Preshared Key for an IKE Policy” on page 583.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

proposal (IKE)

Syntax	<pre>proposal <i>ike-proposal-name</i> { authentication-algorithm (md5 sha1); authentication-method (dsa-signatures pre-shared-keys rsa-signatures); description <i>description</i>; dh-group (group1 group2); encryption-algorithm (3des-cbc des-cbc); lifetime-seconds <i>seconds</i>; }</pre>
Hierarchy Level	[edit security ike]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define an IKE proposal for a dynamic SA.
Options	<p><i>ike-proposal-name</i>—Specifies an IKE proposal name.</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring an IKE Proposal for Dynamic SAs” on page 579.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

proposal (IPsec)

Syntax	<pre>proposal <i>ipsec-proposal-name</i> { authentication-algorithm (hmac-md5-96 hmac-sha1-96); encryption-algorithm (3des-cbc des-cbc); lifetime-seconds <i>seconds</i>; protocol (ah esp bundle); }</pre>
Hierarchy Level	[edit security ipsec]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define an IPsec proposal for a dynamic SA.
Options	<p><i>ipsec-proposal-name</i>—Specifies an IPsec proposal name.</p> <p>The statements are explained separately.</p>
Usage Guidelines	See “Configuring an IPsec Proposal for an ES PIC” on page 585.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

proposals

Syntax	<code>proposals [<i>proposal-names</i>];</code>
Hierarchy Level	<code>[edit security ike policy <i>ike-peer-address</i>],</code> <code>[edit security ipsec policy <i>ipsec-policy-name</i>]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Associate one or more proposals with an IKE or IPsec policy.
Options	<i>proposal-names</i> —Name of one or more proposals.
Usage Guidelines	See “Associating Proposals with an IKE Policy” on page 584 and “Configuring the IPsec Policy for an ES PIC” on page 587.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

protocol (JUNOS Software)

Syntax	<code>protocol (ah esp bundle);</code>
Hierarchy Level	<code>[edit security ipsec proposal <i>ipsec-proposal-name</i>],</code> <code>[edit security ipsec security-association <i>sa-name</i> manual direction (inbound outbound</code> <code> bidirectional)]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define the IPsec protocol for a manual or dynamic SA.
Options	ah—Authentication Header protocol bundle—AH and ESP protocols esp—ESP protocol (the <code>tunnel</code> statement must be included at the <code>[edit security ipsec security-association <i>sa-name</i> mode hierarchy level]</code>)
Usage Guidelines	See “Configuring Manual IPsec Security Associations for an ES PIC” on page 574 and “Configuring the Protocol for a Dynamic IPsec SA” on page 587.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.

protocol (JUNOS-FIPS Software)

Syntax	protocol esp;
Hierarchy Level	[edit security ipsec internal security-association manual direction]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	The protocol used for the internal Routing-Engine-to-Routing-Engine IPsec security association (SA) configuration.
Options	Only esp is supported.
Usage Guidelines	See “Configuring Internal IPsec for JUNOS-FIPS” on page 619.
Required Privilege Level	Crypto Officer—To add and view this statement in the configuration.
Related Topics	<i>Secure Configuration Guide for Common Criteria and JUNOS-FIPS</i>

re-enroll-trigger-time

Syntax	<code>re-enroll-trigger-time percentage;</code>
Hierarchy Level	[edit security pki auto-re-enrollment certificate-id]
Release Information	Statement introduced in JUNOS Release 8.5.
Description	Percentage of the router certificate validity-period statement value, in days, when auto-reenrollment should start before expiration.
Options	<i>percentage</i> —Percentage for the reenroll trigger time. Range: 1 through 99
Usage Guidelines	See “Configuring the Auto-Reenrollment Properties for Automatic Renewal of the Router Certificate from the CA” on page 606.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ auto-re-enrollment

re-generate-keypair

Syntax	<code>re-generate-keypair;</code>
Hierarchy Level	[edit security pki auto-re-enrollment certificate-id]
Release Information	Statement introduced in JUNOS Release 8.5.
Description	(Optional) Automatically generate a new key pair when auto-reenrolling a router certificate. If this statement is not configured, the current key pair is used.
Usage Guidelines	See “Configuring the Auto-Reenrollment Properties for Automatic Renewal of the Router Certificate from the CA” on page 606.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ auto-re-enrollment

refresh-interval

Syntax	<code>refresh-interval <i>hours</i>;</code>
Hierarchy Level	<code>[edit security pki ca-profile <i>ca-profile-name</i> revocation-check crl]</code>
Release Information	Statement introduced in JUNOS Release 8.1.
Description	(Adaptive services interfaces only) Specify the amount of time between certificate revocation list (CRL) updates.
Options	<i>number-of-hours</i> —Time interval, in hours, between CRL updates. Range: 0 through 8784 Default: 24
Usage Guidelines	“Configuring the Certificate Revocation List” on page 603.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ <code>crl</code>

retry

Syntax	<code>retry <i>number-of-attempts</i>;</code>
Hierarchy Level	<code>[edit security pki ca-profile <i>ca-profile-name</i> enrollment]</code>
Release Information	Statement introduced in JUNOS Release 7.5.
Description	(Adaptive services interfaces only) Specify how many times a router can resend a digital certificate request.
Options	<i>number-of-attempts</i> —Number of enrollment retries. Range: 0 through 100 Default: 0
Usage Guidelines	See “Specifying the Enrollment Properties” on page 602.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ <code>enrollment</code>

retry-interval

Syntax	<code>retry-interval seconds;</code>
Hierarchy Level	[edit security pki ca-profile <i>ca-profile-name</i> enrollment]
Release Information	Statement introduced in JUNOS Release 7.5.
Description	(Adaptive services interfaces only) Specify the amount of time the router should wait between enrollment retries.
Options	<i>seconds</i> —Time interval, in seconds, between enrollment retries. Range: 0 through 3600 Default: 0
Usage Guidelines	See “Specifying the Enrollment Properties” on page 602.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ enrollment

revocation-check

Syntax

```

revocation-check {
  disable;
  crl {
    refresh-interval number-of-hours;
    url {
      url-name;
    }
  }
}

```

Hierarchy Level [edit security pki ca-profile *ca-profile-name*]

Release Information Statement introduced in JUNOS Release 8.1.

Description Specify the method to verify revocation status of digital certificates for J Series Services Routers and Adaptive Services (AS) and MultiServices PICs installed in M Series and T Series routers.

Options **disable**—Disable verification of status of digital certificates.

crl—Only certificate revocation list (CRL) is supported. A CRL is a time-stamped list identifying revoked certificates, which is signed by a CA and made available to the participating IPsec peers on a regular periodic basis. By default, **crl** is enabled.

The remaining statements are explained separately.

Usage Guidelines See “Configuring the Certificate Revocation List” on page 603.

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

security-association (JUNOS Software)

Syntax

```
security-association sa-name {
  dynamic {
    ipsec-policy policy-name;
    replay-window-size (32 | 64);
  }
  manual {
    direction (inbound | outbound | bi-directional) {
      authentication {
        algorithm (hmac-md5-96 | hmac-sha1-96);
        key (ascii-text key | hexadecimal key);
      }
      auxiliary-spi auxiliary-spi-value;
      encryption {
        algorithm (des-cbc | 3des-cbc);
        key (ascii-text key | hexadecimal key);
      }
      protocol ( ah | esp | bundle);
      spi spi-value;
    }
    mode (tunnel | transport);
  }
}
```

Hierarchy Level [edit security ipsec]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure an IPsec security association.

Options *name*—Name of the security association.

The remaining statements are explained separately.


Usage Guidelines See “Configuring Security Associations for IPsec on an ES PIC” on page 572.

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

security-association (JUNOS-FIPS Software)

Syntax	<pre> security-association { manual { direction (bidirectional inbound outbound) { protocol esp; spi <i>spi-value</i>; encryption { algorithm 3des-cbc; key ascii-text <i>ascii-text-string</i>; } } } }</pre>
Hierarchy Level	[edit security ipsec internal]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Define a security association (SA) for internal Routing-Engine-to-Routing-Engine communication.
Options	The remaining statements are explained separately.
Usage Guidelines	See “Configuring Internal IPsec for JUNOS-FIPS” on page 619.
Required Privilege Level	Crypto Officer—To view and add this statement in the configuration.
Related Topics	<i>Secure Configuration Guide for Common Criteria and JUNOS-FIPS</i>

spi (JUNOS Software)

Syntax	<code>spi spi-value;</code>
Hierarchy Level	[edit security ipsec security-association sa-name manual direction (inbound outbound bi-directional)]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure SPI for an SA.
Options	<p><i>spi-value</i>—An arbitrary value that uniquely identifies which SA to use at the receiving host (the destination address in the packet).</p> <p>Range: 256 through 16639</p>
<hr/> <div>  NOTE: Use the auxiliary SPI when you configure the <code>protocol</code> statement to use the <code>bundle</code> option. </div> <hr/>	
Usage Guidelines	See “Configuring Manual IPsec Security Associations for an ES PIC” on page 574.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.

spi (JUNOS-FIPS Software)

Syntax	<code>spi spi-value;</code>
Hierarchy Level	[edit security ipsec internal security-association manual direction]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	The Security Parameter Index (SPI) value used for the internal Routing-Engine-to-Routing-Engine IPsec security association (SA) configuration.
Options	<p><i>spi-value</i>—Integer to use for this SPI.</p> <p>Range: 256 through 16639</p>
Usage Guidelines	See “Configuring Internal IPsec for JUNOS-FIPS” on page 619.
Required Privilege Level	Crypto Officer—To add and view this statement in the configuration.
Related Topics	<i>Secure Configuration Guide for Common Criteria and JUNOS-FIPS</i>

ssh-known-hosts

Syntax	ssh-known-hosts { host { dsa-key key; rsa-key key; rsa1-key key; } }
Hierarchy Level	[edit security ssh-known-hosts]
Release Information	Statement introduced in JUNOS Release 7.5.
Description	Configure SSH support for known hosts and for administering for SSH host key updates.
Options	<p>dsa-key—Base64 encoded Digital Signature Algorithm (DSA) key for SSH version 2.</p> <p>rsa-key—Base64 encoded public key algorithm that supports encryption and digital signatures for SSH version 1 and SSH version 2.</p> <p>rsa1-key—Base64 encoded RSA public key algorithm, which supports encryption and digital signatures for SSH version 1.</p> <p>fetch-from-server—Retrieve SSH public host key information from a specified server.</p> <p>load-key-file—Import SSH host key information from the <code>/var/tmp/ssh-known-hosts</code> file.</p>
Usage Guidelines	See “Configuring SSH Host Keys for Secure Copying of Data” on page 616.
Required Privilege Level	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>

traceoptions

Syntax traceoptions {
 file *filename* <files *number*> <size *size*>;
 flag all;
 flag database;
 flag general;
 flag ike;
 flag parse;
 flag policy-manager;
 flag routing-socket;
 flag timer;
 }

Hierarchy Level [edit security],
 [edit services ipsec-vpn]

Trace options can be configured at either the [edit security] or the [edit services ipsec-vpn] hierarchy level, but not at both levels.

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure security trace options.

To specify more than one trace option, include multiple **flag** statements. Trace option output is recorded in the `/var/log/kmd` file.

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

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

Range: 2 through 1000 files

Default: 0 files

size *size*—(Optional) Maximum size of each trace file, in kilobytes (KB). When a trace file (for example, `kmd`) reaches this size, it is renamed, `kmd.0`, then `kmd.1` and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

Default: 1024 KB

flag—Trace operation to perform. To specify more than one trace operation, include multiple **flag** statements.

- all—Trace all security events.
- database—Trace database events.
- general—Trace general events.

- `ike`—Trace IKE module processing.
- `parse`—Trace configuration processing.
- `policy-manager`—Trace policy manager processing.
- `routing-socket`—Trace routing socket messages.
- `timer`—Trace internal timer events.

Usage Guidelines See “Configuring Tracing Operations for Security Services” on page 613.

Required Privilege Level `admin`—To view the configuration.
`admin-control`—To add this statement to the configuration.

url

Syntax `url url-name;`

Hierarchy Level [edit security pki ca-profile *ca-profile-name* enrollment],
 [edit security pki ca-profile *ca-profile-name* revocation-check *crl*]

Release Information Statement introduced in JUNOS Release 7.5.

Description (Adaptive services interfaces only) Specify the certificate authority (CA) URL to use in requesting digital certificates or the URL for the Lightweight Access Directory Protocol (LDAP) location from which retrieve the certificate revocation list (CRL).

Options `url-name`—URL of CA or URL of LDAP location of CRL.

Usage Guidelines See “Specifying an Enrollment URL” on page 602 and “Specifying an LDAP URL” on page 603.

Required Privilege Level `admin`—To view the configuration.
`admin-control`—To add this statement to the configuration.

Related Topics ■ `enrollment`
 ■ `crl` (Adaptive Services Interfaces Only)

validity-period

Syntax	validity-period <i>days</i> ;
Hierarchy Level	[edit security pki auto-re-enrollment certificate-id]
Release Information	Statement introduced in JUNOS Release 8.5.
Description	(Optional) Certificate validity period, in days, from the enrollment start date. If not specified, the issuing certificate authority (CA) sets this time as per its own policy. The start time is when auto-reenrollment is initiated.
Options	<i>days</i> —Number of days that the certificate is valid. Range: 1 through 4095 days Default: Per CA policy
Usage Guidelines	See “Configuring the Auto-Reenrollment Properties for Automatic Renewal of the Router Certificate from the CA” on page 606
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Topics	■ auto-re-enrollment

Part 5

Router Chassis

- Router Chassis Configuration Guidelines on page 677
- Summary of Router Chassis Configuration Statements on page 773

Chapter 18

Router Chassis Configuration Guidelines

This chapter covers the following topics:

- Router Chassis Configuration Statements on page 679
- Configuring the JUNOS Software to Make a Flexible PIC Concentrator Stay Offline on page 682
- Configuring the JUNOS Software to Make an SFM Stay Offline on page 683
- Configuring the JUNOS Software for Supporting Aggregated Devices on page 683
- Configuring the JUNOS Software to Use ATM Cell-Relay Accumulation Mode on an ATM1 PIC on page 686
- Configuring Port-Mirroring Instances on page 686
- Configuring PIC-Level Symmetrical Hashing for Load Balancing on 802.3ad LAGs for MX Series Routers on page 689
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- Configuring the JUNOS Software to Enable a Routing Engine to Reboot on Hard Disk Errors on page 749
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- Configuring the uPIM to Run in Switching or Routing Mode on J Series Routers on page 753
- Configuring the IP and Ethernet Services Mode in MX Series Routers on page 754
- Configuring J Series Services Router Switching Interfaces on page 755
- Example: Configuring J Series Services Router Switching Interfaces on page 756
- TX Matrix Router and T640 Router Configuration Guidelines on page 756
- TX Matrix Plus Router and T1600 Router Configuration Guidelines on page 764

Router Chassis Configuration Statements

You can configure properties of the router chassis, including conditions that activate the red and yellow alarm LEDs on the router craft interface and SONET/SDH framing and concatenation properties for individual Physical Interface Cards (PICs).

To configure router chassis properties, include the following statements at the [edit chassis] hierarchy level:



NOTE: Statements at the [edit chassis redundancy] hierarchy level are described in the *JUNOS High Availability Configuration Guide*.

```
chassis {
  aggregated-devices {
    ethernet {
      device-count number;
      lacp {
        system-priority;
        link-protection;
      }
    }
    sonet {
      device-count number;
    }
  }
  alarm {
    interface-type {
      alarm-name (red | yellow | ignore);
    }
  }
  config-button {
    no-clear;
    no-rescue;
    craft-lockout;
  }
  fpc slot-number {
    port-mirror-instance port-mirroring-instance-name;
    power (off | on);
    pic pic-number {
      port-mirror-instance port-mirroring-instance-name;
      framing (t1 | e1);
      adaptive-services {
        service-package (layer-2 | layer-3);
      }
      aggregate-ports;
      atm-cell-relay-accumulation;
      atm-l2circuit-mode (cell | aal5 | trunk trunk);
      vtmapping number;
      ce1 {
        e1 port-number {
          channel-group group-number timeslots slot-number;
        }
      }
    }
  }
}
```

```

    }
  }
  ct3 {
    port port-number {
      t1 link-number {
        channel-group group-number timeslots slot-number;
      }
    }
  }
  framing (sdh | sonet);
  idle-cell-format {
    itu-t;
    payload-pattern payload-pattern-byte;
  }
  max-queues-per-interface (8 | 4);
  mlfr-uni-nni-bundles number;
  no-concatenate;
  q-pic-large-buffer {
    large-scale;
    small-scale;
  }
  red-buffer-occupancy {
    weighted-averaged [ instant-usage-weight-exponent weight-value ];
  }
  sparse-dlcis;
  traffic-manager {
    ingress-shaping-overhead number;
    mode {
      egress-only;
      ingress-and-egress;
      session-shaping;
    }
    tunnel-services {
      bandwidth (1g | 10g);
      vtmapping (itu-t | klm);
    }
  }
}
fpc-feb-connectivity {
  fpc slot-number feb (slot-number | none);
}
lcc number {
  fpc number {
    pic number {
      atm-cell-relay-accumulation;
      atm-l2circuit-mode (cell | aal5 | trunk trunk);
      framing (sdh | sonet);
      idle-cell-format {
        itu-t;
        payload-pattern payload-pattern-byte;
      }
      max-queues-per-interface (8 | 4);
      no-concatenate;
      hash-key {
        family {
          inet {
            layer-3;

```

```

        layer-4;
        symmetric-hash {
            complement;
        }
    }
    multiservice {
        source-mac;
        destination-mac;
        payload {
            ip {
                layer-3;
                layer-4;
            }
        }
        symmetric-hash {
            complement;
        }
    }
}
}
}
}
}
offline;
online-expected;
}
(packet-scheduling | no-packet-scheduling);
pem {
    minimum number;
}
no-concatenate;
redundancy {
    cfeb slot (always | preferred);
    failover {
        on-disk-failure
        on-loss-of-keepalives;
    }
    feb {
        redundancy-group group-name {
            feb slot-number (backup | primary);
            description description;
            no-auto-failover;
        }
    }
    port-mirror-instance port-mirroring-instance-name;
    graceful-switchover;
    keepalive-time seconds;
    routing-engine slot-number (master | backup | disabled);
    route-memory-enhanced;
    sfm slot-number (always | preferred);
    ssb slot-number (always | preferred);
}
}
network-services (ethernet | ip);
routing-engine {
    on-disk-failure {
        disk-failure-action (halt | reboot);
    }
}

```

```

    }
  }
  sfm slot-number {
    power off;
  }
  sib {
    minimum number;
  }
  vrf-mtu-check;
  vtmapping (km | itu-t);
  synchronization {
    signal-type (e1 | t1);
    switching-mode (revertive | non-revertive);
    y-cable-line-termination;
    transmitter-enable;
    validation-interval seconds;
    primary (external-a | external-b);
    secondary (external-a | external-b);
  }
}

```



NOTE: The configuration statements at the [edit chassis lcc] hierarchy level apply only to a routing matrix based on a TX Matrix router or a TX Matrix Plus router. For information about a routing matrix composed of a TX Matrix router and T640 routers, see “TX Matrix Router and T640 Router Configuration Overview” on page 756 and the *TX Matrix Router Hardware Guide*. For information about a routing matrix composed of a TX Matrix Plus router and T1600 routers, see “TX Matrix Plus Router and T1600 Router Configuration Overview” on page 764 and the *TX Matrix Plus Router Hardware Guide*.

Configuring the JUNOS Software to Make a Flexible PIC Concentrator Stay Offline

By default, a Flexible PIC Concentrator (FPC) is configured to restart after a system reboot. To configure an FPC to stay offline and prevent it from restarting, include the `power off` statement at the [edit chassis fpc slot-number] hierarchy level:

```

[edit chassis fpc slot-number]
power off;

```



NOTE: You can use the `request chassis fpc operational mode` command to take an FPC offline, but the FPC attempts to restart when you enter a `commit` CLI command.

To bring an FPC online that is configured to stay offline and configure it to stay online, include the `power on` statement at the [edit chassis fpc slot-number] hierarchy level:

```

[edit chassis fpc slot-number]
power on;

```

Configuring the JUNOS Software to Make an SFM Stay Offline

By default, if you use the `request chassis sfm` CLI command to take an SFM offline, the SFM attempts to restart when you enter a `commit` CLI command. To prevent a restart, you can configure an SFM to stay offline. This feature is useful for repair situations.

To configure an SFM to stay offline, include the `sfm` statement at the `[edit chassis]` hierarchy level:

```
[edit chassis]
sfm slot-number {
  power off;
}
```

- *slot number*—Slot number in which the SFM is installed.
- *power off*—Take the SFM offline and configure it to remain offline.

For example, the following statement takes an SFM in slot 3 offline:

```
[edit chassis]
sfm 3 power off;
```

Use the `show chassis sfm` CLI command to confirm the offline status:

```
user@host# show chassis sfm
```

Slot	State	Temp (C)	CPU Utilization (%)		Memory Utilization (%)		
			Total	Interrupt	DRAM (MB)	Heap	Buffer
0	Online	34	2	0	64	16	47
1	Online	38	2	0	64	16	47
2	Online	42	2	0	64	16	47
3	Offline	--- Configured power off ---					

To bring the SFM back online, delete the `edit chassis sfm` statement and then commit the configuration.

Configuring the JUNOS Software for Supporting Aggregated Devices

JUNOS Software supports the aggregation of physical devices into defined virtual links, such as the link aggregation of Ethernet interfaces defined by the IEEE 802.3ad standard.

Tasks for configuring aggregated devices are:

1. Configuring Virtual Links for Aggregated Devices on page 684
2. Configuring LACP Link Protection at the Chassis Level on page 684
3. Enabling LACP Link Protection on page 685
4. Configuring System Priority on page 685

Configuring Virtual Links for Aggregated Devices

To define the virtual links, you need to specify the associations between physical and logical devices within the `[edit interfaces]` hierarchy, and assign the correct number of logical devices by including the `device-count` statement at the `[edit chassis aggregated-devices ethernet]` and `[edit chassis aggregated-devices sonet]` hierarchy levels:

```
[edit chassis]
aggregated-devices {
  ethernet {
    device-count number;
  }
  sonet {
    device-count number;
  }
}
```

The maximum number of Ethernet logical interfaces you can configure is 128. The aggregated Ethernet interfaces are numbered from `ae0` through `ae127`. The maximum number of SONET/SDH logical interfaces is 16. The aggregated SONET/SDH interfaces are numbered from `as0` through `as15`.

Configuring LACP Link Protection at the Chassis Level

Link Aggregation Control Protocol (LACP) is one method of bundling several physical interfaces to form one logical interface. You can configure both VLAN-tagged and untagged aggregated Ethernet with or without LACP enabled. LACP exchanges are made between actors and partners. An actor is the local interface in an LACP exchange. A partner is the remote interface in an LACP exchange.

LACP link protection enables you to force active and standby links within an aggregated Ethernet. You configure LACP link protection by configuring the `link-protection` and `system-priority` statements at either the chassis or interface level and by configuring port priority at the interface level using the `port-priority` statement. Configuring LACP parameters at the chassis level results in all aggregated Ethernet interfaces using these values unless overridden by LACP configuration on a specific interface.

```
[edit chassis]
aggregated-devices {
  ethernet {
    lacp {
      link-protection {
        non-revertive;
      }
      system-priority priority;
    }
  }
}
```

You configure LACP link protection by using the `link-protection` and `system-priority` statements and define port priority at the port level using the `port-priority` statement. Configuring LACP parameters at the chassis level results in all aggregated Ethernet interfaces using the defined configuration unless overridden on a specific interface.



NOTE: LACP link protection also uses port priority. You can configure port priority at the Ethernet interface `[gigether-options]` hierarchy level using the `port-priority` statement. If you choose not to configure port priority, LACP link protection uses the default value for port priority (127). See the *JUNOS Network Interfaces Configuration Guide* for detailed information about LACP and how to configure it on individual aggregated Ethernet interfaces.

Enabling LACP Link Protection

To enable LACP link protection for aggregated Ethernet interfaces on the chassis, use the `link-protection` statement at the `[edit chassis aggregated-devices ethernet lacp]` hierarchy level:

```
[edit chassis aggregated-devices ethernet lacp]
link-protection {
    non-revertive;
}
```

By default, LACP link protection reverts to a higher-priority (lower-numbered) link when that higher-priority link becomes operational or a link is added to the aggregator that is determined to be higher in priority. However, you can suppress link calculation by adding the `non-revertive` statement to the LACP link protection configuration. In non-revertive mode, once a link is active and collecting and distributing packets, the subsequent addition of a higher-priority (better) link does not result in a switch, and the current link remains active.



CAUTION: If both ends of an aggregator have LACP link protection enabled, make sure to configure both ends of the aggregator to use the same mode. Mismatching LACP link protection modes can result in lost traffic.

Configuring System Priority

To configure LACP system priority for aggregated Ethernet interfaces on the chassis, use the `system-priority` statement at the `[edit chassis aggregated-devices ethernet lacp]` hierarchy level:

```
[edit chassis aggregated-devices ethernet lacp]
system-priority priority;
```

The system priority is a 2-octet binary value that is part of the LACP system ID. The LACP system ID consists of the system priority as the two most-significant octets and the interface MAC address as the six least-significant octets. The system with the numerically lower value for system priority has the higher priority. By default, system priority is 127, with a range of 0 to 65535.

Configuring the JUNOS Software to Use ATM Cell-Relay Accumulation Mode on an ATM1 PIC

You can configure an Asynchronous Transfer Mode (ATM) 1 PIC to use cell-relay accumulation mode. In this mode, the incoming cells (one to eight cells) are packaged into a single packet and forwarded to the label-switched path (LSP). At the edge router, this packet is divided into individual cells and transmitted over the ATM interface.



NOTE: When you configure an ATM PIC to use cell-relay accumulation, all ports on the ATM PIC use cell-relay accumulation mode.

To configure an ATM PIC to use cell-relay accumulation mode, include the `atm-cell-relay-accumulation` statement at the `[edit chassis fpc slot-number pic pic-number]` hierarchy level:

```
[edit chassis fpc slot-number pic pic-number ]
atm-cell-relay-accumulation;
```

On a TX Matrix or TX Matrix Plus router, include the `atm-cell-relay-accumulation` statement at the `[edit chassis lcc number fpc slot-number pic pic-number]` hierarchy level:

```
[edit chassis lcc number fpc slot-number pic pic-number]
atm-cell-relay-accumulation;
```

Configuring Port-Mirroring Instances

- Port-Mirroring Instances Overview on page 686
- Configuring Port-Mirroring Instances on MX Series Ethernet Services Routers on page 687
- Configuring Port-Mirroring Instances on M320 Routers on page 688
- Configuring Port-Mirroring Instances on M120 Routers on page 689

Port-Mirroring Instances Overview

You can configure port mirroring for IPv4 and IPv6 traffic on all M Series, T Series, and MX Series routers. In addition, on the M7i, M10i, M120, M320, and MX Series routers, you can configure port mirroring for Layer 2 VPLS traffic.

You configure global port mirroring by including the `port-mirroring` statement at the `[edit forwarding-options]` hierarchy level. Configuring port-mirroring properties globally results in the properties being applied system-wide to all the Packet Forwarding Engines and their respective ports.

On MX Series, M320, and M120 routers, you can configure named port-mirroring instances for Layer 2 VPLS traffic. Configuring port-mirroring instances enables you

to customize each instance with different properties for input-sampling and port-mirroring output destinations, instead of having to use a single system-wide configuration for port mirroring.

You configure multiple port-mirroring instances by including the `instance port-mirroring-instance-name` statement at the `[edit forwarding-options port-mirroring]` hierarchy level. You can then associate individual port-mirroring instances with an FPC, PIC, or FEB (depending on the router).

For more information about configuring port mirroring on all routers, see the *JUNOS Policy Framework Configuration Guide*. For more information on configuring port mirroring for Layer 2 VPLS traffic on MX Series routers, see the *JUNOS MX Series Layer 2 Configuration Guide*.

- Related Topics**
- Configuring Port-Mirroring Instances on MX Series Ethernet Services Routers on page 687
 - Configuring Port-Mirroring Instances on M320 Routers on page 688
 - Configuring Port-Mirroring Instances on M120 Routers on page 689

Configuring Port-Mirroring Instances on MX Series Ethernet Services Routers

You can configure port-mirroring instances both at the DPC level and at the PIC level on MX Series routers, as described in the following topics:

- Configuring Port-Mirroring Instances at the DPC Level on page 687
- Configuring Port-Mirroring Instances at the PIC Level on page 687

Configuring Port-Mirroring Instances at the DPC Level

A port-mirroring instance configured at the FPC level for the DPC is bound to all the Packet Forwarding Engines on the DPC.

To associate a port-mirroring instance with a specific DPC and its Packet Forwarding Engines, include the `port-mirror-instance port-mirroring-instance-name` statement at the `[edit chassis fpc slot-number]` hierarchy level:

```
[edit chassis]
fpc slot-number {
  port-mirror-instance port-mirroring-instance-name;
}
```

The properties of the port-mirroring instance associated with the DPC override any global port-mirroring properties (configured by including the `port-mirroring` statement at the `[edit forwarding-options]` hierarchy level).

Configuring Port-Mirroring Instances at the PIC Level

For MX Series routers, there is a one-to-one mapping of Packet Forwarding Engines and PICs. Therefore, a port-mirroring instance configured at the PIC level is bound to its Packet Forwarding Engines and ports.

To associate a port-mirroring instance with a specific Packet Forwarding Engine, include the `port-mirror-instance` *port-mirroring-instance-name* statement at the `[edit chassis fpc slot-number pic slot-number]` hierarchy level:

```
[edit chassis]
fpc slot-number {
  port-mirror-instance port-mirroring-instance-name-a;
  pic slot-number {
    port-mirror-instance port-mirroring-instance-name-b;
  }
}
```

The properties of the port-mirroring instance associated with the PIC override the properties of the port-mirroring instance associated with the DPC (configured by including the `port-mirroring` *port-mirroring-instance-name* statement at the `[edit chassis fpc slot-number]` hierarchy level).

For more information about configuring port mirroring for Layer 2 VPLS traffic on MX Series routers, see the *JUNOS MX Series Layer 2 Configuration Guide*.

Configuring Port-Mirroring Instances on M320 Routers

You can associate only one port-mirroring instance with a specific FPC on an M320 router.

To associate a port-mirroring instance with a specific FPC, include the `port-mirror-instance` *port-mirroring-instance-name* statement at the `[edit chassis fpc slot-number]` hierarchy level:

```
[edit chassis]
fpc slot-number {
  port-mirror-instance port-mirroring-instance-name;
}
```

The properties of the port-mirroring instance associated with an FPC override any global port-mirroring properties (configured by including the `port-mirroring` statement at the `[edit forwarding-options]` hierarchy level.)



NOTE:

- Layer 2 VPLS port mirroring is supported only for Enhanced III FPCs on M320 routers.
 - Ensure that the *port-mirroring-instance-name* specified at the `[edit chassis fpc slot-number]` hierarchy level matches the *port-mirroring-instance-name* configured at the `[edit forwarding-options port-mirroring instance port-mirroring-instance-name]` hierarchy level.
-

Related Topics ■ Port-Mirroring Instances Overview on page 686

Configuring Port-Mirroring Instances on M120 Routers

You can associate only one port-mirroring instance with a specific FEB on an M120 router.

To associate a port-mirroring instance with a FEB, include the `port-mirror-instance port-mirroring-instance-name` statement at the `[edit chassis feb slot-number]` hierarchy level:

```
[edit chassis]
feb slot-number {
  port-mirror-instance port-mirroring-instance-name;
}
```

The properties of the port-mirroring instance associated with the FEB override any global port-mirroring properties (configured by including the `port-mirroring` statement at the `[edit forwarding-options]` hierarchy level.)



NOTE: In a FEB redundancy group, you must associate a port-mirroring instance only with the primary FEB. During failover or switchover, the port-mirroring instance is automatically associated with the backup FEB that fails over or switches over as the primary FEB.

For information about configuring FPC-to-FEB connectivity on an M120 router, see “Configuring the JUNOS Software to Support FPC to FEB Connectivity on M120 Routers” on page 747.

Related Topics ■ Port-Mirroring Instances Overview on page 686

Configuring PIC-Level Symmetrical Hashing for Load Balancing on 802.3ad LAGs for MX Series Routers

Symmetrical hashing for load balancing on an 802.3ad Link Aggregation Group (LAG) is useful when two MX Series routers (for example, Router A and Router B) are connected transparently through Deep Packet Inspection (DPI) devices over a LAG bundle. The DPI devices keep track of traffic flows in both the forward and reverse directions.

If symmetrical hashing is configured, the reverse flow of traffic is also directed through the same child link on the LAG and is bound to flow through the same DPI device. This enables proper accounting on the DPI of the traffic in both the forward and reverse flows.

If symmetrical hashing is not configured, a different child link on the LAG might be chosen for the reverse flow of traffic through a different DPI device. This results in incomplete information about the forward and reverse flows of traffic on the DPI device leading to incomplete accounting of the traffic by the DPI device.

Symmetrical hashing is computed based on fields like source address and destination address. You can configure symmetrical hashing both at the chassis level and the PIC level for load balancing based on Layer 2, Layer 3, and Layer 4 packet fields for family inet (IPv4 protocol family) and multiservice (switch or bridge) traffic.

Symmetrical hashing configured at the chassis level is applicable to the entire router, and is inherited by all its PICs and Packet Forwarding Engines. Configuring PIC-level symmetrical hashing provides you more granularity at the Packet Forwarding Engine level.

For the two routers connected through the DPI devices over a LAG bundle, you can configure **symmetric-hash** on one router and **symmetric-hash complement** on the remote-end router or vice-versa.

To configure symmetrical hashing at the chassis level, include the **symmetric-hash** or the **symmetric-hash complement** statements at the [edit forwarding-options hash-key family] hierarchy level. For information about configuring symmetrical hashing at the chassis level and configuring the link index, see the *JUNOS Network Interfaces Configuration Guide* and the *JUNOS VPN Guide*.



NOTE: On MX Series DPCs, configuring symmetrical hashing at the PIC level refers to configuring symmetrical hashing at the Packet Forwarding Engine level.

To configure symmetrical hashing at the PIC level on the inbound traffic interface (where traffic enters the router), include the **symmetric-hash** or **symmetric-hash complement** statement at the [edit chassis fpc slot-number pic pic-number hash-key] hierarchy level:

```
[edit chassis fpc slot-number pic pic-number hash-key]
family multiservice {
  source-mac;
  destination-mac;
  payload {
    ip {
      layer-3 (source-ip-only | destination-ip-only);
      layer-4;
    }
  }
  symmetric-hash {
    complement;
  }
}

family inet {
  layer-3;
  layer-4;
  symmetric-hash {
    complement;
  }
}
```

**NOTE:**

- PIC-level symmetrical hashing overrides the chassis-level symmetrical hashing configured at the [edit chassis forwarding-options hash-key] hierarchy level.
- Symmetrical hashing for load balancing on 802.3ad Link Aggregation Groups is currently supported for the VPLS, INET and bridged traffic only.
- Any change in the hash-key configuration requires rebooting the FPC for the changes to take effect.
- Hash key configuration on a PIC or Packet Forwarding Engine can be either in the “symmetric hash” or the “symmetric hash complement” mode, but not both at the same time.

Related Topics

- Examples: Configuring PIC-Level Symmetrical Hashing for Load Balancing on 802.3ad LAGs on MX Series Routers on page 691
- family
- hash-key
- inet
- multiservice
- payload
- symmetric-hash

Examples: Configuring PIC-Level Symmetrical Hashing for Load Balancing on 802.3ad LAGs on MX Series Routers

The following examples show how to configure symmetrical hashing at the PIC level for load balancing on MX Series routers:

- Configuring Symmetrical Hashing for family multiservice on Both Routers on page 691
- Configuring Symmetrical Hashing for family inet on Both Routers on page 692
- Configuring Symmetrical Hashing for family inet and family multiservice on the two Routers on page 693

Configuring Symmetrical Hashing for family multiservice on Both Routers

On the inbound traffic interface where traffic enters Router A, include the symmetric-hash statement at the [edit chassis fpc slot-number pic pic-number hash-key family multiservice] hierarchy level:

```
[edit chassis fpc 2 pic 2 hash-key]
family multiservice {
  source-mac;
  destination-mac;
  payload {
```

```

        ip {
            layer-3;
            layer-4;
        }
    }
    symmetric-hash;
}

```

On the inbound traffic interface where traffic enters Router B, include the `symmetric-hash complement` statement at the `[edit chassis fpc slot-number pic pic-number hash-key family multiservice]` hierarchy level:

```

[edit chassis fpc 0 pic 3 hash-key]
family multiservice {
    source-mac;
    destination-mac;
    payload {
        ip {
            layer-3;
            layer-4;
        }
    }
    symmetric-hash {
        complement;
    }
}

```

Configuring Symmetrical Hashing for family inet on Both Routers

On the inbound traffic interface where traffic enters Router A, include the `symmetric-hash` statement at the `[edit chassis fpc slot-number pic pic-number hash-key family inet]` hierarchy level:

```

[edit chassis fpc 0 pic 1 hash-key]
family inet {
    layer-3;
    layer-4;
    symmetric-hash;
}

```

On the inbound traffic interface where traffic enters Router B, include the `symmetric-hash complement` statement at the `[edit chassis fpc slot-number pic pic-number hash-key family inet]` hierarchy level:

```

[edit chassis fpc 1 pic 2 hash-key]
family inet {
    layer-3;
    layer-4;
    symmetric-hash {
        complement;
    }
}

```

Configuring Symmetrical Hashing for family inet and family multiservice on the two Routers

On the inbound traffic interface where traffic enters Router A, include the symmetric-hash statement at the [edit chassis fpc slot-number pic pic-number hash-key family multiservice] hierarchy level:

```
[edit chassis fpc 1 pic 0 hash-key]
family multiservice {
  payload {
    ip {
      layer-3;
      layer-4;
    }
  }
  symmetric-hash;
}
```

On the inbound traffic interface where traffic enters Router B, include the symmetric-hash complement statement at the [edit chassis fpc slot-number pic pic-number hash-key family inet] hierarchy level:

```
[edit chassis fpc 0 pic 3 hash-key]
family inet {
  layer-3;
  layer-4;
  symmetric-hash {
    complement;
  }
}
```

- Related Topics**
- Configuring PIC-Level Symmetrical Hashing for Load Balancing on 802.3ad LAGs for MX Series Routers on page 689

Configuring the JUNOS Software to Determine the Conditions That Trigger Alarms

- Configuring the JUNOS Software to Determine Conditions That Trigger Alarms on Different Interface Types on page 693
- System-Wide Alarms and Alarms for Each Interface Type on page 694
- Chassis Conditions That Trigger Alarms on page 696
- Silencing External Devices Connected to the Alarm Relay Contacts on page 726
- Configuring the JUNOS Software to Disable the Physical Operation of the Craft Interface on page 727

Configuring the JUNOS Software to Determine Conditions That Trigger Alarms on Different Interface Types

For the different types of PICs, you can configure which conditions trigger alarms and whether they trigger a red or yellow alarm. Red alarm conditions light the RED ALARM LED on the router's craft interface and trigger an audible alarm if one is

connected to the contacts on the craft interface. Yellow alarm conditions light the **YELLOW ALARM** LED on the router's craft interface and trigger an audible alarm if one is connected to the craft interface.



NOTE: By default, any failure condition on the integrated-services interface (Adaptive Services PIC) triggers a red alarm.

To configure conditions that trigger alarms and that can occur on any interface of the specified type, include the **alarm** statement at the **[edit chassis]** hierarchy level.

```
[edit chassis]
alarm {
  interface-type {
    alarm-name (red | yellow | ignore);
  }
}
```

alarm-name is the name of an alarm.

System-Wide Alarms and Alarms for Each Interface Type

Table 39 on page 695 lists the system-wide alarms and the alarms for each interface type.

Table 39: Configurable PIC Alarm Conditions

Interface/System	Alarm Condition	Configuration Option
SONET/SDH and ATM	Link alarm indication signal	ais-l
	Path alarm indication signal	ais-p
	Signal degrade (SD)	ber-sd
	Signal fail (SF)	ber-sf
	Loss of cell delineation (ATM only)	locd
	Loss of framing	lof
	Loss of light	lol
	Loss of pointer	lop-p
	Loss of signal	los
	Phase locked loop out of lock	pll
	Synchronous transport signal (STS) payload label (C2) mismatch	plm-p
	Line remote failure indication	rfl-l
	Path remote failure indication	rfl-p
	STS path (C2) unequipped	uneq-p
E3/T3	Alarm indicator signal	ais
	Excessive numbers of zeros	exz
	Failure of the far end	ferf
	Idle alarm	idle
	Line code violation	lcv
	Loss of frame	lof
	Loss of signal	los
	Phase locked loop out of lock	pll
	Yellow alarm	ylw
Ethernet	Link has gone down	link-down
DS1	Alarm indicator signal	ais
	Yellow alarm	ylw

Table 39: Configurable PIC Alarm Conditions (*continued*)

Interface/System	Alarm Condition	Configuration Option
Integrated-services	Hardware or software failure	failure
Management-Ethernet	Link has gone down	link-down

Chassis Conditions That Trigger Alarms

Various conditions related to the chassis components trigger yellow and red alarms. You cannot configure these conditions. Table 40 on page 696 through “Chassis Component Alarm Conditions on M5 and M10 Routers” on page 696 list the alarms that the chassis components can generate. For information about chassis alarms for J Series Services Routers, see the *J Series Services Router Administration Guide*. For information about chassis alarms for the TX Matrix router, see the *TX Matrix Router Hardware Guide*. For information about chassis alarms for the TX Matrix Plus router, see the *TX Matrix Plus Router Hardware Guide*.

Chassis Component Alarm Conditions on M5 and M10 Routers

Table 40 on page 696 lists the alarms that the chassis components can generate on M5 and M10 routers.

Table 40: Chassis Component Alarm Conditions on M5 and M10 Routers

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Alternative media	The router boots from an alternate boot device, the hard disk. The CompactFlash card is typically the primary boot device. The Routing Engine boots from the hard disk when the primary boot device fails.	Open a support case using the Case Manager link at www.juniper.net/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Yellow
	Craft interface	The craft interface has failed.	Replace failed craft interface.
Fan trays	One fan tray has been removed from the chassis.	Install missing fan tray.	Yellow
	Two or more fan trays have been removed from the chassis.	Install missing fan trays.	Red
	One fan in the chassis is not spinning or is spinning below required speed.	Replace failed fan tray.	Red

Table 40: Chassis Component Alarm Conditions on M5 and M10 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Forwarding Engine Board (FEB)	The control board has failed. If this occurs, the board attempts to reboot.	Replace failed FEB.	Red
Flexible PIC Concentrator (FPC)	An FPC has failed. If this occurs, the FPC attempts to reboot. If the FEB sees that an FPC is rebooting too often, it shuts down the FPC.	Replace failed FPC.	Red
Hot swapping	Too many hot-swap interrupts are occurring. This message generally indicates that a hardware component that plugs into the router's backplane from the front (generally, an FPC) is broken.	Replace failed component.	Red
Routing Engine	Error in reading or writing CompactFlash card.	Reformat CompactFlash card and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	System booted from hard disk.	Install bootable image on CompactFlash card. If this fails, replace failed Routing Engine.	Yellow
	CompactFlash card missing in boot list.	Replace failed Routing Engine.	Red
	Hard disk missing in boot list.	Replace failed Routing Engine.	Red
Power supplies	A power supply has been removed from the chassis.	Install missing power supply.	Yellow
	A power supply has failed.	Replace failed power supply.	Red

Table 40: Chassis Component Alarm Conditions on M5 and M10 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Temperature	The chassis temperature has exceeded 55 degrees C (131 degrees F), the fans have been turned on to full speed, and one or more fans have failed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and the fans have been turned on to full speed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and a fan has failed. If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The chassis temperature has exceeded 75 degrees C (167 degrees F). If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The temperature sensor has failed.	<p>Open a support case using the Case Manager link at</p> <p>www.juniper.net/</p> <p>or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).</p>	Red

Chassis Component Alarm Conditions on M7i and M10i Routers

Table 41 on page 699 lists the alarms that the chassis components can generate on M7i and M10i routers.

Table 41: Chassis Component Alarm Conditions on M7i and M10i Routers

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Alternative media	The router boots from an alternate boot device, the hard disk. The CompactFlash card is typically the primary boot device. The Routing Engine boots from the hard disk when the primary boot device fails.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Yellow
	For an M7i router, CFEB has failed. If this occurs, the board attempts to reboot.	Replace failed CFEB.	Red
	For an M10i router, both control boards have been removed or have failed.	Replace failed or missing CFEB.	Red
	Too many hard errors in CFEB memory.	Replace failed CFEB.	Red
	Too many soft errors in CFEB memory.	Replace failed CFEB.	Red
Fan trays	A CFEB microcode download has failed.	Replace failed CFEB.	Red
	A fan has failed.	Replace failed fan tray.	Red
	For an M7i router, a fan tray has been removed from the chassis.	Install missing fan tray.	Red
Hot swapping	For an M10i router, both fan trays are absent from the chassis.	Install missing fan tray.	Red
	Too many hot-swap interrupts are occurring. This message generally indicates that a hardware component that plugs into the router's midplane from the front is broken.	Replace failed component.	Red

Table 41: Chassis Component Alarm Conditions on M7i and M10i Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Power supplies	A power supply has been removed.	Insert missing power supply.	Yellow
	A power supply has failed.	Replace failed power supply.	Red
	For an M10i router, only one power supply is operating.	Insert or replace secondary power supply.	Red
Routing Engine	Error in reading or writing hard disk.	Reformat hard disk and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	Error in reading or writing CompactFlash card.	Reformat CompactFlash card and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	System booted from hard disk. This alarm only applies, if you have an optional CompactFlash card.	Install bootable image on CompactFlash card. If this fails, replace failed Routing Engine.	Yellow
	CompactFlash card missing in boot list.	Replace failed Routing Engine.	Red
	Hard disk missing in boot list.	Replace failed Routing Engine.	Red
	Routing Engine failed to boot.	Replace failed Routing Engine.	Red

Table 41: Chassis Component Alarm Conditions on M7i and M10i Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Temperature	The chassis temperature has exceeded 55 degrees C (131 degrees F), the fans have been turned on to full speed, and one or more fans have failed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and the fans have been turned on to full speed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and a fan has failed. If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The chassis temperature has exceeded 75 degrees C (167 degrees F). If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The temperature sensor has failed.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Red

Chassis Component Alarm Conditions on M20 Routers

Table 42 on page 702 lists the alarms that the chassis components can generate on M20 routers.

Table 42: Chassis Component Alarm Conditions on M20 Routers

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Alternative media	The router boots from an alternate boot device, the hard disk. The CompactFlash card is typically the primary boot device. The Routing Engine boots from the hard disk when the primary boot device fails.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Yellow
Craft interface	The craft interface has failed.	Replace failed craft interface.	Red
Fan trays	One fan tray has been removed from the chassis.	Install missing fan tray.	Yellow
	Two or more fan trays have been removed from the chassis.	Install missing fan trays.	Red
	One fan in the chassis is not spinning or is spinning below requires speed.	Replace fan tray.	Red
FPC	An FPC has failed. If this occurs, the FPC attempts to reboot. If the System and Switch Board (SSB) sees that an FPC is rebooting too often, it shuts down the FPC.	Replace failed FPC.	Red
Hot swapping	Too many hot-swap interrupts are occurring. This message generally indicates that a hardware component that plugs in to the router's backplane from the front (generally, an FPC) is broken.	Replace failed component.	Red

Table 42: Chassis Component Alarm Conditions on M20 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Routing Engine	Error in reading or writing hard disk.	Reformat hard disk and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	Error in reading or writing CompactFlash card.	Reformat CompactFlash card and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	System booted from default backup Routing Engine. If you manually switched mastership, ignore this alarm condition.	Install bootable image on default master Routing Engine. If this fails, replace failed Routing Engine.	Yellow
	System booted from hard disk.	Install bootable image on CompactFlash . If this fails, replace failed Routing Engine.	Yellow
	CompactFlash card missing in boot list.	Replace failed Routing Engine.	Red
	Hard disk missing in boot list.	Replace failed Routing Engine.	Red
	Routing Engine failed to boot.	Replace failed Routing Engine.	Red
Power supplies	A power supply has been removed from the chassis.	Insert power supply into empty slot.	Yellow
	A power supply has failed.	Replace failed power supply.	Red
SSB	The control board has failed. If this occurs, the board attempts to reboot.	Replace failed control board.	Red

Table 42: Chassis Component Alarm Conditions on M20 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Temperature	The chassis temperature has exceeded 55 degrees C (131 degrees F), the fans have been turned on to full speed, and one or more fans have failed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and the fans have been turned on to full speed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and a fan has failed. If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The chassis temperature has exceeded 75 degrees C (167 degrees F). If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The temperature sensor has failed.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Red

Chassis Component Alarm Conditions on M40 Routers

Table 43 on page 705 lists the alarms that the chassis components can generate on M40 routers.

Table 43: Chassis Component Alarm Conditions on M40 Routers

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Air filter	Change air filter.	Change air filter.	Yellow
Alternative media	The router boots from an alternate boot device, the hard disk. The CompactFlash card is typically the primary boot device. The Routing Engine boots from the hard disk when the primary boot device fails.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Yellow
Craft interface	The craft interface has failed.	Replace failed craft interface.	Red
Fan trays	One fan tray has been removed from the chassis.	Install missing fan tray.	Yellow
	Two or more fan trays have been removed from the chassis.	Install missing fan trays.	Red
	One fan in the chassis is not spinning or is spinning below required speed.	Replace fan tray.	Red
FPC	An FPC has an out of range or invalid temperature reading.	Replace failed FPC.	Yellow
	An FPC microcode download has failed.	Replace failed FPC.	Red
	An FPC has failed. If this occurs, the FPC attempts to reboot. If the SCB sees that an FPC is rebooting too often, it shuts down the FPC.	Replace failed FPC.	Red
	Too many hard errors in FPC memory.	Replace failed FPC.	Red
	Too many soft errors in FPC memory.	Replace failed FPC.	Red

Table 43: Chassis Component Alarm Conditions on M40 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Hot swapping	Too many hot-swap interrupts are occurring. This message generally indicates that a hardware component that plugs into the router's backplane from the front (generally, an FPC) is broken.	Replace failed component.	Red
Power supplies	A power supply has been removed from the chassis.	Insert power supply into empty slot.	Yellow
	A power supply temperature sensor has failed.	Replace failed power supply or power entry module.	Yellow
	A power supply fan has failed.	Replace failed power supply fan.	Yellow
	A power supply has high temperature.	Replace failed power supply or power entry module.	Red
	A 5-V power supply has failed.	Replace failed power supply or power entry module.	Red
	A 3.3-V power supply has failed.	Replace failed power supply or power entry module.	Red
	A 2.5-V power supply has failed.	Replace failed power supply or power entry module.	Red
	A power supply input has failed.	Check power supply input connection.	Red
	A power supply has failed.	Replace failed power supply or power entry module.	Red

Table 43: Chassis Component Alarm Conditions on M40 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Routing Engine	Error in reading or writing hard disk.	Reformat hard disk and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	Error in reading or writing CompactFlash card.	Reformat CompactFlash and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	System booted from default backup Routing Engine. If you manually switched mastership, ignore this alarm condition.	Install bootable image on default master Routing Engine. If this fails, replace failed Routing Engine.	Yellow
	System booted from hard disk.	Install bootable image on CompactFlash card. If this fails, replace failed Routing Engine.	Yellow
	CompactFlash card missing in boot list.	Replace failed Routing Engine.	Red
	Hard disk missing in boot list.	Replace failed Routing Engine.	Red
	Routing Engine failed to boot.	Replace failed Routing Engine.	Red
SCB	The System Control Board (SCB) has failed. If this occurs, the board attempts to reboot.	Replace failed SCB.	Red

Table 43: Chassis Component Alarm Conditions on M40 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Temperature	The chassis temperature has exceeded 55 degrees C (131 degrees F), the fans have been turned on to full speed, and one or more fans have failed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and the fans have been turned on to full speed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and a fan has failed. If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The chassis temperature has exceeded 75 degrees C (167 degrees F). If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The temperature sensor has failed.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Red

Chassis Component Alarm Conditions on M40e and M160 Routers

Table 44 on page 709 lists the alarms that the chassis components can generate on M40e and M160 routers.

Table 44: Chassis Component Alarm Conditions on M40e and M160 Routers

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Air filter	Change air filter.	Change air filter	Yellow
Alternative media	The router boots from an alternate boot device, the hard disk. The CompactFlash card is typically the primary boot device. The Routing Engine boots from the hard disk when the primary boot device fails.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Yellow
Connector Interface Panel (CIP)	A CIP is missing.	Insert CIP into empty slot.	Red
Craft interface	The craft interface has failed.	Replace failed craft interface.	Red
Fan trays	One fan tray has been removed from the chassis.	Install missing fan tray.	Yellow
	Two or more fan trays have been removed from the chassis.	Install missing fan trays.	Red
	One fan in the chassis is not spinning or spinning below required speed.	Replace fan tray.	Red
FPC	An FPC has an out of range or invalid temperature reading.	Replace failed FPC.	Yellow
	An FPC microcode download has failed.	Replace failed FPC.	Red
	An FPC has failed. If this occurs, the FPC attempts to reboot. If the MCS sees that an FPC is rebooting too often, it shuts down the FPC.	Replace failed FPC.	Red
	Too many hard errors in FPC memory.	Replace failed FPC.	Red
	Too many soft errors in FPC memory.	Replace failed FPC.	Red

Table 44: Chassis Component Alarm Conditions on M40e and M160 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Hot swapping	Too many hot-swap interrupts are occurring. This message generally indicates that a hardware component that plugs into the router's backplane from the front (generally, an FPC) is broken.	Replace failed component.	Red
	An MCS has an out of range or invalid temperature reading.	Replace failed MCS.	Yellow
	MCS0 has been removed.	Reinstall MCS0.	Yellow
	An MCS has failed.	Replace failed MCS.	Red
Packet Forwarding Engine Clock Generator (PCG)	A backup PCG is offline.	Set backup PCG online.	Yellow
	A PCG has an out of range or invalid temperature reading.	Replace failed PCG.	Yellow
	A PCG has been removed.	Insert PCG into empty slot.	Yellow
	A PCG has failed to come online.	Replace failed PCG.	Red

Table 44: Chassis Component Alarm Conditions on M40e and M160 Routers (continued)

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Routing Engine	Error in reading or writing hard disk.	Reformat hard disk and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	Error in reading or writing CompactFlash card.	Reformat CompactFlash and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	System booted from default backup Routing Engine. If you manually switched mastership, ignore this alarm condition.	Install bootable image on default master Routing Engine. If this fails, replace failed Routing Engine.	Yellow
	System booted from hard disk.	Install bootable image on CompactFlash card. If this fails, replace failed Routing Engine.	Yellow
	CompactFlash card missing in boot list.	Replace failed Routing Engine.	Red
	Hard disk missing in boot list.	Replace failed Routing Engine.	Red
	Routing Engine failed to boot.	Replace failed Routing Engine.	Red
Power supplies	A power supply has been removed from the chassis.	Insert power supply into empty slot.	Yellow
	A power supply has failed.	Replace failed power supply.	Red
Switching and Forwarding Module (SFM)	An SFM has an out of range or invalid temperature reading on SPP.	Replace failed SFM.	Yellow
	An SFM has an out of range or invalid temperature reading on SPR.	Replace failed SFM.	Yellow
	An SFM is offline.	Set SFM online.	Yellow
	An SFM has failed.	Replace failed SFM.	Red
	An SFM has been removed from the chassis.	Insert SFM into empty slot.	Red
	All SFMs are offline or missing from the chassis.	Insert SFMs into empty slots or set all SFMs online.	Red

Table 44: Chassis Component Alarm Conditions on M40e and M160 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Temperature	The chassis temperature has exceeded 55 degrees C (131 degrees F), the fans have been turned on to full speed, and one or more fans have failed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and the fans have been turned on to full speed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and a fan has failed. If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The chassis temperature has exceeded 75 degrees C (167 degrees F). If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The temperature sensor has failed.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Red

Chassis Component Alarm Conditions on M120 Routers

Table 45 on page 713 lists the alarms that the chassis components can generate on M120 routers.

Table 45: Chassis Component Alarm Conditions on M120 Routers

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Air filters	Change air filter.	Change air filter.	Yellow
Alternative media	The router boots from an alternate boot device, the hard disk. The CompactFlash card is typically the primary boot device. The Routing Engine boots from the hard disk when the primary boot device fails.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Yellow
Control Board (CB)	A CB Ethernet switch has failed.	Replace failed CB.	Yellow
	A CB has been removed.	Insert CB into empty slot.	Red
	A CB has failed.	Replace failed CB.	Red
Craft interface	The craft interface has failed.	Replace failed craft interface.	Red
Fan trays	One fan tray has been removed from the chassis.	Install missing fan tray.	Yellow
	Two or more fan trays have been removed from the chassis.	Install missing fan trays.	Red
	One fan in the chassis is not spinning or is spinning below required speed.	Replace fan tray.	Red
Forwarding Engine Boards (FEBs)	A spare FEB has failed.	Replace failed FEB.	Yellow
	A spare FEB has been removed.	Insert FEB into empty slot.	Yellow
	A FEB is offline.	Check FEB. Remove and reinsert the FEB. If this fails, replace failed FEB.	Yellow
	A FEB has failed.	Replace failed FEB.	Red
	A FEB has been removed.	Insert FEB into empty slot.	Red

Table 45: Chassis Component Alarm Conditions on M120 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Host subsystem	A host subsystem has failed.	Replace the host subsystem.	Yellow
	A host subsystem has been removed.	Insert host subsystem into empty slot.	Red
Hot swapping	Too many hot-swap interrupts are occurring. This message generally indicates that a hardware component that plugs into the router's backplane from the front (generally, an FPC) is broken.	Replace failed component.	Red
Power supplies	A power supply has been removed from the chassis.	Insert power supply into empty slot.	Yellow
	A power supply has a high temperature.	Replace failed power supply or power entry module.	Red
	A power supply input has failed.	Check power supply input connection.	Red
	A power supply output has failed.	Check power supply output connection.	Red
	A power supply has failed.	Replace failed power supply.	Red

Table 45: Chassis Component Alarm Conditions on M120 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Routing Engine	Error in reading or writing hard disk.	Reformat hard disk and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	Error in reading or writing CompactFlash card.	Reformat CompactFlash and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	System booted from default backup Routing Engine. If you manually switched mastership, ignore this alarm condition.	Install bootable image on default master Routing Engine. If this fails, replace failed Routing Engine.	Yellow
	System booted from hard disk.	Install bootable image on CompactFlash card. If this fails, replace failed Routing Engine.	Yellow
	CompactFlash card missing in boot list.	Replace failed Routing Engine.	Red
	Hard disk missing in boot list.	Replace failed Routing Engine.	Red
	Routing Engine failed to boot.	Replace failed Routing Engine.	Red

Table 45: Chassis Component Alarm Conditions on M120 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Temperature	The chassis temperature has exceeded 55 degrees C (131 degrees F), the fans have been turned on to full speed, and one or more fans have failed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and the fans have been turned on to full speed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and a fan has failed. If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	Chassis temperature has exceeded 75 degrees C (167 degrees F). If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The temperature sensor has failed.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Red

Chassis Component Alarm Conditions on M320 Routers

Table 46 on page 717 lists the alarms that the chassis components can generate on M320 routers.

Table 46: Chassis Component Alarm Conditions on M320 Routers

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Air filters	Change air filter.	Change air filter.	Yellow
Alternative media	The router boots from an alternate boot device, the hard disk. The CompactFlash card is typically the primary boot device. The Routing Engine boots from the hard disk when the primary boot device fails.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Yellow
Control Board (CB)	A CB has been removed.	Insert CB into empty slot.	Yellow
	A CB temperature sensor alarm has failed.	Replace failed CB.	Yellow
	A CB has failed.	Replace failed CB.	Red
CIP	A CIP is missing.	Insert CIP into empty slot.	Red
Craft interface	The craft interface has failed.	Replace failed craft interface.	Red
Fan trays	One fan tray has been removed from the chassis.	Install missing fan tray.	Yellow
	Two or more fan trays have been removed from the chassis.	Install missing fan trays.	Red
	One fan in the chassis is not spinning or is spinning below required speed.	Replace fan tray.	Red

Table 46: Chassis Component Alarm Conditions on M320 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
FPC	An FPC has an out of range or invalid temperature reading.	Replace failed FPC.	Yellow
	An FPC microcode download has failed.	Replace failed FPC.	Red
	An FPC has failed. If this occurs, the FPC attempts to reboot. If the CB sees that an FPC is rebooting too often, it shuts down the FPC.	Replace failed FPC.	Red
	Too many hard errors in FPC memory.	Replace failed FPC.	Red
	Too many soft errors in FPC memory.	Replace failed FPC.	Red
Hot swapping	Too many hot-swap interrupts are occurring. This message generally indicates that a hardware component that plugs into the router's backplane from the front (generally, an FPC) is broken.	Replace failed component.	Red
Power supplies	A power supply has been removed from the chassis.	Insert power supply into empty slot.	Yellow
	A power supply has failed.	Replace failed power supply.	Red

Table 46: Chassis Component Alarm Conditions on M320 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Routing Engine	Error in reading or writing hard disk.	Reformat hard disk and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	Error in reading or writing CompactFlash card.	Reformat CompactFlash and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	System booted from default backup Routing Engine. If you manually switched mastership, ignore this alarm condition.	Install bootable image on default master Routing Engine. If this fails, replace failed Routing Engine.	Yellow
	System booted from hard disk.	Install bootable image on CompactFlash card. If this fails, replace failed Routing Engine.	Yellow
	CompactFlash card missing in boot list.	Replace failed Routing Engine.	Red
	Hard disk missing in boot list.	Replace failed Routing Engine.	Red
	Routing Engine failed to boot.	Replace failed Routing Engine.	Red
Switch Interface Board (SIB)	A spare SIB is missing.	Insert spare SIB in to empty slot.	Yellow
	A SIB has failed.	Replace failed SIB.	Yellow
	A spare SIB has failed.	Replace failed SIB.	Yellow
	A SIB has an out of range or invalid temperature reading.	Replace failed SIB.	Yellow
	A SIB is missing.	Insert SIB into empty slot.	Red
	A SIB has failed.	Replace failed SIB.	Red

Table 46: Chassis Component Alarm Conditions on M320 Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Temperature	The chassis temperature has exceeded 55 degrees C (131 degrees F), the fans have been turned on to full speed, and one or more fans have failed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and the fans have been turned on to full speed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and a fan has failed. If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	Chassis temperature has exceeded 75 degrees C (167 degrees F). If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The temperature sensor has failed.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Red

Chassis Component Alarm Conditions on MX Series Ethernet Services Routers

Table 47 on page 721 lists the alarms that the chassis components can generate on MX Series Ethernet Services routers.

Table 47: Chassis Component Alarm Conditions on MX Series Ethernet Services Routers

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Air filters	Change air filter.	Change air filter.	Yellow
Alternative media	The router boots from an alternate boot device, the hard disk. The CompactFlash card is typically the primary boot device. The Routing Engine boots from the hard disk when the primary boot device fails.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Yellow
Craft interface	The craft interface has failed.	Replace failed craft interface.	Red
Dense Port Concentrators (DPC)s	A DPC is offline.	Check DPC. Remove and reinsert the DPC. If this fails, replace failed DPC.	Yellow
	A DPC has failed.	Replace failed DPC.	Red
	A DPC has been removed.	Insert DPC into empty slot.	Red
Fan trays	A fan tray has been removed from the chassis.	Install missing fan tray.	Red
	One fan in the chassis is not spinning or is spinning below required speed.	Replace fan tray.	Red
Host subsystem	A host subsystem has been removed.	Insert host subsystem into empty slot.	Yellow
	A host subsystem has failed.	Replace failed host subsystem.	Red
Hot swapping	Too many hot-swap interrupts are occurring. This message generally indicates that a hardware component that plugs into the router's backplane from the front (generally, an FPC) is broken.	Replace failed component.	Red

Table 47: Chassis Component Alarm Conditions on MX Series Ethernet Services Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Power supplies	A power supply has been removed from the chassis.	Insert power supply into empty slot.	Yellow
	A power supply has a high temperature.	Replace failed power supply or power entry module.	Red
	A power supply input has failed.	Check power supply input connection.	Red
	A power supply output has failed.	Check power supply output connection.	Red
	A power supply has failed.	Replace failed power supply.	Red
	Invalid AC power supply configuration.	When two AC power supplies are installed, insert one power supply into an odd-numbered slot and the other power supply into an even-numbered slot.	Red
	Invalid DC power supply configuration.	When two DC power supplies are installed, insert one power supply into an odd-numbered slot and the other power supply into an even-numbered slot.	Red
	Mix of AC and DC power supplies.	Do not mix AC and DC power supplies. For DC power, remove the AC power supply. For AC power, remove the DC power supply.	Red
	Not enough power supplies.	Install an additional power supply.	Red

Table 47: Chassis Component Alarm Conditions on MX Series Ethernet Services Routers (continued)

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Routing Engine	Error in reading or writing hard disk.	Reformat hard disk and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	Error in reading or writing CompactFlash card.	Reformat CompactFlash and install bootable image. If this fails, replace failed Routing Engine.	Yellow
	System booted from default backup Routing Engine. If you manually switched mastership, ignore this alarm condition.	Install bootable image on default master Routing Engine. If this fails, replace failed Routing Engine.	Yellow
	System booted from hard disk.	Install bootable image on CompactFlash card. If this fails, replace failed Routing Engine.	Yellow
	CompactFlash card missing in boot list.	Replace failed Routing Engine.	Red
	Hard disk missing in boot list.	Replace failed Routing Engine.	Red
	Routing Engine failed to boot.	Replace failed Routing Engine.	Red
System Control Board (SCB)	An SCB has been removed.	Insert SCB into empty slot.	Yellow
	An SCB temperature sensor alarm has failed.	Replace failed SCB.	Yellow
	An SCB has failed.	Replace failed SCB.	Red

Table 47: Chassis Component Alarm Conditions on MX Series Ethernet Services Routers *(continued)*

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Temperature	The chassis temperature has exceeded 55 degrees C (131 degrees F), the fans have been turned on to full speed, and one or more fans have failed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and the fans have been turned on to full speed.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Yellow
	The chassis temperature has exceeded 65 degrees C (149 degrees F), and a fan has failed. If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	Chassis temperature has exceeded 75 degrees C (167 degrees F). If this condition persists for more than 4 minutes, the router shuts down.	<ul style="list-style-type: none"> ■ Check room temperature. ■ Check air filter and replace it. ■ Check airflow. ■ Check fan. 	Red
	The temperature sensor has failed.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Red

Chassis Component Alarm Conditions on TX Matrix and TX Matrix Plus Routers

For information about chassis component alarms on the TX Matrix and TX Matrix Plus routers, see the *TX Matrix Router Hardware Guide* and the *TX Matrix Plus Router Hardware Guide*, respectively.

Backup Routing Engine Alarms

For routers with master and backup Routing Engines, a master Routing Engine can generate alarms for events that occur on a backup Routing Engine. Table 48 on page 725 lists chassis alarms generated for a backup Routing Engine.



NOTE: Because the failure occurs on the backup Routing Engine, alarm severity for some events (such as Ethernet interface failures) is yellow instead of red.



NOTE: For information about configuring redundant Routing Engines, see the *JUNOS High Availability Configuration Guide*.

Table 48: Backup Routing Engine Alarms

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Alternative media	The backup Routing Engine boots from an alternate boot device, the hard disk. The CompactFlash card is typically the primary boot device. The Routing Engine boots from the hard disk when the primary boot device fails.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Yellow
Boot Device	The boot device (CompactFlash or hard disk) is missing in boot list on the backup Routing Engine.	Replace failed backup Routing Engine.	Red

Table 48: Backup Routing Engine Alarms (continued)

Chassis Component	Alarm Condition	Remedy	Alarm Severity
Ethernet	The Ethernet management interface (fxp0) on the backup Routing Engine is down.	<ul style="list-style-type: none"> ■ Check the interface cable connection. ■ Reboot the system. ■ If the alarm recurs, open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States) 	Yellow
FRU Offline	The backup Routing Engine has stopped communicating with the master Routing Engine.	Open a support case using the Case Manager link at http://www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).	Yellow
Hard Disk	Error in reading or writing hard disk on the backup Routing Engine.	Reformat hard disk and install bootable image. If this fails, replace failed backup Routing Engine.	Yellow
Multibit Memory ECC	The backup Routing Engine reports a multibit ECC error.	<ul style="list-style-type: none"> ■ Reboot the system with the board reset button on the backup Routing Engine. ■ If the alarm recurs, open a support case using the Case Manager link at www.juniper.net/support/ or call 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States) 	Yellow

Silencing External Devices Connected to the Alarm Relay Contacts

You can manually silence external devices connected to the alarm relay contacts. To silence the external devices, press the alarm cutoff button located on the craft interface front panel.

Silencing the device does not remove the alarm messages from the display (if present on the router) or extinguish the alarm LEDs. In addition, new alarms that occur after an external device is silenced reactivate the external device.

Configuring the JUNOS Software to Disable the Physical Operation of the Craft Interface

You can disable the physical operation of the craft interface front panel on the router. When you disable the operation of the craft interface, the buttons on the front panel, such as the alarm cutoff button, no longer function. To disable the craft interface operation, include the `craft-lockout` statement at the `[edit chassis]` hierarchy level:

```
[edit chassis]
craft-lockout;
```

Configuring the JUNOS Software to Enable Service Packages on Adaptive Services Interfaces

For Adaptive Services (AS) PICs, MultiServices PICs, and the internal Adaptive Services Module (ASM) in the M7i platform, there are two service packages: Layer 2 and Layer 3. Both service packages are supported on all adaptive services interfaces, but you can enable only one service package per PIC, with the exception of the combined package supported on the ASM. On a single router, you can enable both service packages by installing two or more PICs on the platform.

You enable service packages per PIC, not per port. For example, if you configure the Layer 2 service package, the entire PIC uses the configured package. To enable a service package, include the `service-package` statement at the `[edit chassis fpc slot-number pic pic-number adaptive-services]` hierarchy level, and specify `layer-2` or `layer-3`:

```
[edit chassis fpc slot-number pic pic-number adaptive-services]
service-package (layer-2 | layer-3);
```

To determine which package an AS PIC supports, issue the `show chassis hardware` command: if the PIC supports the Layer 2 package, it is listed as **Link Services II**, and if it supports the Layer 3 package, it is listed as **Adaptive Services II**. To determine which package a MultiServices PIC supports, issue the `show chassis pic fpc-slot slot-number pic-slot slot-number` command. The **Package** field displays the value `Layer-2` or `Layer-3`.



NOTE: The ASM has a default option that combines the features available in the Layer 2 and Layer 3 service packages.

After you commit a change in the service package, the PIC is taken offline and then brought back online immediately. You do not need to manually take the PIC offline and online.



NOTE: Changing the service package causes all state information associated with the previous service package to be lost. You should change the service package only when there is no active traffic going to the PIC.

The services supported in each package differ by PIC and platform type.

- Related Topics** ■ Configuring the JUNOS Software to Support Layer 2 Services on MX Series Ethernet Services Routers with MS-DPCs on page 728

Configuring the JUNOS Software to Support Layer 2 Services on MX Series Ethernet Services Routers with MS-DPCs

The JUNOS Software supports Layer 2 link services on MX Series Ethernet Services routers with MS-DPCs and MX-FPCs with non-Ethernet IQE PICs that bundle PPP links from the Type 2 channelized SONET PICs. To enable the Layer 2 service packages such as LSQ interfaces, include the `service-package layer-2` statement at the [edit chassis fpc slot-number pic pic-number adaptive-services] hierarchy level:

```
[edit chassis fpc slot-number pic pic-number adaptive-services]
service-package (layer-2 | layer-3);
```

Configuring the supported link services such as Multilink PPP (MLPPP), Compressed Real-Time Transport Protocol (CRTP), real-time performance monitoring (RPM) is identical to configuring these link services for a Multiservices PIC. For more information about Layer 2 link services, see the *JUNOS Services Interfaces Configuration Guide*.

- Related Topics** ■ Configuring the JUNOS Software to Enable Service Packages on Adaptive Services Interfaces on page 727

Configuring the JUNOS Software to Enable SONET/SDH Framing for SONET/SDH PICs

In JUNOS Release 8.4 and later, the family of next-generation SONET Phase I PICs includes Type 2 and Type 1 PICs. Each PIC type has three varieties.

Type 1 PICs include:

- 4-port OC3
- 2-port OC3
- 1-port OC12

Type 2 PICs include:

- 1-port OC48
- 4-port OC12
- 4-port OC3

The support both type 1 and type 2 FPC interfaces. Hot-pluggable SFPs are used as optical transponders. The PICs provide unprecedented flexibility by allowing the user to configure a variety of modes on them through the configuration of concatenation/nonconcatenation and speed.

The 4-port OC48 PIC with SFP installed, the next-generation SONET/SDH PICs with SFP, and the 4-port OC192 PIC on M Series and T Series routers, support SONET or SDH framing on a per-port basis. This functionality allows you to mix SONET and SDH modes on interfaces on a single PIC.

For information about configuring SONET/SDH framing, see “Configuring the JUNOS Software to Enable SONET/SDH Framing for SONET/SDH PICs” on page 729.

For information about configuring port speed for concatenate mode on a next-generation PIC, see the *JUNOS Hardware Network Operations Guide*.

By default, SONET/SDH PICs use SONET framing. For a discussion of the differences between the two standards, see the *JUNOS Network Interfaces Configuration Guide*.

To configure a PIC to use SDH framing, include the **framing** statement at the [edit chassis fpc slot-number pic pic-number] hierarchy level, specifying the **sdh** option:

```
[edit chassis]
user@host# set fpc slot-number pic pic-number framing sdh
[edit chassis]
user@host# show
fpc slot-number {
  pic pic-number {
```

```

        framing sdh;
    }
}

```

On a TX Matrix or TX Matrix Plus router, include the **framing** statement at the [edit chassis lcc *number* fpc *slot-number* pic *pic-number*] hierarchy level, specifying the **sdh** option:

```

[edit chassis lcc number]
user@host# set fpc slot-number pic pic-number framing sdh
[edit chassis lcc number]
user@host# show
fpc slot-number {
    pic pic-number {
        framing sdh;
    }
}

```

To explicitly configure a PIC to use SONET framing, include the **framing** statement at the [edit chassis fpc *slot-number* pic *pic-number*] hierarchy level, specifying the **sonet** option:

```

[edit chassis]
user@host# set fpc slot-number pic pic-number framing sonet
[edit chassis]
user@host# show
fpc slot-number {
    pic pic-number {
        framing sonet;
    }
}

```

On a TX Matrix or TX Matrix Plus router, include the **framing** statement at the [edit chassis lcc *number* fpc *slot-number* pic *pic-number*] hierarchy level, specifying the **sonet** option:

```

user@host# set fpc slot-number pic pic-number framing sonet
[edit chassis lcc number]
user@host# show
fpc slot-number {
    pic pic-number {
        framing sonet;
    }
}

```

For information about configuring a TX Matrix router, see “TX Matrix Router and T640 Router Configuration Overview” on page 756. For information about configuring a TX Matrix Plus router, see “TX Matrix Plus Router and T1600 Router Configuration Overview” on page 764

Configuring the JUNOS Software to Support an External Clock Synchronization Interface for the M320, M40e, and M120 Routers

The M320, M40e, and M120 routers support an external synchronization interface that can be configured to synchronize the internal Stratum 3 clock to an external source, and then synchronize the chassis interface clock to that source.

This feature can be configured for external primary and secondary interfaces that use Building Integrated Timing System (BITS), SDH Equipment Timing Source (SETS) timing sources, or an equivalent quality timing source. When internal timing is set for SONET/SDH, Plesiochronous Digital Hierarchy (PDH), or digital hierarchy (DS-1) interfaces on the Physical Interface Cards (PICs), the transmit clock of the interface is synchronized to BITS/SETS timing and is traceable to timing within the network.

To configure external synchronization on the M320, M40e, or M120 router, include the `synchronization` statement at the `[edit chassis]` hierarchy level:

```
[edit chassis]
synchronization {
  signal-type (t1 | e1);
  switching-mode (revertive | non-revertive);
  y-cable-line-termination;
  transmitter-enable;
  validation-interval seconds;
  primary (external-a | external-b);
  secondary (external-a | external-b);
}
```

Use the `synchronization` statement options to specify a primary and secondary timing source. To do this, configure the following options:

- For the M320 router, specify a signal type mode for interfaces, either `t1` or `e1`. For the M40e router, only the `t1` signal type mode is supported. The default setting is `t1`.
- Specify the switching mode as `revertive` if a lower-priority synchronization can be switched to a valid, higher-priority synchronization.
- For the M320 router, specify that a single signal should be wired to both Control Boards (CBs) using a Y-cable. For the M40e router, the signal is wired to the CIP and Y-cable functionality is embedded in this system.

The `y-cable-line-termination` option is not available on the M40e and M120 routers.

- Control whether the diagnostic timing signal is transmitted.

The `transmitter-enable` option is not available on the M120 routers.

- Set a validation interval. The `validation-interval` option validates the synchronized deviation of the synchronization source. If revertive switching is enabled and a higher-priority clock is validated, the clock module is directed to the higher-priority clock, and all configured and active synchronizations are validated. The validation timer resumes after the current validation interval expires. The validation interval can be a value from 90 through 86400 seconds. The default value is 90 seconds.

For the M120 router, the range for the **validation-interval** option is 30 through 86400 and the default value is 30.

- Specify the primary external timing source using the **primary** (**external-a** | **external-b**) statement.
- Specify the secondary external timing source using the **secondary** (**external-a** | **external-b**) statement.

Configuring the JUNOS Software to Support the Sparse DLCI Mode on Channelized STM1 or Channelized DS3 PICs

By default, original channelized DS3 and original channelized STM1-to-E1 (or T1) interfaces can support a maximum of 64 data-link connection identifiers (DLCIs) per channel—as many as 1792 DLCIs per DS3 interface or 4032 DLCIs per STM1 interface (0 through 63).

In sparse DLCI mode, the full DLCI range (1 through 1022) is supported. This allows you to use circuit cross-connect (CCC) and translation cross-connect (TCC) features by means of Frame Relay on T1 and E1 interfaces.



NOTE: Sparse DLCI mode requires a Channelized STM1 or Channelized DS3 PIC.

DLCI 0 is reserved for Local Management Interface (LMI) signaling.

Channelized T3 (CT3) intelligent queuing (IQ) and STM1 IQ interfaces support a maximum of 64 DLCIs, numbered 0 through 1022, and therefore do not require sparse mode.

The CT3 PIC must use field-programmable gate array (FPGA) hardware revision 17 to run sparse DLCI mode.

To configure the router to use sparse DLCI mode, include the **sparse-dlcis** statement at the [edit chassis fpc slot-number pic pic-number] hierarchy level:

```
[edit chassis fpc slot-number pic pic-number ]
sparse-dlcis;
```

Configuring the JUNOS Software to Enable a SONET PIC to Operate in the Channelized (Multiplexed) Mode

By default, SONET PICs (interfaces with names **so-fpc/pic/port**) operate in concatenated mode, a mode in which the bandwidth of the interface is in a single channel.

To configure a PIC to operate in channelized (multiplexed) mode, include the **no-concatenate** statement at the [edit chassis fpc slot-number pic pic-number] hierarchy level:

```
[edit chassis]
```

```

user@host# set fpc slot-number pic pic-number no-concatenate
[edit chassis]
user@host# show
fpc slot-number {
  pic pic-number {
    no-concatenate;
  }
}

```

On a TX Matrix or TX Matrix Plus router, include the **no-concatenate** statement at the [edit chassis lcc number fpc slot-number pic pic-number] hierarchy level:

```

[edit chassis lcc number]
user@host# set fpc slot-number pic pic-number no-concatenate
[edit chassis lcc number]
user@host# show
fpc slot-number {
  pic pic-number {
    no-concatenate;
  }
}

```

When configuring and displaying information about interfaces that are operating in channelized mode, you must specify the channel number in the interface name (*physical:channel*); for example, **so-2/2/0:0** and **so-2/2/0:1**.



NOTE: On SONET OC48 interfaces that are configured for channelized (multiplexed) mode, the bytes **e1-quiet** and bytes **f1** options in the **sonet-options** statement have no effect. The bytes **f2**, bytes **z3**, bytes **z4**, and **path-trace** options work correctly on channel 0. These bytes work in the transmit direction only on channels 1, 2, and 3.

The M160 four-port SONET/SDH OC12 PIC can run each of the OC12 links in concatenated mode only and requires a Type 2 M160 FPC. Similarly, the four-port SONET/SDH OC3 PIC cannot run in nonconcatenated mode on any platform.

Configuring Channelized DS3-to-DS0 Naming

- Configuring the JUNOS Software to Support Channelized DS3-to-DS0 Naming for Channel Groups and Time Slots on page 733
- Ranges for Channelized DS3-to-DS0 Configuration on page 735

Configuring the JUNOS Software to Support Channelized DS3-to-DS0 Naming for Channel Groups and Time Slots

You can configure 28 T1 channels per T3 interface. Each T1 link can have up to eight channel groups, and each channel group can hold any combination of DS0 time slots. To specify the T1 link and DS0 channel group number in the name, use colons (:) as separators. For example, a Channelized DS3-to-DS0 PIC might have the following physical and virtual interfaces:

`ds-0/0/0:x:y`

where *x* is a T1 link ranging from 0 through 27 and *y* is a DS0 channel group ranging from 0 through 7. (See Table 49 on page 735 for more information about ranges.)

You can use any of the values within the range available for *x* and *y*; you do not have to configure the links sequentially. The software applies the interface options you configure according to the following rules:

- You can configure **t3-options** for **t1** link 0 and channel group 0 only; for example, `ds-0/0/0:0:0`.
- You can configure **t1-options** for any **t1** link value, but only for channel group 0; for example, `ds-0/0/0:x:0`.
- There are no restrictions on changing the default **ds0-options**.
- If you delete a configuration you previously committed for channel group 0, the options return to the default values.

To configure the channel groups and time slots for a channelized DS3 interface, include the **channel-group** and **timeslots** statements at the `[edit chassis fpc slot-number pic pic-number ct3 port port-number t1 link-number]` hierarchy level:

```
[edit chassis fpc slot-number pic pic-number ct3 port port-number t1 link-number]
channel-group group-number timeslots slot-number;
```



NOTE: If you commit the interface name but do not include the `[edit chassis]` configuration, the Channelized DS3-to-DS0 PIC behaves like a Channelized DS3-to-DS1 PIC: none of the DS0 functionality is accessible.



NOTE: The FPC slot range depends on the platform. The maximum range of 0 through 7 applies to M40 routers; for M20 routers, the range is 0 through 3; for M10 routers the range is 0 through 1; for M5 routers, the only applicable value is 0. The Multichannel DS3 (Channelized DS3-to-DS0) PIC is not supported on M160 routers.

Bandwidth limitations restrict the interface to a maximum of 128 channel groups per T3 port, rather than the theoretical maximum of $8 \times 28 = 224$.

There are 24 time slots on a T1 interface. You can designate any combination of time slots for usage, but you can use each time slot number on only one channel group within the same T1 link.

To use time slots 1 through 10, designate *slot-number* as follows:

```
[edit chassis fpc slot-number pic pic-number ct3 port port-number t1 link-number]
channel-group group-number timeslots 1-10;
```


To use time slots 1 through 5, time slot 10, and time slot 24, designate *slot-number* as follows:

```
[edit chassis fpc slot-number pic pic-number ct3 port port-number t1 link-number]
channel-group group-number timeslots 1-5,10,24;
```

Note that spaces are not allowed when you specify time slot numbers.

Ranges for Channelized DS3-to-DS0 Configuration

Table 49 on page 735 shows the ranges for each of the quantities in the preceding configuration.

Table 49: Ranges for Channelized DS3-to-DS0 Configuration

Item	Variable	Range
FPC slot	<i>slot-number</i>	0 through 7 (see note below)
PIC slot	<i>pic-number</i>	0 through 3
Port	<i>port-number</i>	0 through 1
T1 link	<i>link-number</i>	0 through 27
DS0 channel group	<i>group-number</i>	0 through 7
time slot	<i>slot-number</i>	1 through 24

Configuring the JUNOS Software to Support Eight Queues on IQ Interfaces for T Series and M320 Routers

By default, IQ PICs on T Series and M320 routers are restricted to a maximum of four egress queues per interface. To configure a maximum of eight egress queues on IQ interfaces, include the `max-queues-per-interface` statement at the `[edit chassis fpc slot-number pic pic-number]` hierarchy level:

```
[edit chassis fpc slot-number pic pic-number]
max-queues-per-interface (8 | 4);
```

On a TX Matrix or TX Matrix Plus router, include the `max-queues-per-interface` statement at the `[edit chassis lcc number fpc slot-number pic pic-number]` hierarchy level:

```
[edit chassis lcc number fpc slot-number pic pic-number]
max-queues-per-interface (8 | 4);
```



NOTE: The configuration at the `[edit class-of-service]` hierarchy level must also support eight queues per interface.

The maximum number of queues per IQ PIC can be 4 or 8. If you include the **max-queues-per-interface** statement, all ports on the IQ PIC use configured mode and all interfaces on the IQ PIC have the same maximum number of queues.

If you include the **max-queues-per-interface 4** statement, you can configure all four ports and configure up to four queues per port.

For 4-port OC3c/STM1 Type I and Type II PICs on M320 and T Series routers, when you include the **max-queues-per-interface 8** statement, you can configure up to eight queues on ports 0 and 2. After you commit the configuration, the PIC goes offline and comes back online with only ports 0 and 2 operational. No interfaces can be configured on ports 1 and 3.

For Quad T3 and Quad E3 PICs, when you include the **max-queues-per-interface 8** statement, you can configure up to eight queues on ports 0 and 2. After you commit the configuration, the PIC goes offline and comes back online with only ports 0 and 2 operational. No interfaces can be configured on ports 1 and 3.

When you include the **max-queues-per-interface** statement and commit the configuration, all physical interfaces on the IQ PIC are deleted and readded. Also, the PIC is taken offline and then brought back online immediately. You do not need to take the PIC offline and online manually. You should change modes between four queues and eight queues only when there is no active traffic going to the IQ PIC.

Configuring Channel Groups and Time Slots for a Channelized E1 Interface

- Configuring the JUNOS Software to Support Channel Groups and Time Slots for Channelized E1 PICs on page 736
- Ranges for Channelized E1 Interfaces Configuration on page 738

Configuring the JUNOS Software to Support Channel Groups and Time Slots for Channelized E1 PICs

Each Channelized E1 PIC has 10 E1 ports that you can channelize to the NxDS0 level. Each E1 interface has 32 time slots (DS0), in which time slot 0 is reserved. You can combine one or more of these timeslots (DS-0) to create a channel group (NxDS-0). There can be a maximum of 32 channel groups per E1 interface. Thus, you can configure as many as 320 channel groups per PIC (10 ports x 32 channel groups per port).

To specify the DS0 channel group number in the interface name, include a colon (:) as a separator. For example, a Channelized E1 PIC might have the following physical and virtual interfaces:

```
ds-0/0/0:x
```

where x is a DS0 channel group ranging from 0 through 23. (See Table 50 on page 738 for more information about ranges.)

You can use any of the values within the range available for x; you do not have to configure the links sequentially. The software applies the interface options you configure according to the following rules:

- You can configure the **e1-options** statement for channel group 0 only; for example, **ds-0/0/0:0**.
- There are no restrictions on changing the default **ds0-options**.
- If you delete a configuration you previously committed for channel group 0, the options return to the default values.

To configure the channel groups and time slots for a Channelized E1 interface, include the **channel-group** and **timeslots** statements at the **[edit chassis fpc slot-number pic pic-number ce1 e1 port-number]** hierarchy level:

```
[edit chassis fpc slot-number pic pic-number ce1 e1 port-number]
channel-group group-number timeslots slot-number;
```



NOTE: If you commit the interface name but do not include the **[edit chassis]** configuration, the Channelized E1 PIC behaves like a standard E1 PIC: none of the DS0 functionality is accessible.



NOTE: The FPC slot range depends on the platform. The maximum range of 0 through 7 applies to M40 routers; for M20 routers, the range is 0 through 3; for M10 routers the range is 0 through 1; for M5 routers, the only applicable value is 0. The Channelized E1 PIC is not supported on M160 routers.

The theoretical maximum number of channel groups possible per PIC is $10 \times 24 = 240$. This is within the maximum bandwidth available.

There are 32 time slots on an E1 interface. You can designate any combination of time slots for usage.

To use time slots 1 through 10, designate **slot-number** as follows:

```
[edit chassis fpc slot-number pic pic-number ce1 e1 port-number]
channel-group group-number timeslots 1-10;
```

To use time slots 1 through 5, time slot 10, and time slot 24, designate **slot-number** as follows:

```
[edit chassis fpc slot-number pic pic-number ce1 e1 port-number]
channel-group group-number timeslots 1-5,10,24;
```

Note that spaces are not allowed when you specify time slot numbers.

For further information about these interfaces, see the *JUNOS Network Interfaces Configuration Guide*.

Ranges for Channelized E1 Interfaces Configuration

Table 50 on page 738 shows the ranges for configuring channel groups and time slots for Channelized E1 Interfaces.

Table 50: Ranges for Channelized E1 Configuration

Item	Variable	Range
FPC slot	<i>slot-number</i>	0 through 7 (see note below)
PIC slot	<i>pic-number</i>	0 through 3
E1 port	<i>port-number</i>	0 through 9
DSO channel group	<i>group-number</i>	0 through 23
Time slot	<i>slot-number</i>	1 through 32



NOTE: The FPC slot range depends on the router. For the TX Matrix and TX Matrix Plus routers, the range is from 0 through 31. For M40, M40e, M160, M320, M120, and other T Series routers, the range is from 0 through 7. For M20 routers, the range is from 0 through 3. For M10 and M10i routers, the range is from 0 through 1. For M5 and M7i routers, the only applicable value is 0.

Configuring the JUNOS Software to Support Channelized STM1 Interface Virtual Tributary Mapping

By default, virtual tributary mapping uses KLM mode. You can configure virtual tributary mapping to use KLM or ITU-T mode. On the original Channelized STM1 PIC, to configure virtual tributary mapping, include the `vtmapping` statement at the `[edit chassis fpc slot-number pic pic-number]` hierarchy level:

```
[edit chassis fpc slot-number pic pic-number]
  vtmapping (klm | itu-t);
```

For the Channelized STM1 PIC with IQ, you can configure virtual tributary mapping by including the `vtmapping` statement at the `[edit interfaces cau4 fpc slot-number pic pic-number sonet-options]` hierarchy level.

Configuring the JUNOS Software to Enable ATM2 Intelligent Queuing Layer 2 Circuit Transport Mode

On ATM2 IQ PICs only, you can configure Layer 2 circuit cell relay, Layer 2 circuit ATM Adaptation Layer 5 (AAL5), or Layer 2 circuit trunk mode.

Layer 2 circuit cell relay and Layer 2 circuit AAL5 are defined in the Internet draft `draft-martini-l2circuit-encap-mpls-04.txt`, *Encapsulation Methods for Transport of Layer 2 Frames Over IP and MPLS Networks*.

Layer 2 circuit trunk mode allows you to send ATM cells over Multiprotocol Label Switching (MPLS) trunking.

The four transport modes are defined as follows:

- To tunnel IP packets over an ATM backbone, use the default standard AAL5 transport mode.
- To tunnel a stream of AAL5-encoded ATM segmentation-and-reassembly protocol data units (SAR-PDUs) over an MPLS or IP backbone, use Layer 2 circuit AAL5 transport mode.
- To tunnel a stream of ATM cells over an MPLS or IP backbone, use Layer 2 circuit cell-relay transport mode.
- To transport ATM cells over an MPLS core network that is implemented on some other vendor switches, use Layer 2 circuit trunk mode.



NOTE: You can transport AAL5-encoded traffic with Layer 2 circuit cell-relay transport mode, because Layer 2 circuit cell-relay transport mode ignores the encoding of the cell data presented to the ingress interface.

When you configure AAL5 mode Layer 2 circuits, the control word carries cell loss priority (CLP) information by default.

By default, ATM2 IQ PICs are in standard AAL5 transport mode. Standard AAL5 allows multiple applications to tunnel the protocol data units of their Layer 2 protocols over an ATM virtual circuit. To configure the Layer 2 circuit transport modes, include the `atm-l2circuit-mode` statement at the `[edit chassis fpc slot-number pic pic-number]` hierarchy level:

```
[edit chassis fpc slot-number pic pic-number]
atm-l2circuit-mode (cell | aal5 | trunk trunk);
```

On a TX Matrix or TX Matrix Plus router, include the `atm-l2circuit-mode` statement at the `[edit chassis lcc number fpc slot-number pic pic-number]` hierarchy level:

```
[edit chassis lcc number fpc slot-number pic pic-number]
atm-l2circuit-mode (cell | aal5 | trunk trunk);
```

`aal5` tunnels a stream of AAL5-encoded ATM cells over an IP backbone.

`cell` tunnels a stream of ATM cells over an IP backbone.

`trunk` transports ATM cells over an MPLS core network that is implemented on some other vendor switches. Trunk mode can be user-to-network interface (UNI) or network-to-network interface (NNI).



NOTE: To determine which vendors support Layer 2 circuit trunk mode, contact Juniper Networks customer support.

Configuring the JUNOS Software to Support ILMI for Cell Relay Encapsulation on an ATM2 IQ PIC

Integrated Local Management Interface (ILMI) is supported on AAL5 interfaces, regardless of transport mode. To enable ILMI on interfaces with cell-relay encapsulation, you must configure an ATM2 IQ PIC to use Layer 2 circuit trunk transport mode.

To configure ILMI on an interface with cell-relay encapsulation, include the following statements:

```
[edit chassis fpc slot-number pic pic-number]
atm-l2circuit-mode trunk trunk;
[edit interfaces at-fpc/pic/port]
encapsulation atm-ccc-cell-relay;
atm-options {
    ilmi;
    pic-type atm2;
}
unit logical-unit-number {
    trunk-id number;
}
```

For an example on how to enable ILMI for cell relay, see the *JUNOS Network Interfaces Configuration Guide*.

Configuring the JUNOS Software to Support Tunnel Interfaces on MX Series Ethernet Services Routers

The MX Series routers do not use FPCs. The DPC combines the functions of four FPCs and PICs. The MX960 router has 12 DPC slots. The MX480 router has 7 DPC slots. The MX240 has 4 DPC slots. Each DPC has either 40 Gigabit Ethernet ports or 4 10-Gigabit Ethernet ports.

Because the MX Series routers do not support Tunnel Services PICs, you configure a DPC and corresponding Packet Forwarding Engine to use tunneling services at the [edit chassis] hierarchy level. You also configure the amount of bandwidth reserved for tunnel services. The JUNOS Software creates tunnel interfaces on the Packet Forwarding Engine. To create tunnel interfaces on MX Series routers, include the following statements at the [edit chassis] hierarchy level:

```
[edit chassis]
fpc slot-number {
    pic number {
        tunnel-services {
            bandwidth (1g | 10g);
        }
    }
}
```

```
    }
}
```

fpc slot-number is the slot number of the DPC. If two SCBs are installed, the range is 0 through 11. If three SCBs are installed, the range is 0 through 5 and 7 through 11.

pic number is the number of the Packet Forwarding Engine on the DPC. The range is 0 through 3.

bandwidth (1g | 10g) is the amount of bandwidth to reserve for tunnel traffic on each Packet Forwarding Engine.

1g indicates that 1 Gbps of bandwidth is reserved for tunnel traffic. Configure this option only for a Packet Forwarding Engine on a Gigabit Ethernet 40-port DPC.

10g indicates that 10 Gbps of bandwidth is reserved for tunnel traffic. Configure this option only for a Packet Forwarding Engine on a 10-Gigabit Ethernet 4-port DPC.

If you specify a bandwidth that is not compatible with the type of DPC and Packet Forwarding Engine, tunnel services are not activated. For example, you cannot specify a bandwidth of 1 Gbps for a Packet Forwarding Engine on a 10-Gigabit Ethernet 4-port DPC.

When you configure tunnel interfaces on the Packet Forwarding Engine of a 10-Gigabit Ethernet 4-port DPC, the Ethernet interfaces for that port are removed from service and are no longer visible in the CLI. The Packet Forwarding Engine of a 10-Gigabit Ethernet 4-port DPC supports either tunnel interfaces or Ethernet interfaces, but not both. Each port on the 10-Gigabit Ethernet 4-port DPC includes two LEDs, one for tunnel services and one for Ethernet services, to indicate which type of service is being used. On the Gigabit Ethernet 40-port DPC, you can configure both tunnel and Ethernet interfaces at the same time.

To verify that the tunnel interfaces have been created, issue the **show interfaces terse** operational mode command. For more information, see the *JUNOS Interfaces Command Reference*.

Example: Configuring Tunnel Interfaces on a Gigabit Ethernet 40-Port DPC

The following example shows how to create tunnel interfaces on Packet Forwarding Engine 1 of DPC 4 with 1 Gbps of bandwidth reserved for tunnel services. On a Gigabit Ethernet 40-port DPC, tunnel interfaces coexist with Ethernet interfaces. With this configuration, the Gigabit Ethernet interfaces are **ge-4/1/0** through **ge-4/1/9**. The tunnel interfaces created are **gr-4/1/10**, **pe-4/1/10**, **pd-4/1/10**, **vt-4/1/10** and so on.

```
[edit chassis]
fpc 4 pic 1 {
  tunnel-services {
    bandwidth 1g;
  }
}
```

Example: Configuring Tunnel Interfaces on a 10-Gigabit Ethernet 4-Port DPC

In this example, you create tunnel interfaces on Packet Forwarding Engine 0 of DPC 4 with 10 Gbps of bandwidth reserved for tunnel traffic. Ethernet and tunnel interfaces cannot coexist on the same Packet Forwarding Engine of a 10-Gigabit Ethernet 4-port DPC. With this configuration, the tunnel interfaces created are `gr-4/0/0`, `pe-4/0/0`, `pd-4/0/0`, `vt-4/0/0` and so on.

```
[edit chassis]
fpc 4 pic 0 {
  tunnel-services {
    10g;
  }
}
```

Configuring the JUNOS Software to Enable an M160 Router to Operate in Packet Scheduling Mode

By default, packet scheduling is disabled on M160 Routers. To configure a router to operate in packet-scheduling mode, include the `packet-scheduling` statement at the `[edit chassis]` hierarchy level:

```
[edit chassis]
packet-scheduling;
```

To explicitly disable the `packet-scheduling` statement, include the `no-packet-scheduling` statement at the `[edit chassis]` hierarchy level:

```
[edit chassis]
no-packet-scheduling;
```

When you enable packet-scheduling mode, the Packet Director application-specific integrated circuit (ASIC) schedules packet dispatches to compensate for transport delay differences. This preserves the interpacket gaps as the packets are distributed from the Packet Director ASIC to the Packet Forwarding Engine.

Whenever you change the configuration for packet-scheduling, the system stops all SFMs and FPCs and restarts them in the new mode.



NOTE: Packet scheduling is for M160 routers only.

Configuring the JUNOS Software to Allocate More Memory for Routing Tables

The jtree memory on all MX Series, all M120, and some M320, M10i, and M7i router Packet Forwarding Engines has two segments: one segment primarily stores routing tables and related information, and the other primarily stores firewall-filter-related information.

The JUNOS Software provides a new configuration statement **route-memory-enhanced** to reallocate the jtree memory. This statement enables you to provide more memory for routing tables over firewall filters on the following routers:

- M10i and M7i routers with Enhanced CFEB
- M320 routers with Enhanced III FPC1, Enhanced III FPC2, and Enhanced III FPC3
- M120 routers
- MX Series routers

This option is useful when you want to support larger routing tables with more number of routes. For example, you can enable this option, when you want to support a large number of routes for Layer 3 VPNs implemented using MPLS. However, we recommend enabling this option only if you do not have a very large firewall configuration.

To allocate more memory for routing tables, include the **route-memory-enhanced** statement at the **[edit chassis]** hierarchy level:

```
[edit chassis]
route-memory-enhanced;
```

As the allocation of more memory for routing tables might disrupt the forwarding operations of a Packet Forwarding Engine, the JUNOS Software CLI displays a warning to restart the FPC when you commit the **route-memory-enhanced** configuration. The configuration does not become effective until you restart the FPC or DPC (on MX Series routers).

To restart a single FPC or DPC without rebooting the entire router, issue the **request chassis fpc slot *slot-number* restart** command. On an M120 router, issue the **request chassis feb slot *slot-number* restart** command.

To view if the configuration is active on an FPC or DPC, issue the **show pfe fpc *slot-number*** command. The **Route Memory Enhanced** line in the output indicates whether the configuration is active or inactive:

```
user@ host > show pfe fpc 1
```

```
XDPC 1 status:
Slot:                Present
State:               Online
Last State Change:   2009-07-16 00:27:32 PDT
Uptime (total):      01:16:54
Failures:            1
Pending:             0
Route Memory Enhanced: 0
...
```

Related Topics ■ route-memory-enhanced

Configuring the Link Services PIC for Multilink Protocol Support

- Configuring the JUNOS Software to Support the Link Services PIC on page 744
- Multiclass Extension for Multiple Classes of Service Using MLPPP (RFC 2686) on page 745

Configuring the JUNOS Software to Support the Link Services PIC

The Multilink Protocol enables you to split, recombine, and sequence datagrams across multiple logical data links. The goal of multilink operation is to coordinate multiple independent links between a fixed pair of systems, providing a virtual link with greater bandwidth than any of the members.

The Links Services PIC supports the following Multilink Protocol encapsulation types at the logical unit level:

- Multilink Point-to-Point Protocol (MLPPP)
- Multilink Frame Relay (MLFR FRF.15)

The Link Services PIC also supports the Multilink Frame Relay UNI and NNI (MLFR FRF.16) encapsulation type at the physical interface level.

MLFR (FRF.16) is supported on a channelized interface, *ls-fpc/pic/port:channel*, which denotes a single MLFR (FRF.16) bundle. For MLFR (FRF.16), multiple links are combined to form one logical link. Packet fragmentation and reassembly occur on a per-virtual circuit (VC) basis. Each bundle can support multiple VCs. The physical connections must be E1, T1, channelized DS3 to DS1, channelized DS3 to DS0, channelized E1, channelized STM 1, or channelized IQ interfaces.

The default number of bundles per Link Services PIC is 16, ranging from *ls-fpc/pic/port:0* to *ls-fpc/pic/port:15*.

To configure the number of bundles on a Link Services PIC, include the *mlfr-uni-nni-bundles* statement at the *[edit chassis fpc slot-number pic pic-number]* hierarchy level:

```
[edit chassis fpc slot-number pic pic-number]
mlfr-uni-nni-bundles number;
```

The maximum number of MLFR UNI NNI bundles each Link Services PIC can accommodate is 128. A link can associate with one link services bundle only.



NOTE: The Link Services PIC is not compatible with the M160 or T Series routers.

Multiclass Extension for Multiple Classes of Service Using MLPPP (RFC 2686)

The multiclass extension to the MLPPP extension enables multiple classes of service using MLPPP. For more information, see RFC 2686, *The Multi-Class Extension to Multi-Link PPP*. The JUNOS Software PPP implementation does not support the negotiation of address field compression and protocol field compression PPP NCP options. The software always sends a full 4-byte PPP header.

Configuring the JUNOS Software to Enable Idle Cell Format and Payload Patterns for ATM Devices

ATM devices send idle cells to enable the receiving ATM interface to recognize the start of each new cell. The receiving ATM device does not act on the contents of idle cells and does not pass them up to the ATM layer in the ATM protocol stack.

By default, the idle cell format for ATM cells is (4 bytes): 0x00000000. For ATM 2 PICs only, you can configure the format of the idle cell header and payload bytes.

To configure the idle cell header to use the International Telecommunications Union (ITU-T) standard of 0x00000001, include the `itu-t` statement at the `[edit chassis fpc slot-number pic number idle-cell-format]` hierarchy level:

```
[edit chassis fpc slot-number pic pic-number idle-cell-format]
itu-t;
```

On a TX Matrix or TX Matrix Plus router, include the `itu-t` statement at the `[edit chassis lcc number fpc slot-number pic pic-number idle-cell-format]` hierarchy level:

```
[edit chassis lcc number fpc slot-number pic pic-number idle-cell-format]
itu-t;
```

By default, the payload pattern is cell payload (48 bytes). To configure the idle cell payload pattern, include the `payload-pattern` statement at the `[edit chassis fpc slot-number pic number idle-cell-format]` hierarchy level:

```
[edit chassis fpc slot-number pic pic-number idle-cell-format]
payload-pattern payload-pattern-byte;
```

On a TX Matrix router, include the `payload-pattern` statement at the `[edit chassis lcc number fpc slot-number pic pic-number idle-cell-format]` hierarchy level:

```
[edit chassis lcc number fpc slot-number pic pic-number idle-cell-format]
payload-pattern payload-pattern-byte;
```

The payload pattern byte can range from 0x00 through 0xff.

For information about the TX Matrix router, see “TX Matrix Router and T640 Router Configuration Overview” on page 756. For information about the TX Matrix Plus router, see “TX Matrix Plus Router and T1600 Router Configuration Overview” on page 764.

Configuring the JUNOS Software to Enable MTU Path Check for a Routing Instance on M Series Routers

By default, the maximum transmission unit (MTU) check for routing instance is disabled on M Series routers (except the M320), and enabled for all T Series and J Series routers.



NOTE: The MTU check is automatically present for interfaces belonging to the main router.

On M Series routers (except the M320 router) you can configure MTU path checks on the outgoing interface for unicast traffic routed on a virtual private network (VPN) routing and forwarding (VRF) routing instance. When you enable MTU check, the router sends an Internet Control Message Protocol (ICMP) message when the size of a unicast packet traversing a VRF routing instance or virtual-router routing instance has exceeded the MTU size and when an IP packet is set to "do not fragment". The ICMP message uses the routing instance local address as its source address.

For an MTU check to work in a routing instance, you must include the `vrf-mtu-check` statement at the `[edit chassis]` hierarchy level and assign at least one interface containing an IP address to the routing instance.

To configure path MTU checks, complete the following tasks:

1. Enabling MTU Check for a Routing Instance on page 746
2. Assigning an IP Address to an Interface in the Routing Instance on page 746

Enabling MTU Check for a Routing Instance

To enable MTU check for a routing instance, include the `vrf-mtu-check` statement at the `[edit chassis]` hierarchy level:

```
[edit chassis]
vrf-mtu-check;
```

Assigning an IP Address to an Interface in the Routing Instance

To assign an IP address to an interface in the VRF or virtual-router routing instance, configure the local address for that routing instance. A local address is any IP address derived from an interface that is assigned to the routing instance.

To assign an interface to a routing instance, include the `interface` statement at the `[edit routing-instances routing-instance-name]` hierarchy level:

```
[edit routing-instances routing-instance-name]
interface interface-name;
```

To configure an IP address for a loopback interface, include the `address` statement at the `[edit interfaces interface-name unit logical-unit-number family inet]` hierarchy level:

```
[edit interfaces interface-name unit logical-unit-number family inet]
address address;
```



NOTE: If you are assigning Internet Protocol Security (IPsec) or generic routing encapsulation (GRE) tunnel interfaces without IP addresses in the routing instance, include a loopback interface to the routing instance. To do this, include the `lo0.n` option at the `[edit routing-instances routing-instance-name interface]` hierarchy level. *n* cannot be 0, because `lo0.0` is reserved for the main router (and not appropriate for use with routing instances). Also, an IP address must be assigned to this loopback interface in order to work. To set an IP address for a loopback interface, include the `address` statement at the `[edit interfaces lo0 unit logical-unit-number family inet]` hierarchy level.

Configuring the JUNOS Software to Support Redundancy on Routers Having Multiple Routing Engines or Switching Boards

For routers that have multiple Routing Engines or these multiple switching control boards: Switching and Forwarding Modules (SFMs), System and Switch Boards (SSBs), Forwarding Engine Boards (FEBs), or Compact Forwarding Engine Boards (CFEBs), you can configure redundancy properties.

To configure redundancy, include the following redundancy statements at the `[edit chassis]` hierarchy level:

```
redundancy {
  cfeb slot (always | preferred);
  failover {
    on-disk-failure
    on-loss-of-keepalives;
  }
  feb {
    redundancy-group group-name {
      feb slot-number (backup | primary);
      description description;
      no-auto-failover;
    }
  }
  graceful-switchover;
  keepalive-time seconds;
  routing-engine slot-number (master | backup | disabled);
  sfm slot-number (always | preferred);
  ssb slot-number (always | preferred);
}
```

Configuring the JUNOS Software to Support FPC to FEB Connectivity on M120 Routers

The M120 router supports six Forwarding Engine Boards (FEBs) and six Flexible PIC Concentrators (FPCs). The supported FPCs include:

- Two compact FPCs:

- OC192 compact FPC (supported only on the D4 chip-based compact FPC)
- 10-Gigabit Ethernet compact FPC
- Up to four Type 1, Type 2, or Type 3 FPCs

On the M120 router, you can map a connection between any FPC and any FEB. This capability allows you to configure resources for a chassis that contains empty slots, supporting configurations where the FPC and FEB pairs are not in slot order. You do not have to populate every empty slot position, but you must configure a FEB for every FPC.

If you do not want to map a connection between an FPC and a FEB, you must explicitly configure the FPC not to connect to the FEB. To do so, include the **none** option at the `[edit chassis fpc-feb-connectivity fpc number feb]` hierarchy level. If you do not configure FPC and FEB connectivity, it is automatically assigned in the following order: FPC 0 to FEB 0, FPC 1 to FEB 1, and so on.

For each FEB, you can map a maximum of two Type 1 FPCs or one Type 2, Type 3, or compact FPC.

The following restrictions apply when you configure FPC and FEB connectivity:

- When an FPC is configured not to connect to any FEB, interfaces on that FPC are not created.
- If a PIC comes online, but the FEB to which the FPC is configured to connect is not online, the physical interfaces for the PIC are not created. For example, PIC 1 on FPC 2 comes online. The configuration specifies that FPC 2 connects to FEB 3. If FEB 3 is not online at the time PIC 1 comes online, the physical interfaces corresponding to PIC 1 on FPC 2 are not created. If FEB 3 subsequently comes online, the physical interfaces are created.
- If a FEB is brought offline or removed, any interfaces on the FPCs connected to the FEB are deleted. If the FEB is subsequently brought back online, the interfaces are restored.
- FPCs and FEBs might reboot following a change in the FPC and FEB connectivity configuration. If an FPC connects to a different FEB as a result of the configuration change, the FPC is rebooted following the commit. As a result of the reboot, interfaces on the FPC are deleted.
- If a FEB connects to a different FPC or set of FPCs after a connectivity configuration change, the FEB is rebooted. The exception is if the FEB is already connected to one or two Type 1 FPCs and the change only results in the FEB being connected either to one additional or one fewer Type 1 FPC.

To configure a connection between an FPC and a FEB, include the **fpc-feb-connectivity** statement at the `[edit chassis]` hierarchy level:

```
[edit chassis]
fpc-feb-connectivity {
  fpc number feb (slot-number | none);
}
```

For **fpc number**, enter a value from 0 through 5. For **feb slot-number**, enter a value from 0 through 5 or **none**. The **none** option disconnects the FPC from the FEB.

To view the current FPC and FEB mapping and the status of each FPC and FEB, issue the **show chassis fpc-feb-connectivity** operational mode command. For more information, see the *JUNOS System Basics and Services Command Reference*.



NOTE: FPC-to-FEB connectivity is supported only on the M120 router.

In this example, FPC 3 is already mapped to FEB 3 by default. You are also mapping a connection between FPC 2 and FEB 3.

```
[edit chassis]
fpc-feb-connectivity {
  fpc 2 feb 3;
}
```

However, this configuration results in a mismatch between the FPC type and the FEB type. For example, FPC 3 is not a Type 1 FPC. You can map only one FPC that is not a Type 1 FPC to a FEB. Use the **fpc-feb-connectivity** statement to explicitly disconnect FPC 3 from FEB 3. To do so, include the **none** option at the **[edit chassis fpc-feb-connectivity fpc number feb]** hierarchy level:

```
[edit chassis]
fpc-feb-connectivity {
  fpc 2 feb 3;
  fpc 3 feb none;
}
```

Configuring the JUNOS Software to Enable a Routing Engine to Reboot on Hard Disk Errors

When a hard disk error occurs, a Routing Engine might enter a state in which it responds to local pings and interfaces remain up, but no other processes are responding.

To recover from this situation, you can configure a single Routing Engine to reboot automatically when a hard disk error occurs. To enable this feature, include the **on-disk-failure reboot** statement at the **[edit chassis routing-engine]** hierarchy level.

```
[edit chassis routing-engine]
on-disk-failure {
  disk-failure-action (halt | reboot);
```

For dual Routing Engine environments, you can configure a backup Routing Engine to assume mastership automatically, if it detects a hard disk error on the master Routing Engine. To enable this feature, include the **on-disk-failure** statement at the **[edit chassis redundancy failover]** hierarchy level. For information about this statement, see the *JUNOS High Availability Configuration Guide*.

You can configure the Routing Engine to halt (instead of rebooting) when the hard disk fails on the Routing Engine. To configure this feature, include the **disk-failure-action**

(halt | reboot) statement at the [edit chassis routing-engine on-disk-failure] hierarchy level:

```
[edit chassis routing-engine]
on-disk-failure {
    disk-failure-action (halt | reboot);
}
```

Use **halt** to configure the Routing Engine to halt when the hard disk fails. Use **reboot** to configure the Routing Engine to reboot when the hard disk fails.

Configuring the JUNOS Software to Prevent the Resetting of the Factory Default or Rescue Configuration During Current Configuration Failure on J Series Routers

On J Series Services Routers, if the current configuration fails, you can load a rescue configuration or the factory default configuration by pressing the **CONFIG (Reset)** button:

- **Rescue configuration**—When you press and quickly release the **CONFIG** button, the configuration LED blinks green and the rescue configuration is loaded and committed. The rescue configuration is user defined and must be set previously for this operation to be successful.
- **Factory defaults**—When you hold the **CONFIG** button for more than 15 seconds, the configuration LED blinks red and the router is set back to the factory default configuration.



CAUTION: When you set the router back to the factory default configuration, the current committed configuration and all previous revisions of the router's configuration are deleted.

To limit how the **CONFIG** button resets a router configuration, include one or both of the following statements at the [edit chassis] hierarchy level:

```
[edit chassis]
config-button {
    no-clear;
    no-rescue;
}
```

no-clear—Prevents resetting the router to the factory default configuration. You can still press and quickly release the button to reset to the rescue configuration (if one was set previously).

no-rescue—Prevents resetting the router to the rescue configuration. You can still press and hold the button for more than 15 seconds to reset to the factory default configuration.

When both the **no-clear** and **no-rescue** statements are present, the **CONFIG** button does not reset to either configuration.

Configuring Larger Delay Buffers to Prevent Congestion And Packet Dropping

- Configuring the JUNOS Software to Enable Larger Delay Buffers for T1, E1, and DS0 Interfaces Configured on Channelized IQ PICs on page 751
- Maximum Delay Buffer with q-pic-large-buffer Statement Enabled on page 751

Configuring the JUNOS Software to Enable Larger Delay Buffers for T1, E1, and DS0 Interfaces Configured on Channelized IQ PICs

By default, T1, E1, and NxDS0 interfaces configured on channelized IQ PICs are limited to 100,000 microseconds of delay buffer. (The default average packet size on the IQ PIC is 40 bytes.) For these interfaces, it might be necessary to configure a larger buffer size to prevent congestion and packet dropping.

To ensure traffic is queued and transmitted properly, you can configure a buffer size larger than the default maximum. Include the `q-pic-large-buffer large-scale` statement at the `[edit chassis fpc slot-number pic pic-number]` hierarchy level:

```
[edit chassis fpc slot-number pic pic-number]
q-pic-large-buffer {
  large-scale;
}
```

On a TX Matrix and TX Matrix Plus router, include the `q-pic-large-buffer large-scale` statement at the `[edit chassis lcc number fpc slot-number pic pic-number]` hierarchy level:

```
[edit chassis lcc number fpc slot-number pic pic-number]
q-pic-large-buffer {
  large-scale;
}
```



NOTE: When you commit the configuration after including the `q-pic-large-buffer` statement for a PIC, the JUNOS Software temporarily takes the PIC offline and brings it back online before the new configuration is activated and becomes the current operational configuration.

This statement sets the maximum buffer size. (See Table 51 on page 752.)

For information on configuring the buffer size, see the *JUNOS Class of Service Configuration Guide*.

Maximum Delay Buffer with q-pic-large-buffer Statement Enabled

Table 51 on page 752 lists the maximum delay buffer that can be configured for T1, E1, and DS0 interfaces configured on Channelized IQ PICs:

Table 51: Maximum Delay Buffer with q-pic-large-buffer Statement Enabled

Platform, PIC, or Interface Type	Maximum Buffer Size
With Large Buffer Sizes Not Enabled	
T Series and M320 routers	50,000 microseconds
Other M Series routers	200,000 microseconds
IQ PICs on all routers	100,000 microseconds
Channelized T1/E1 interface on J Series Services Routers	400,000 microseconds
With Large Buffer Sizes Enabled	
Channelized T3 and channelized OC3 DLCIs—Maximum sizes vary by shaping rate:	
With shaping rate from 64,000 through 255,999 bps	4,000,000 microseconds
With shaping rate from 256,000 through 511,999 bps	2,000,000 microseconds
With shaping rate from 512,000 through 1,023,999 bps	1,000,000 microseconds
With shaping rate from 1,024,000 through 2,048,000 bps	500,000 microseconds
With shaping rate from 2,048,001 bps through 10 mbps	400,000 microseconds
With shaping rate from 10,000,001 bps through 20 mbps	300,000 microseconds
With shaping rate from 20,000,001 bps through 30 mbps	200,000 microseconds
With shaping rate from 30,000,001 bps through 40 mbps	150,000 microseconds
With shaping rate up to 40,000,001 bps or higher	100,000 microseconds
NxDSO IQ Interfaces—Maximum sizes vary by channel size:	
1xDSO through 3xDSO	4,000,000 microseconds
4xDSO through 7xDSO	2,000,000 microseconds
8xDSO through 15xDSO	1,000,000 microseconds
16xDSO through 32xDSO	500,000 microseconds
Other IQ interfaces	500,000 microseconds

Configuring the JUNOS Software to Support Entry-Level Configuration on an M320 Router with a Minimum Number of SIBs and PIMs

An M320 router can include an entry-level configuration with a minimum number of SIBs and PEMs. With this configuration, the router may have fewer than four SIBs or four PEMs.

To prevent unwanted alarms from occurring with this entry-level configuration, include the `pem minimum` and `sib minimum` statements at the `[edit chassis]` hierarchy level:

```
[edit chassis]
pem {
    minimum number;
}
sib {
    minimum number;
}
```

`minimum number` can be 0 through 3. With this configuration, SIB absent or PEM absent alarms are generated only if the SIB or PEM count falls below the minimum specified. For example, set this number to 2 for an entry-level configuration with 2 Switch Interface Boards and 2 Power Entry Modules.

Configuring the uPIM to Run in Switching or Routing Mode on J Series Routers

- Configuring the JUNOS Software to Support the uPIM Mode on J Series Routers on page 753
- Configuring the JUNOS Software to Set a PIM Offline on J Series Routers on page 754
- Configuring the JUNOS Software to Disable Power Management on the J Series Chassis on page 754

Configuring the JUNOS Software to Support the uPIM Mode on J Series Routers

The 6-port, 8-port, and 16-port Gigabit Ethernet uPIMs used on the J Series routers (J2320, J2350, J4350, and J6350) support Layer 2 switching and can forward traffic at both Layer 2 (switching) and Layer 3 (routing). You can configure a uPIM to run in either routing mode (the default) or switching mode.

Routing mode provides the standard routing services. Switching mode allows traffic forwarding at both Layer 2 and Layer 3. At Layer 2, a uPIM can switch intra-LAN traffic from one LAN host to another, such as from one port on a uPIM to another on the same uPIM. At Layer 3, a uPIM can route traffic to WAN interfaces and other PIMs present on the chassis.

To configure the PIM mode, include the following statements at the `[edit chassis fpc]` hierarchy level:

```
[edit chassis]
```

```
fpc fpc-slot {
  pic pim-slot {
    ethernet {
      pic-mode (switching | routing);
    }
  }
}
```

Configuring the JUNOS Software to Set a PIM Offline on J Series Routers

On J Series routers, the system monitors the PIMs and verifies that a newly inserted PIM falls within the power capacity of the chassis. PIMs that fall outside of acceptable power ranges can be taken offline or disabled for power management purposes.

This operation differs from the `power-off` option used on non-J Series products.

To take a PIM offline, include the `offline` statement at the `[edit chassis fpc slot-number]` hierarchy level:

```
[edit chassis fpc slot-number]
offline;
```

Configuring the JUNOS Software to Disable Power Management on the J Series Chassis

Instead of setting a PIM offline, the power management feature on a chassis can be disabled. The `disable-power-management` statement disables power management on the chassis and, when used, causes any PIMs disabled because of exceeding chassis power limits to come online.

It is important to consider power management carefully before enabling disabled PIMs. If the PIMs have been disabled because they exceeded power limits, they should not be enabled.

To disable power on the J Series chassis, include the `disable-power-management` statement at the `[edit chassis]` hierarchy level:

```
[edit chassis]
disable-power-management;
```

Configuring the IP and Ethernet Services Mode in MX Series Routers

- Configuring the JUNOS Software to Run in the IP and Ethernet Services Mode in MX Series Routers on page 754
- Restrictions on JUNOS Features for MX Series Routers on page 755

Configuring the JUNOS Software to Run in the IP and Ethernet Services Mode in MX Series Routers

MX Series Ethernet services routers can be configured to run in IP Services mode or in Ethernet Services mode. The default IP Services mode provides complete

functionality, while the Ethernet Services mode only provides support for Layer 2.5 functions.

Operating in Ethernet Services mode restricts certain BGP protocol functions and does not support Layer 3 VPN, unicast RPF, and source and destination class usage (SCU and DCU) functions. In addition, the number of externally configured filter terms are restricted to 64K. The details of Layer 2.5 support for Ethernet Services are shown in Table 52 on page 755.

To configure the network services mode of an MX Series router, include the `network-services` statement with the appropriate option at the `[edit chassis]` hierarchy level:

```
[edit chassis]
network-services (ethernet | ip);
```

If DPCs in Ethernet Services mode are up and running, the system cannot be set to IP services mode. You must set any Ethernet mode DPCs offline before switching to IP Services mode.

Restrictions on JUNOS Features for MX Series Routers

The following features contain restrictions when running in Ethernet Services mode.

Table 52: Restricted Software Features in Ethernet Services Mode

Software Feature	Restriction in Ethernet Services Mode
BGP	<ul style="list-style-type: none"> ■ BGP allows only family L2 VPN to provide IP control plane support. ■ Data plane support applies only for Ethernet and MPLS. ■ BGP in Ethernet Services mode does not support inet, inet6, inet-vpn and inet-6vpn
L3VPN	Layer 3 VPN is not available in Ethernet Services mode.
Unicast RPF	Unicast reverse-path forwarding is disabled in Ethernet Services mode.
Source and destination class usage (SCU and DCU)	Source and Destination Class Usage is disabled in Ethernet Services mode.
Filter terms	In Ethernet Services mode, the number of externally configured filter terms is restricted to 64 KB.

Configuring J Series Services Router Switching Interfaces

In access switching mode, only one physical interface is configured for the entire Gigabit Ethernet uPIM. The single physical interface serves as a virtual router interface (VRI). Configuration of the physical port characteristics is done under the single physical interface.

To configure Gigabit Ethernet uPIM physical Ethernet interface properties, include the `switch-port` statement at the `[edit interfaces ge-pim/0/0 switch-options]` hierarchy level:

```
[edit interfaces ge-pim /0/0 switch-options]
switch-port port-number {
  (auto-negotiation | no-auto-negotiation);
  speed (10m | 100m | 1g);
  link-mode (full-duplex | half-duplex);
}
```

Example: Configuring J Series Services Router Switching Interfaces

Configure a single physical interface for the uPIM and set the port parameters for port 0 and port 1:

```
[edit interfaces]
ge-2/0/0 {
  {
    switch-port 0 {
      no-auto-negotiation;
      1g;
      link-mode full-duplex;
    }
    port 1 {
      no-auto-negotiation;
      10m;
      link-mode half-duplex;
    }
  }
}
```

TX Matrix Router and T640 Router Configuration Guidelines

- TX Matrix Router and T640 Router Configuration Overview on page 756
- Using the JUNOS Software to Configure a T640 Router Within a Routing Matrix on page 759
- TX Matrix Router Chassis and Interface Names on page 760
- Configuring the JUNOS Software to Upgrade and Downgrade Switch Interface Boards on a TX Matrix Router on page 762
- Configuring the JUNOS Software to Enable the TX Matrix Router to Generate an Alarm If a T640 Router Stays Offline on page 763

TX Matrix Router and T640 Router Configuration Overview

This topic provides an overview of configuring the TX Matrix router and T640 routers.

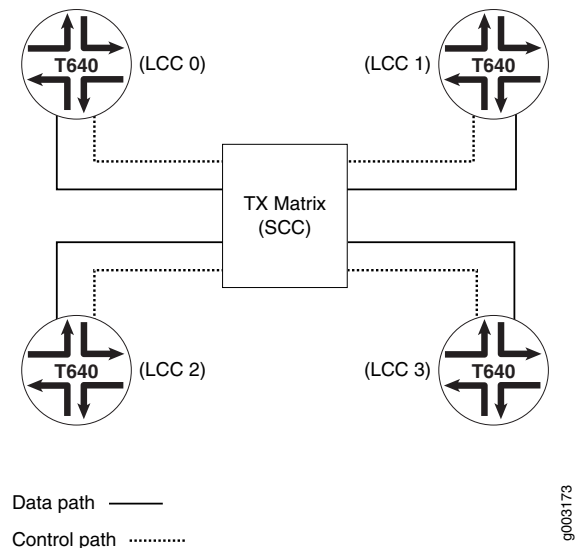
- TX Matrix Router and T640 Router-Based Routing Matrix Overview on page 757
- Running Different JUNOS Software Releases on the TX Matrix Router and T640 Routers on page 758
- TX Matrix Router Software Upgrades and Reinstallation on page 758

- TX Matrix Router Rebooting Process on page 758
- Committing Configurations on the TX Matrix Router on page 758
- TX Matrix and T640 Router Configuration Groups on page 759
- Routing Matrix System Log Messages on page 759

TX Matrix Router and T640 Router-Based Routing Matrix Overview

A routing matrix is a multichassis architecture that consists of a TX Matrix router and from one to four T640 routers. From the perspective of the user interface, the routing matrix appears as a single router. The TX Matrix router controls all the T640 routers in the routing matrix, as shown in Figure 9 on page 757.

Figure 9: Routing Matrix Composed of a TX Matrix Router and Four T640 Routers



You configure and manage the TX Matrix router and its T640 routers in the routing matrix through the CLI on the TX Matrix router. This means that the configuration file on the TX Matrix router is used for the entire routing matrix.

Because all configuration, troubleshooting, and monitoring are performed through the TX Matrix router, we do not recommend accessing its T640 routers directly (through the console port or management Ethernet [fxp0]). If you do, the following messages appear when you first start the CLI through a T640 router:

```
% cli
warning: This chassis is a Line Card Chassis (LCC) in a multichassis system.
warning: Use of interactive commands should be limited to debugging.
warning: Normal CLI access is provided by the Switch Card Chassis (SCC).
warning: Use 'request routing-engine login scc' to log into the SCC.
{master}
```

These messages appear because any configuration you commit on a T640 router is not propagated to the TX Matrix router or other T640 routers in the routing matrix. For details, see “Committing Configurations on the TX Matrix Router” on page 758.

Running Different JUNOS Software Releases on the TX Matrix Router and T640 Routers

On a routing matrix, if you elect to run different JUNOS Software releases on the TX Matrix router and T640 Routing Engines, a change in Routing Engine mastership can cause one or all T640 routers to be logically disconnected from the TX Matrix router.



NOTE: The routing matrix supports Release 7.0 and later versions of the JUNOS Software. All the master Routing Engines on the routing matrix must use the same software version. For information about hardware and software requirements, see the *TX Matrix Router Hardware Guide*.

TX Matrix Router Software Upgrades and Reinstallation

By default, when you upgrade or reinstall software on the TX Matrix router, the new software image is distributed to the connected T640 routers. Software installed on a primary TX Matrix router is distributed to all connected primary T640 routers and the backup is distributed to all connected backup routers.

TX Matrix Router Rebooting Process

When you reboot the TX Matrix router master Routing Engine, all the master Routing Engines in the connected T640 routers reboot. In addition, you can selectively reboot the master Routing Engine or any of the connected T640 routers.

Committing Configurations on the TX Matrix Router

In a routing matrix composed of a TX Matrix router and T640 routers, all configuration must be performed on the TX Matrix router. Any configuration you commit on a T640 router is not propagated to the TX Matrix router or other T640 routers. Only configuration changes you commit on the TX Matrix router are propagated to all T640 routers. A commit on a TX Matrix router overrides any changes you commit on a T640 router.

If you issue the `commit` command, you commit the configuration to all the master Routing Engines in the routing matrix.

```
user@host# commit
scc-re0:
configuration check succeeds
lcc0-re0:
commit complete
lcc1-re0:
commit complete
scc-re0:
commit complete
```




NOTE: If a commit operation fails on any node, then the commit operation is not completed for the entire TX Matrix router.

If you issue the `commit synchronize` command on the TX Matrix router, you commit the configuration to all the master and backup Routing Engines in the routing matrix.

```
user@host# commit synchronize
scc-re0:
configuration check succeeds
lcc0-re1:
commit complete
lcc0-re0:
commit complete
lcc1-re1:
commit complete
lcc1-re0:
commit complete
scc-re1:
commit complete
scc-re0:
commit complete
```

TX Matrix and T640 Router Configuration Groups

For routers that include two Routing Engines, you can specify two special group names—`re0` and `re1`. These two special group names apply to the Routing Engines in slots 0 and 1 of the TX Matrix router. In addition, the routing matrix supports group names for the Routing Engines for each T640 router: `lcc n-re0` and `lcc n-re1`. *n* identifies a T640 router from 0 through 3.

Routing Matrix System Log Messages

You configure the T640 routers to forward their system log messages to the TX Matrix router at the `[edit system syslog host scc-master]` hierarchy level. For information about how to configure system log messages in a routing matrix, see “JUNOS Software System Log Configuration Overview” on page 125 and “Configuring System Logging for a TX Matrix Router” on page 151.

Using the JUNOS Software to Configure a T640 Router Within a Routing Matrix

A routing matrix composed of a TX Matrix router and T640 routers supports the same chassis configuration statements as a standalone router (except `ce1`, `ct3`, `mlfr-uni-nni-bundles`, `sparse-dlcis`, and `vtmapping`). By including the `lcc` statement at the `[edit chassis]` hierarchy level, you configure PIC-specific features, such as framing, on specific T640 routers. In addition, a routing matrix has two more chassis configuration statements, `online-expected` and `offline`.

To configure a T640 router that is connected to a TX Matrix router, include the `lcc` statement at the `[edit chassis]` hierarchy level:

```
[edit chassis]
```

lcc number;

number can be 0 through 3.

To configure a T640 router within a routing matrix, include the following statements at the `[edit chassis lcc number]` hierarchy level:

```
[edit chassis lcc number]
fpc slot-number { # Use the hardware FPC slot number
pic pic-number {
  atm-cell-relay-accumulation;
  atm-l2circuit-mode (cell | aal5 | trunk trunk);
  framing (sdh | sonet);
  idle-cell-format {
    itu-t;
    payload-pattern payload-pattern-byte;
  }
  max-queues-per-interface (8 | 4);
  no-concatenate;
}
offline;
online-expected;
q-pic-large-buffer {
  large-scale;
}
```



NOTE: For the FPC slot number, specify the actual hardware slot number (numbered 0 through 7) as labeled on the T640 router chassis. Do not use the corresponding software FPC number shown in Table 53 on page 761.

For information about how to configure the **online-expected** and **offline** configuration statements, see “Configuring the JUNOS Software to Enable the TX Matrix Router to Generate an Alarm If a T640 Router Stays Offline” on page 763.

TX Matrix Router Chassis and Interface Names

The output from some CLI commands uses the terms SCC and **scc** (for *switch-card chassis*) to refer to the TX Matrix router. Similarly the terms LCC, and **lcc** as a prefix (for *line-card chassis*) refer to a T640 router in a routing matrix.

T640 routers are assigned LCC index numbers, 0 through 3, depending on the hardware setup of the routing matrix. A routing matrix can have up to four T640 routers, and each T640 router has up to eight FPCs. Therefore, the routing matrix can have up to 32 FPCs (0 through 31). The FPCs are configured at the `[edit chassis lcc number]` hierarchy level.

In the JUNOS CLI, an interface name has the following format:

type-fpc/pic/port

When you specify the FPC number, the JUNOS Software determines which T640 router contains the specified FPC based on the following assignment:

- On LCC 0, FPC hardware slots 0 through 7 correspond to FPC software numbers 0 through 7.
- On LCC 1, FPC hardware slots 0 through 7 correspond to FPC software numbers 8 through 15.
- On LCC 2, FPC hardware slots 0 through 7 correspond to FPC software numbers 16 through 23.
- On LCC 3, FPC hardware slots 0 through 7 correspond to FPC software numbers 24 through 31.

To convert FPC numbers in the T640 routers to the correct FPC in a routing matrix, use the conversion chart shown in Table 53 on page 761. You can use the converted FPC number to configure the interfaces on the TX Matrix router in your routing matrix.

Table 53: T640 to Routing Matrix FPC Conversion Chart

FPC Numbering	T640 Routers							
	LCC 0							
T640 FPC Slots	0	1	2	3	4	5	6	7
Routing Matrix FPC Slots Equivalent	0	1	2	3	4	5	6	7
	LCC 1							
T640 FPC Slots	0	1	2	3	4	5	6	7
Routing Matrix FPC Slots Equivalent	8	9	10	11	12	13	14	15
	LCC 2							
T640 FPC Slots	0	1	2	3	4	5	6	7
Routing Matrix FPC Slots Equivalent	16	17	18	19	20	21	22	23
	LCC 3							
T640 FPC Slots	0	1	2	3	4	5	6	7
Routing Matrix FPC Slots Equivalent	24	25	26	27	28	29	30	31

Some examples include:

- In a routing matrix that contains lcc 0 through lcc 2, so-20/0/1 refers to FPC slot 4 of lcc 2.
- If you have a Gigabit Ethernet interface installed in FPC slot 7, PIC slot 0, port 0 of T640 router LCC 3, you can configure this interface on the TX Matrix router by including the `ge-31/0/0` statement at the `[edit interfaces]` hierarchy level.

[edit]

```

interfaces {
  ge-31/0/0 {
    unit 0 {
      family inet {
        address ip-address;
      }
    }
  }
}

```

Configuring the JUNOS Software to Upgrade and Downgrade Switch Interface Boards on a TX Matrix Router

The JUNOS Software does not support mixed mode operation of switch interface boards (SIBs). To successfully upgrade 1.0 SIBs to 2.0 SIBs in a TX Matrix environment, you must force all newly installed 2.0 SIBs to operate in 1.0 mode until the upgrade is complete.

1. Configuring the JUNOS Software to Upgrade Switch Interface Boards on a TX Matrix Router on page 762
2. Configuring the JUNOS Software to Downgrade Switch Interface Boards on a TX Matrix Router on page 763

Configuring the JUNOS Software to Upgrade Switch Interface Boards on a TX Matrix Router

To configure the TX Matrix router to support a SIB upgrade, include the `fabric upgrade-mode` statement at the `[edit chassis]` hierarchy level and commit the changes to update the configuration. Configuration changes that you commit on the TX Matrix router are propagated to all T640 routers.

```

[edit chassis]
user@host# set chassis fabric upgrade-mode
user@host# commit

```

The `fabric upgrade-mode` statement instructs the newly installed 2.0 boards to operate in 1.0 mode. When all 1.0 boards have been replaced by 2.0 boards, remove the `fabric upgrade-mode` statement from the configuration hierarchy, and commit the changes again.

```

[edit chassis]
user@host# delete chassis fabric upgrade-mode
user@host# commit

```

Use the `request chassis sib (offline | online)` command sequence to power cycle the newly installed 2.0 SIBs.

```

user@host> request chassis sib offline slot slot-number
user@host> request chassis sib online slot slot-number

```

As the system discovers each new board, the 2.0 ASIC enables 2.0 features, and the upgrade is complete.

Configuring the JUNOS Software to Downgrade Switch Interface Boards on a TX Matrix Router

To downgrade your 2.0 SIBs to 1.0 SIBs, follow the upgrade procedure. When you replace the first 2.0 SIB with a 1.0 SIB, the system operates in a downgraded 1.0 mode until all 2.0 SIBs are replaced, and the newly installed 1.0 SIBs are power cycled using a `request chassis sib (offline | online)` command sequence.



NOTE: The TX Matrix switch fabric supports 2.0 SIBs for enabling Gigabit FPC-4 and Type 4 PICs. Gigabit FPC-4 devices are not compatible with 1.0 SIBs. Therefore, if you are planning to downgrade from 2.0 SIBs to 1.0 SIBs, you must take all Gigabit FPC-4 devices offline to ensure that the link between the new SIBs and the FPC does not fail.

Configuring the JUNOS Software to Enable the TX Matrix Router to Generate an Alarm If a T640 Router Stays Offline

By default, the JUNOS Software enables all the T640 routers in the routing matrix to come online. The JUNOS Software also allows you to configure all the T640 routers so that if they do not come online, an alarm is sent by the TX Matrix router.

To configure this alarm, include the `online-expected` statement at the `[edit chassis lcc number]` hierarchy level:

```
[edit chassis lcc number]  
  online-expected;
```

If you do not want a T640 router to be part of the routing matrix, you can configure it to be offline. This is useful when you are performing maintenance on a T640 router. When the T640 router is ready to come back online, delete the `offline` configuration statement.

To configure a T640 router so that it is offline, include the `offline` statement at the `[edit chassis lcc number]` hierarchy level:

```
[edit chassis lcc number]  
  offline;
```



NOTE: If you do not configure the `online-expected` or `offline` statement, any T640 router that is part of the routing matrix is allowed to come online. However, if a T640 router does not come online, the TX Matrix router does not generate an alarm.

TX Matrix Plus Router and T1600 Router Configuration Guidelines

- TX Matrix Plus Router and T1600 Router Configuration Overview on page 764
- Using the JUNOS Software to Configure a T1600 Router Within a Routing Matrix on page 768
- TX Matrix Plus Router Chassis and Interface Names on page 769
- Configuring the JUNOS Software to Enable the TX Matrix Plus Router to Generate an Alarm If a T1600 Router Stays Offline on page 770

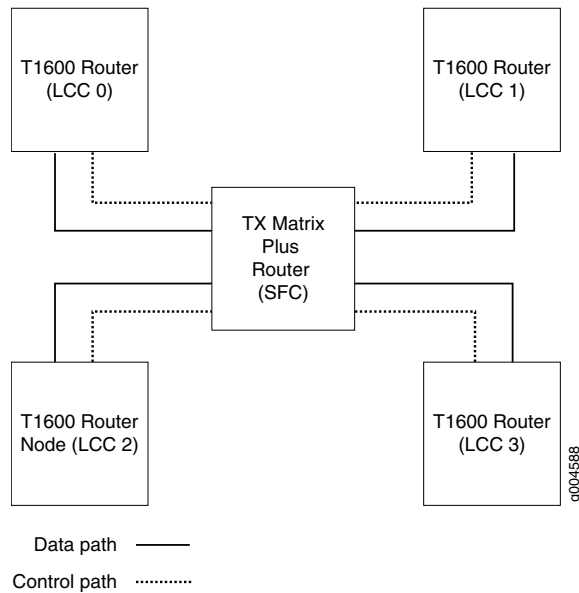
TX Matrix Plus Router and T1600 Router Configuration Overview

This topic provides an overview of configuring the TX Matrix Plus router and T1600 routers.

- TX Matrix Plus Router and T1600 Router-Based Routing Matrix Overview on page 764
- Running Different JUNOS Software Releases on the TX Matrix Plus Router and T1600 Routers on page 765
- TX Matrix Plus Router Software Upgrades and Reinstallation on page 766
- TX Matrix Plus Router Rebooting Process on page 766
- TX Matrix Plus Router Routing Engine Rebooting Sequence on page 766
- TX Matrix Plus Router Management Ethernet Interface on page 766
- TX Matrix Plus Router Internal Ethernet Interfaces on page 767
- Routing Matrix-Based T1600 Router Internal Ethernet Interfaces on page 767
- Committing Configurations on the TX Matrix Plus Router on page 767
- Routing Matrix Configuration Groups on page 768
- Routing Matrix System Log Messages on page 768

TX Matrix Plus Router and T1600 Router-Based Routing Matrix Overview

A routing matrix based on a TX Matrix Plus router is a multichassis architecture that consists of a TX Matrix Plus router and from one to four T1600 routers. From the perspective of the user interface, the routing matrix appears as a single router. The TX Matrix Plus router (or switch-fabric chassis (SFC)) controls all the T1600 routers (or line-card chassis (LCC)) in the routing matrix, as shown in Figure 10 on page 765.

Figure 10: Routing Matrix Composed of a TX Matrix Plus Router and Four T1600 Routers

You configure and manage the TX Matrix Plus router and its T1600 routers in the routing matrix through the CLI on the TX Matrix Plus router. This means that the configuration file on the TX Matrix Plus router is used for the entire routing matrix.

Because all configuration, troubleshooting, and monitoring are performed through the TX Matrix Plus router, we do not recommend accessing its T1600 routers directly (through the console port or management Ethernet interface [em0]). If you do, the following messages appear when you first start the CLI through a T1600 router:

```
% cli
warning: This chassis is a Line Card Chassis (LCC) in a multichassis system.
warning: Use of interactive commands should be limited to debugging.
warning: Normal CLI access is provided by the Switch Fabric Chassis (SFC).
warning: Please logout and log into the SFC to use CLI.
```

These messages appear because any configuration you commit on a T1600 router is not propagated to the TX Matrix Plus router or other T1600 routers in the routing matrix. For details, see “Committing Configurations on the TX Matrix Plus Router” on page 767.

Running Different JUNOS Software Releases on the TX Matrix Plus Router and T1600 Routers

On a routing matrix composed of a TX Matrix Plus router and T1600 routers, if you elect to run different JUNOS Software releases on the TX Matrix Plus router and T1600 Routing Engines, a change in Routing Engine mastership can cause one or all T1600 routers to be logically disconnected from the TX Matrix Plus router.



NOTE: All the master Routing Engines on the routing matrix must use the same JUNOS Software version. For information about hardware and software requirements, see the *TX Matrix Plus Router Hardware Guide*.

TX Matrix Plus Router Software Upgrades and Reinstallation

By default, when you upgrade or reinstall software on the TX Matrix Plus router, the new software image is distributed to the connected T1 600 routers. Software installed on a primary TX Matrix Plus router is distributed to all connected primary T1 600 routers and the backup is distributed to all connected backup routers.

TX Matrix Plus Router Rebooting Process

When you reboot the TX Matrix Plus router master Routing Engine, all the master Routing Engines in the connected T1 600 routers reboot. In addition, you can selectively reboot the master Routing Engine or any of the connected T1 600 routers.

TX Matrix Plus Router Routing Engine Rebooting Sequence

The Routing Engines on the TX Matrix Plus router (or switch-fabric chassis) and T1 600 routers (or line-card chassis) in the routing matrix boot from the storage media in this order: the USB device (if present), the CompactFlash card (if present), the disk (if present) in slot 1, and then the LAN.

TX Matrix Plus Router Management Ethernet Interface

The management Ethernet interface used for the TX Matrix Plus router and the T1 600 routers in a routing matrix is **em0**. This interface provides an out-of-band method for connecting to the routers in the routing matrix. The JUNOS Software automatically creates the router's management Ethernet interface, **em0**. To use **em0** as a management port, you must configure its logical port, **em0.0**, with a valid IP address.



NOTE:

- The Routing Engines in the TX Matrix Plus router and in the T1 600 routers configured in a routing matrix do not support the management Ethernet interface **fxp0** or the internal Ethernet interfaces **fxp1** or **fxp2**.
 - Automated scripts that have been developed for standalone T1 600 routers (T1 600 routers not configured in a routing matrix) might contain references to the **fxp0**, **fxp1**, or **fxp2** interfaces. Before reusing the scripts on T1 600 routers in a routing matrix, edit any command lines that reference the T1 600 router management Ethernet interface **fxp0** by replacing “**fxp0**” with “**em0**”.
-

TX Matrix Plus Router Internal Ethernet Interfaces

On a TX Matrix Plus router, the Routing Engine (RE-TXP-SFC) and Control Board (TXP-CB) function as a unit, or host subsystem. For each host subsystem in the router, the JUNOS Software automatically creates two internal Ethernet interfaces, `ixgbe0` and `ixgbe1`, for the two 10-Gigabit Ethernet ports on the Routing Engine.

Routing Matrix-Based T1600 Router Internal Ethernet Interfaces

On a T1600 router configured in a routing matrix, the Routing Engine (RE-TXP-LCC) and Control Board (LCC-CB) function as a unit, or host subsystem. For each host subsystem in the router, the JUNOS Software automatically creates two internal Ethernet interfaces, `bcm0` and `em1`, for the two Gigabit Ethernet ports on the Routing Engine.

For more information about the management Ethernet interface and internal Ethernet interfaces on a TX Matrix Plus router and T1600 routers configured in a routing matrix, see the *JUNOS Network Interfaces Configuration Guide*.

Committing Configurations on the TX Matrix Plus Router

In a routing matrix composed of a TX Matrix Plus router and T1600 routers, all configuration must be performed on the TX Matrix Plus router. Any configuration you commit on a T1600 router is not propagated to the TX Matrix Plus router or other T1600 routers. Only configuration changes you commit on the TX Matrix Plus router are propagated to all T1600 routers. A commit on a TX Matrix Plus router overrides any changes you commit on a T1600 router.

If you issue the `commit` command, you commit the configuration to all the master Routing Engines in the routing matrix.

```
user@host# commit
sfc-re0:
configuration check succeeds
lcc0-re0:
commit complete
lcc1-re0:
commit complete
sfc-re0:
commit complete
```



NOTE: If a commit operation fails on any node, then the commit operation is not completed for the entire TX Matrix Plus router.

If you issue the `commit synchronize` command on the TX Matrix Plus router, you commit the configuration to all the master and backup Routing Engines in the routing matrix.

```
user@host# commit synchronize
sfc-re0:
```

```

configuration check succeeds
lcc0-re1:
commit complete
lcc0-re0:
commit complete
lcc1-re1:
commit complete
lcc1-re0:
commit complete
sfc-re1:
commit complete
sfc-re0:
commit complete

```

Routing Matrix Configuration Groups

For routers that include two Routing Engines, you can specify two special group names—**re0** and **re1**. These two special group names apply to the Routing Engines in slots 0 and 1 of the TX Matrix Plus router. In addition, the routing matrix supports group names for the Routing Engines for each T1600 router: **lcc *n*-re0** and **lcc *n*-re1**. *n* identifies a T1600 router from 0 through 3.

Routing Matrix System Log Messages

You configure the T1600 routers to forward their system log messages to the TX Matrix Plus router at the **[edit system syslog host sfc0-master]** hierarchy level. For information about how to configure system log messages on a routing matrix based on the TX Matrix Plus router or the T1600 routers, see “Configuring System Logging for a TX Matrix Plus Router” on page 160.

Using the JUNOS Software to Configure a T1600 Router Within a Routing Matrix

A routing matrix composed of a TX Matrix Plus router and T1600 routers supports the same chassis configuration statements as a standalone router (except **ce1**, **ct3**, **mlfr-uni-nni-bundles**, **sparse-dlcis**, and **vtmapping**). By including the **lcc** statement at the **[edit chassis]** hierarchy level, you configure PIC-specific features, such as framing, on specific T1600 routers. In addition, a TX Matrix Plus router has two more chassis configuration statements, **online-expected** and **offline**.

To configure a T1600 router that is connected to a TX Matrix Plus router, include the **lcc** statement at the **[edit chassis]** hierarchy level:

```

[edit chassis]
lcc number;

```

number can be 0 through 3.

To configure a T1600 router within a routing matrix, include the following statements at the **[edit chassis lcc *number*]** hierarchy level:

```

[edit chassis lcc number]
fpc slot-number { # Use the hardware FPC slot number
pic pic-number {

```

```

atm-cell-relay-accumulation;
atm-l2circuit-mode (cell | aal5 | trunk trunk);
framing (sdh | sonet);
idle-cell-format {
    itu-t;
    payload-pattern payload-pattern-byte;
}
max-queues-per-interface (8 | 4);
no-concatenate;
}
offline;
online-expected;
q-pic-large-buffer {
    large-scale;
}

```



NOTE: For the FPC slot number, specify the actual hardware slot number (numbered 0 through 7) as labeled on the T1600 router chassis. Do not use the corresponding software FPC number shown in the “TX Matrix Plus Router Chassis and Interface Names” on page 769.

For information about how to configure the **online-expected** and **offline** configuration statements, see “Configuring the JUNOS Software to Enable the TX Matrix Plus Router to Generate an Alarm If a T1600 Router Stays Offline” on page 770.

TX Matrix Plus Router Chassis and Interface Names

The output from some CLI commands uses the terms SFC and **sfc** (for *switch-fabric chassis*) to refer to the TX Matrix Plus router. Similarly the terms LCC, and **lcc** as a prefix (for *line-card chassis*) refer to a T1600 router in a routing matrix composed of a TX Matrix Plus router and T1600 routers.

T1600 routers are assigned LCC index numbers, 0 through 3, depending on the hardware setup of the routing matrix. The current supported configuration of the routing matrix, can have up to four T1600 routers, and each T1600 router has up to eight FPCs. Therefore, the routing matrix can have up to 32 FPCs (0 through 31). The FPCs are configured at the [edit chassis lcc *number*] hierarchy level.

In the JUNOS CLI, an interface name has the following format:

type-fpc/pic/port

When you specify the FPC number, the JUNOS Software determines which T1600 router contains the specified FPC based on the following assignment:

- On LCC 0, FPC hardware slots 0 through 7 correspond to FPC software numbers 0 through 7.
- On LCC 1, FPC hardware slots 0 through 7 correspond to FPC software numbers 8 through 15.

- On LCC 2, FPC hardware slots 0 through 7 correspond to FPC software numbers 16 through 23.
- On LCC 3, FPC hardware slots 0 through 7 correspond to FPC software numbers 24 through 31.

To convert FPC numbers in the T1600 routers to the correct FPC in a routing matrix, use the conversion chart shown in Table 54 on page 770. You can use the converted FPC number to configure the interfaces on the TX Matrix Plus router in your routing matrix.

Table 54: T1600 Router to Routing Matrix FPC Conversion Chart

FPC Numbering	T1600 Routers							
LCC 0								
T1600 Router FPC Slots	0	1	2	3	4	5	6	7
Routing Matrix FPC Slots Equivalent	0	1	2	3	4	5	6	7
LCC 1								
T1600 Router FPC Slots	0	1	2	3	4	5	6	7
Routing Matrix FPC Slots Equivalent	8	9	10	11	12	13	14	15
LCC 2								
T1600 Router FPC Slots	0	1	2	3	4	5	6	7
Routing Matrix FPC Slots Equivalent	16	17	18	19	20	21	22	23
LCC 3								
T1600 Router FPC Slots	0	1	2	3	4	5	6	7
Routing Matrix FPC Slots Equivalent	24	25	26	27	28	29	30	31

For example, in a routing matrix that contains lcc 0 through lcc 2, so-20/0/1 refers to FPC slot 4 of lcc 2.

Configuring the JUNOS Software to Enable the TX Matrix Plus Router to Generate an Alarm If a T1600 Router Stays Offline

By default, the JUNOS Software enables all the T1600 routers in the routing matrix to come online. The JUNOS Software also enables you to configure all the T1600 routers so that if they do not come online, an alarm is sent by the TX Matrix Plus router.

To configure this alarm, include the `online-expected` statement at the `[edit chassis lcc number]` hierarchy level:

```
[edit chassis lcc number]  
online-expected;
```

If you do not want a T1600 router to be part of the routing matrix, you can configure it to be offline. This is useful when you are performing maintenance on a T1600 router. When the T1600 router is ready to come back online, delete the **offline** configuration statement.

To configure a T1600 router so that it is offline, include the **offline** statement at the `[edit chassis lcc number]` hierarchy level:

```
[edit chassis lcc number]  
offline;
```



NOTE: If you do not configure the **online-expected** or **offline** statement, any T1600 router that is part of the routing matrix is allowed to come online. However, if a T1600 router does not come online, the TX Matrix Plus router does not generate an alarm.

Chapter 19

Summary of Router Chassis Configuration Statements

The following topics explain each of the chassis configuration statements. The statements are organized alphabetically.

adaptive-services

Syntax adaptive-services {
 (layer-2 | layer-3);
 }

Hierarchy Level [edit chassis fpc *slot-number* pic *pic-number*]

Release Information Statement introduced before JUNOS Release 7.4.

Description Enable a service package on adaptive services interfaces.

Options The statements are explained separately.

Usage Guidelines See “Configuring the JUNOS Software to Enable Service Packages on Adaptive Services Interfaces” on page 727 and “Configuring the JUNOS Software to Support Layer 2 Services on MX Series Ethernet Services Routers with MS-DPCs” on page 728.

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

Related Topics *JUNOS Services Interfaces Configuration Guide* and *JUNOS Feature Guide*

aggregate-ports

Syntax	aggregate-ports;
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i>]
Release Information	Statement introduced in JUNOS Release 8.1.
Description	For T Series routers only, specify OC768-over-OC192 mode on the 4-port OC192C PIC. Four OC192 links are aggregated into one OC768 link with one logical interface.
Usage Guidelines	See <i>JUNOS Interfaces Network Operations Guide</i> .
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

aggregated-devices

Syntax	<pre> aggregated-devices { ethernet { device-count <i>number</i>; lacp { link-protection { non-revertive; } system-priority; } } sonet { device-count <i>number</i>; } } </pre>
Hierarchy Level	[edit chassis]
Release Information	Statement introduced before JUNOS Release 7.4. Support for LACP link protection and system priority introduced in JUNOS Release 9.3.
Description	Configure properties for aggregated devices on the router.
Options	The statements are explained separately.
Usage Guidelines	See “Configuring the JUNOS Software for Supporting Aggregated Devices” on page 683.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

alarm

Syntax alarm {
 interface-type {
 alarm-name (red | yellow | ignore);
 }
 }

Hierarchy Level [edit chassis]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure the chassis alarms and whether they trigger a red or yellow alarm, or whether they are ignored. Red alarm conditions light the **RED ALARM** LED on the router's craft interface and trigger an audible alarm if one is connected to the contact on the craft interface. Yellow alarm conditions light the **YELLOW ALARM** LED on the router's craft interface and trigger an audible alarm if one is connected to the craft interface.

To configure more than one alarm, include multiple *alarm-name* lines.

Options *alarm-name*—Alarm condition. For a list of conditions, see Table 39 on page 695.

ignore—The specified alarm condition does not set off any alarm.

interface-type—Type of interface on which you are configuring the alarm. It can be one of the following: **atm**, **ethernet**, **sonet**, or **t3**.

red—The specified alarm condition sets off a red alarm.

yellow—The specified alarm condition sets off a yellow alarm.

Usage Guidelines See “Chassis Conditions That Trigger Alarms” on page 696.

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

atm-cell-relay-accumulation

Syntax	atm-cell-relay-accumulation;
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i>], [edit chassis lcc <i>number</i> fpc <i>slot-number</i> pic <i>pic-number</i>] (Routing Matrix)
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure an Asynchronous Transfer Mode (ATM) Physical Interface Card (PIC) in cell-relay accumulation mode.
Usage Guidelines	See “Configuring the JUNOS Software to Use ATM Cell-Relay Accumulation Mode on an ATM1 PIC” on page 686.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ TX Matrix Router and T640 Router Configuration Overview on page 756 ■ TX Matrix Plus Router and T1600 Router Configuration Overview on page 764

atm-l2circuit-mode

Syntax	atm-l2circuit-mode (cell aal5 trunk <i>trunk</i>);
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i>], [edit chassis lcc <i>number</i> fpc <i>slot-number</i> pic <i>pic-number</i>] (Routing Matrix)
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the ATM2 intelligent queuing (IQ) Layer 2 circuit transport mode.
Default	aal5
Options	<p>aal5—Tunnel a stream of ATM cells encoded with ATM Adaptation Layer (AAL5) over an IP Multiprotocol Label Switching (MPLS) backbone.</p> <p>cell—Tunnel a stream of ATM cells over an IP MPLS backbone.</p> <p>trunk <i>trunk</i>—Transport ATM cells over an MPLS core network that is implemented on some other vendor switches. Trunk mode can be UNI or NNI.</p>



NOTE: To determine which vendors support Layer 2 circuit trunk mode, contact Juniper Networks Customer Support.

Usage Guidelines	<ul style="list-style-type: none"> ■ See “Configuring the JUNOS Software to Enable ATM2 Intelligent Queuing Layer 2 Circuit Transport Mode” on page 738
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Topics	<ul style="list-style-type: none"> ■ TX Matrix Router and T640 Router Configuration Overview on page 756 ■ TX Matrix Plus Router and T1600 Router Configuration Overview on page 764

bandwidth

Syntax bandwidth (1g | 10g);

Hierarchy Level [edit chassis fpc *slot-number* pic *number* tunnel-services]

Release Information Statement introduced in JUNOS Release 8.2.

Description On the MX Series Ethernet Services routers only, specify the amount of bandwidth to reserve for tunnel services.

Options 1g—Specify a bandwidth of 1 Gbps on the Packet Forwarding Engine connected to a Gigabit Ethernet 40-port Dense Port Concentrator (DPC).

10g—Specify a bandwidth of 10 Gbps on the Packet Forwarding Engine connected to 10-Gigabit Ethernet 4-port DPC.



NOTE: If you specify a bandwidth that is not compatible with the type of DPC and Packet Forwarding Engine, tunnel services are not activated. For example, you cannot specify a bandwidth of 1 Gbps for a Packet Forwarding Engine on a 10-Gigabit Ethernet 4-port DPC.

Usage Guidelines See “Configuring the JUNOS Software to Support Tunnel Interfaces on MX Series Ethernet Services Routers” on page 740.

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

ce1

Syntax	<pre>ce1 { e1 port-number { channel-group group-number timeslots slot-number; } }</pre>
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure channelized E1 port and channel specifications.
Options	<p><i>port-number</i>—Any valid E1 port number on the host system.</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Support Channel Groups and Time Slots for Channelized E1 PICs” on page 736.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>

channel-group

Syntax	channel-group <i>group-number</i> ;
Hierarchy Level	<p>[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> ce1 e1 <i>port-number</i>],</p> <p>[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> ct3 port <i>port-number</i> t1 <i>link-number</i>]</p>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the DS0 channel number.
Options	<p><i>group-number</i>—DS0 channel group.</p> <p>Range: 0 through 7 for DS0 naming, and 0 through 23 for E1 naming.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Support Channelized DS3-to-DS0 Naming for Channel Groups and Time Slots” on page 733 and “Configuring the JUNOS Software to Support Channel Groups and Time Slots for Channelized E1 PICs” on page 736.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>

chassis

Syntax	chassis { ... }
Hierarchy Level	[edit]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure router chassis properties.
Usage Guidelines	See “Router Chassis Configuration Statements” on page 679.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

config-button

Syntax	config-button { no-clear; no-rescue; }
Hierarchy Level	[edit chassis]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	(J Series Services Routers only) Configure the CONFIG button on the router to prevent resetting the router to the factory default or rescue configuration.
Options	<p>no-clear—Prevent resetting the router to the factory default configuration. You can still press and quickly release the button to reset to the rescue configuration (if one was set previously).</p> <p>no-rescue—Prevent resetting the router to the rescue configuration. You can still press and hold the button for more than 15 seconds to reset to the factory default configuration.</p> <p>When both the no-clear and no-rescue statements are present, the CONFIG button is deactivated for all types of reset.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Prevent the Resetting of the Factory Default or Rescue Configuration During Current Configuration Failure on J Series Routers” on page 750.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

craft-lockout

Syntax	craft-lockout;
Hierarchy Level	[edit chassis]
Release Information	Statement introduced in JUNOS Release 8.1.
Description	Disable the physical operation of the craft interface front panel.
Usage Guidelines	See “Configuring the JUNOS Software to Disable the Physical Operation of the Craft Interface” on page 727.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

ct3

Syntax	<pre>ct3 { port <i>port-number</i> { t1 <i>link-number</i> { channel-group <i>group-number</i> timeslots <i>slot-number</i>; } } }</pre>
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure channelized T3 port and channel specifications.
Options	<p>port <i>port-number</i>—Any valid T3 port number on the host system.</p> <p>t1 <i>link-number</i>—T1 link. Range: 0 through 27</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Support Channelized DS3-to-DS0 Naming for Channel Groups and Time Slots” on page 733.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

device-count

Syntax	device-count <i>number</i> ;
Hierarchy Level	[edit chassis aggregated-devices ethernet]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the number of aggregated logical devices available to the router.
Usage Guidelines	See “Configuring the JUNOS Software for Supporting Aggregated Devices” on page 683.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

disk-failure-action

Syntax	disk-failure-action (halt reboot);
Hierarchy Level	[edit chassis routing-engine on-disk-failure]
Release Information	Statement introduced in JUNOS Release 9.0.
Description	On M7i and M10i routers only, configure the Routing Engine to halt or reboot when the Routing Engine hard disk fails.
Options	halt—Specify the Routing Engine to halt. reboot—Specify the Routing Engine to reboot.
Usage Guidelines	See “Configuring the JUNOS Software to Enable a Routing Engine to Reboot on Hard Disk Errors” on page 749.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

e1

Syntax	<code>e1 <i>port-number</i> { channel-group <i>group-number</i> timeslots <i>slot-number</i>; }</code>
Hierarchy Level	<code>[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> ce1]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the channelized E1 port number on the PIC. The range is from 0 through 9.
Usage Guidelines	See “Configuring the JUNOS Software to Support Channel Groups and Time Slots for Channelized E1 PICs” on page 736.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

ethernet

Syntax	<code>ethernet { device-count <i>number</i>; lACP { link-protection { non-revertive; } } system-priority; }</code>
Hierarchy Level	<code>[edit chassis aggregated-devices]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure properties for Ethernet aggregated devices on the router.
Usage Guidelines	See “Configuring the JUNOS Software for Supporting Aggregated Devices” on page 683.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

family

Syntax

```
family {
  inet {
    layer-3;
    layer-4;
    symmetric-hash {
      complement;
    }
  }
  multiservice {
    source-mac;
    destination-mac;
    payload {
      ip {
        layer-3;
        layer-4;
      }
    }
    symmetric-hash {
      complement;
    }
  }
}
```

Hierarchy Level [edit chassis fpc *slot-number* pic *pic-number* hash-key]

Release Information Statement introduced in JUNOS Release 9.6.

Description (MX Series Ethernet Services routers only) Configure data used in a hash key for a specific protocol family when configuring PIC-level symmetrical load balancing on an 802.3ad Link Aggregation Group.

Options **inet**—Configure data used in a hash key for the **inet** protocol family.

multiservice—Configure data used in a hash key for the **multiservice** protocol family.

Usage Guidelines See “Configuring PIC-Level Symmetrical Hashing for Load Balancing on 802.3ad LAGs for MX Series Routers” on page 689.

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

fabric upgrade-mode

Syntax	<pre>fabric { upgrade-mode; }</pre>
Hierarchy Level	[edit chassis]
Release Information	Statement introduced in JUNOS Release 7.5.
Description	Configure upgrade mode for SIBs and forces them to operate in the same mode until the upgrade is complete.
Usage Guidelines	See “TX Matrix Router and T640 Router Configuration Overview” on page 756.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

fpc (M320, T320, T640 Routers)

```

Syntax  fpc slot-number {
            pic pic-number {
              ce1 {
                e1 port-number {
                  channel-group group-number timeslots slot-number;
                }
              }
              ct3 {
                port port-number {
                  t1 link-number {
                    channel-group group-number timeslots slot-number;
                  }
                }
              }
            }
            framing (sdh | sonet);
            idle-cell-format {
              itu-t;
              payload-pattern payload-pattern-byte;
            }
            max-queues-per-interface (8 | 4);
            no-concatenate;
            q-pic-large-buffer (large-scale | small-scale);
          }

```

Hierarchy Level [edit chassis]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure properties for the PICs in individual Flexible PIC Concentrators (FPCs).

Options *slot-number*—Slot number in which the FPC is installed.
Range: 0 through 7

The remaining statements are explained separately.

Usage Guidelines See “Configuring the JUNOS Software to Enable SONET/SDH Framing for SONET/SDH PICs” on page 729 and “Configuring the JUNOS Software to Enable a SONET PIC to Operate in the Channelized (Multiplexed) Mode” on page 732.

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

fpc (MX Series Ethernet Services Routers)

Syntax `fpc slot-number {
 pic number {
 port-mirror-instance port-mirroring-instance-name-pic-level;
 tunnel-services {
 bandwidth (1g | 10g)
 }
 }
 port-mirror-instance port-mirroring-instance-name-fpc-level;
 }`

Hierarchy Level [edit chassis]

Release Information Statement introduced in JUNOS Release 8.2.
 port-mirror-instance option introduced in JUNOS Release 9.3.

Description On MX Series Ethernet Services Routers only, configure properties for the DPC and corresponding Packet Forwarding Engines to create tunnel interfaces.

Configure a port-mirroring instance for the DPC and its corresponding Packet Forwarding Engines.

Options *slot-number*—Specify the slot number of the DPC.

Range: 0 through 11

pic number—Specify the number of the Packet Forwarding Engine. Each DPC includes four Packet Forwarding Engines.

Range: 0 through 4

port-instance-name port-mirroring-instance-name-fpc-level—Associate a port-mirroring instance with the DPC and its corresponding PICs. The port-mirroring instance is configured under the [edit forwarding-options port-mirroring] hierarchy level.

The remaining statements are explained separately.

Usage Guidelines See “Configuring the JUNOS Software to Support Tunnel Interfaces on MX Series Ethernet Services Routers” on page 740 and “Configuring Port-Mirroring Instances on MX Series Ethernet Services Routers” on page 687.

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

fpc (TX Matrix and TX Matrix Plus Routers)

Syntax	<pre>fpc slot-number { pic pic-number { atm-cell-relay-accumulation; atm-l2circuit-mode (cell aal5 trunk <i>trunk</i>); framing (sdh sonet); idle-cell-format { itu-t; payload-pattern <i>payload-pattern-byte</i>; } max-queues-per-interface (8 4); no-concatenate; q-pic-large-buffer (large-scale small-scale); } }</pre>
Hierarchy Level	[edit chassis lcc <i>number</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	On a TX Matrix or TX Matrix Plus router, configure properties for the PICs in individual FPCs.
Options	<p><i>slot-number</i>—Slot number in which the FPC is installed.</p> <p>Range: 0 through 7</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Enable SONET/SDH Framing for SONET/SDH PICs” on page 729, “TX Matrix Router Chassis and Interface Names” on page 760, and “TX Matrix Plus Router Chassis and Interface Names” on page 769.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Topics	<ul style="list-style-type: none"> ■ TX Matrix Router and T640 Router Configuration Overview on page 756 ■ TX Matrix Plus Router and T1600 Router Configuration Overview on page 764

fpc-feb-connectivity

Syntax	fpc-feb-connectivity { fpc <i>number</i> feb (<i>slot-number</i> none); }
Hierarchy Level	[edit chassis]
Release Information	Statement introduced in JUNOS Release 8.0.
Description	On the M120 router only, configure a connection between any Flexible PIC Concentrator (FPC) and any Forwarding Engine Board (FEB).
Options	<p>fpc <i>number</i>—Specify the FPC slot number. Range: 0 through 5</p> <p>feb <i>slot-number</i>—Specify the FEB slot number. Range: : 0 through 5</p> <p>none—Disconnects the FPC from the FEB.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Support FPC to FEB Connectivity on M120 Routers” on page 747.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>

framing

Syntax	framing (sdh sonet);
Hierarchy Level	<p>[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i>],</p> <p>[edit chassis lcc <i>number</i> fpc <i>slot-number</i> pic <i>pic-number</i>] (Routing Matrix)</p>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	On SONET/SDH PICs only, configure the framing type.
Default	sonet
Options	<p>sdh—SDH framing.</p> <p>sonet—SONET framing.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Enable SONET/SDH Framing for SONET/SDH PICs” on page 729.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>

hash-key

```

Syntax  hash-key {
            family {
              inet {
                layer-3;
                layer-4;
                symmetric-hash {
                  complement;
                }
              }
            }
            multiservice {
              source-mac;
              destination-mac;
              payload {
                ip {
                  layer-3 (source-ip-only | destination-ip-only);
                  layer-4;
                }
              }
            }
          }

```

Hierarchy Level [edit chassis fpc *slot-number* pic *pic-number*]

Release Information Statement introduced in JUNOS Release 9.6.

Description (MX Series Ethernet Services routers only) Configure data used in a hash key for a PIC for symmetrical load balancing on an 802.3ad Link Aggregation Group.

Options family—Configure data used in a hash key for a protocol family. This statement has the following suboptions:

- **inet**—Configure data used in a hash key for the **inet** protocol family.
- **multiservice**—Configure data used in a hash key for the **multiservice** protocol family.

Usage Guidelines See “Configuring PIC-Level Symmetrical Hashing for Load Balancing on 802.3ad LAGs for MX Series Routers” on page 689.

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

idle-cell-format

Syntax	idle-cell-format { itu-t; payload-pattern <i>payload-pattern-byte</i> ; }
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> idle-cell-format], [edit chassis lcc <i>number</i> fpc <i>slot-number</i> pic <i>pic-number</i> idle-cell-format] (Routing Matrix)
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For ATM2 PICs only, configure the format of the idle cell header and payload bytes.
Options	<p>itu-t—Configure the idle cell header to use the International Telecommunications Union (ITU-T) standard of 0x00000001.</p> <p>Default: (4 bytes): 0x00000000</p> <p><i>payload-pattern-byte</i>—Configure the idle cell payload pattern. The payload pattern byte can range from 0x00 through 0xff.</p> <p>Default: cell payload (48 bytes)</p>
Usage Guidelines	See “Configuring the JUNOS Software to Enable Idle Cell Format and Payload Patterns for ATM Devices” on page 745.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Topics	<ul style="list-style-type: none"> ■ TX Matrix Router and T640 Router Configuration Overview on page 756 ■ TX Matrix Plus Router and T1600 Router Configuration Overview on page 764

inet

Syntax

```
family {
  inet {
    layer-3;
    layer-4;
    symmetric-hash {
      complement;
    }
  }
}
```

Hierarchy Level [edit chassis fpc *slot-number* pic *pic-number* hash-key family]

Release Information Statement introduced in JUNOS Release 9.6.

Description (MX Series Ethernet Services routers only) Configure data used in a hash key for the `inet` protocol family when configuring PIC-level symmetrical load balancing on an 802.3ad Link Aggregation Group.

Options `layer-3`—Include Layer 3 IP data in the hash key.

`layer-4`—Include Layer 4 IP data in the hash key.

`symmetric-hash`—Configure symmetric hash key with source and destination ports.

Usage Guidelines “Configuring PIC-Level Symmetrical Hashing for Load Balancing on 802.3ad LAGs for MX Series Routers” on page 689

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

lacp

Syntax lacp {
 link-protection {
 non-revertive;
 }
 system-priority *priority*;
 }

Hierarchy Level [edit chassis aggregated-devices ethernet]

Release Information Statement introduced in JUNOS Release 9.3.

Description For aggregated Ethernet interfaces only, configure Link Aggregation Control Protocol (LACP) parameters at the global level for use by LACP at the interface level.

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

Related Topics ■ Configuring the JUNOS Software for Supporting Aggregated Devices on page 683

lcc

Syntax `lcc number {`
 `fpc slot-number {`
 `pic pic-number {`
 `atm-cell-relay-accumulation;`
 `atm-l2circuit-mode (cell | aal5 | trunk trunk);`
 `framing (sdh | sonet);`
 `idle-cell-format {`
 `itu-t;`
 `payload-pattern payload-pattern-byte;`
 `}`
 `max-queues-per-interface (8 | 4);`
 `no-concatenate;`
 `}`
 `}`
 `online-expected;`
 `offline;`
 `}`
 `q-pic-large-buffer {`
 `large-scale;`
 `}`
`}`

Hierarchy Level [edit chassis]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure a T640 router on a routing matrix.

Options *number*—Specifies a T640 router on a routing matrix.
Range: 0 through 3

The remaining statements are explained separately.

Usage Guidelines For a TX Matrix router, see “TX Matrix Router and T640 Router Configuration Overview” on page 756 and “Using the JUNOS Software to Configure a T640 Router Within a Routing Matrix” on page 759.

For a TX Matrix Plus router, see “TX Matrix Plus Router and T1600 Router Configuration Overview” on page 764 and “Using the JUNOS Software to Configure a T1600 Router Within a Routing Matrix” on page 768.

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

Related Topics

- *TX Matrix Router Hardware Guide*
- *TX Matrix Plus Router Hardware Guide*

link-protection

Syntax	link-protection { non-revertive; }
Hierarchy Level	[edit chassis aggregated-devices ethernet lacp]
Release Information	Statement introduced in JUNOS Release 9.3.
Description	Enable LACP link protection at the global (chassis) level.
Options	The statements are explained separately.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ Configuring the JUNOS Software for Supporting Aggregated Devices on page 683

max-queues-per-interface

Syntax	max-queues-per-interface (8 4);
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i>], [edit chassis lcc <i>number</i> fpc <i>slot-number</i> pic <i>pic-number</i>] (Routing Matrix)
Release Information	Statement introduced before JUNOS Release 7.4.
Description	On M320, T320, T640 , TX Matrix, and TX Matrix Plus routers, configure eight egress queues on IQ interfaces.
Usage Guidelines	See “Configuring the JUNOS Software to Support Eight Queues on IQ Interfaces for T Series and M320 Routers” on page 735.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Topics	■ TX Matrix Router and T640 Router Configuration Overview on page 756 ■ TX Matrix Plus Router and T1600 Router Configuration Overview on page 764

mlfr-uni-nni-bundles

Syntax	mlfr-uni-nni-bundles <i>number</i> ;
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure link services management properties.
Options	<i>number</i> —Number of Multilink Frame Relay user-to-network interface network-to-network interface (UNI-NNI) (FRF.16) bundles to allocate on a Link Services PIC. Range: 1 through 128 Default: 16
Usage Guidelines	See “Configuring the JUNOS Software to Support the Link Services PIC” on page 744. See also the <i>JUNOS Network Interfaces Configuration Guide</i> .
Required Privilege Level	chassis—To view this statement in the configuration. chassis-control—To add this statement to the configuration.

multiservice

Syntax

```
multiservice {
  source-mac;
  destination-mac;
  payload {
    ip {
      layer-3 (source-ip-only | destination-ip-only);
      layer-4;
    }
  }
  symmetric-hash {
    complement;
  }
}
```

Hierarchy Level [edit chassis fpc *slot-number* pic *pic-number* hash-key family]

Release Information Statement introduced in JUNOS Release 9.6.

Description (MX Series Ethernet Services routers only) Configure data used in a hash key for the multiservice protocol family when configuring PIC-level symmetrical hashing for load balancing on an 802.3ad Link Aggregation Group.

Options

- destination-mac**—Include destination MAC address in the hash key.
- payload**—Include payload data in the hash key.
- source-mac**—Include source MAC address in the hash key.
- symmetric-hash**—Create a symmetric hash or symmetric hash complement key with any attribute.

Usage Guidelines See “Configuring PIC-Level Symmetrical Hashing for Load Balancing on 802.3ad LAGs for MX Series Routers” on page 689.

Required Privilege Level

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

network-services

Syntax	network-services (ethernet ip);
Hierarchy Level	[edit chassis]
Release Information	Statement introduced before JUNOS Release 8.5.
Description	Use the set network-services statement to set the router's network services to either Ethernet or to Internet Protocol (IP).
Options	ethernet—Set the router's network services to Ethernet. ip—Set the router's network services to Internet Protocol.
Usage Guidelines	See “Configuring the JUNOS Software to Run in the IP and Ethernet Services Mode in MX Series Routers” on page 754.
Required Privilege Level	chassis—To view this statement in the configuration. chassis-control—To add this statement to the configuration.

no-concatenate

Syntax	no-concatenate;
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i>], [edit chassis lcc <i>number</i> fpc <i>slot-number</i> pic <i>pic-number</i>] (Routing Matrix)
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>Do not concatenate (multiplex) the output of a SONET/SDH PIC (an interface with a name <i>so-fpc/pic/port</i>).</p> <p>When configuring and displaying information about interfaces that are operating in channelized mode, you must specify the channel number in the interface name (<i>physical:channel</i>); for example, <i>so-2/2/0:0</i> and <i>so-2/2/0:1</i>.</p> <p>On SONET OC48 interfaces that are configured for channelized (multiplexed) mode, the bytes e1-quiet and bytes f1 options in the sonet-options statement have no effect. The bytes f2, bytes z3, bytes z4, and path-trace options work correctly on channel 0. They work in the transmit direction only on channels 1, 2, and 3.</p>
Default	Output is concatenated (multiplexed).
Usage Guidelines	See “Configuring the JUNOS Software to Enable a SONET PIC to Operate in the Channelized (Multiplexed) Mode” on page 732.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Topics	<ul style="list-style-type: none"> ■ <i>JUNOS Network Interfaces Configuration Guide</i> <ul style="list-style-type: none"> ■ TX Matrix Router and T640 Router Configuration Overview on page 756 ■ TX Matrix Plus Router and T1600 Router Configuration Overview on page 764 ■ TX Matrix Router and T640 Router Configuration Overview on page 756

non-revertive

Syntax	non-revertive;
Hierarchy Level	[edit chassis aggregated-devices ethernet lacp link-protection]
Release Information	Statement introduced in JUNOS Release 9.3.
Description	Disable the ability to switch to a better priority link (if one is available) once a link is established as active and a collection or distribution is enabled.
Required Privilege Level	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
Related Topics	■ Configuring the JUNOS Software for Supporting Aggregated Devices on page 683

offline

Syntax	offline;
Hierarchy Level	[edit chassis lcc <i>number</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(Routing matrix based on the TX Matrix and TX Matrix Plus routers only) On a TX Matrix router, configure a T640 router so that it is not part of the routing matrix. On a TX Matrix Plus router, configure a T1600 router so that it is not part of the routing matrix.
Usage Guidelines	For a routing matrix composed of a TX Matrix router and T640 routers, see “Configuring the JUNOS Software to Enable the TX Matrix Router to Generate an Alarm If a T640 Router Stays Offline” on page 763. For a routing matrix composed of a TX Matrix Plus router and T1600 routers, see “Configuring the JUNOS Software to Enable the TX Matrix Plus Router to Generate an Alarm If a T1600 Router Stays Offline” on page 770.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Topics	■ online-expected ■ TX Matrix Router and T640 Router Configuration Overview on page 756 ■ TX Matrix Plus Router and T1600 Router Configuration Overview on page 764

route-memory-enhanced

Syntax	route-memory-enhanced;
Hierarchy Level	[edit chassis]
Release Information	Statement added in JUNOS Release 9.6.
Description	(All MX Series and M120 routers, M320 routers with Enhanced III FPC1, Enhanced III FPC2, and Enhanced III FPC3, M10i and M7i routers with Enhanced CFEB) Reallocate the jtree memory on the Packet Forwarding Engine to allocate more memory for routing tables.
Usage Guidelines	See “Configuring the JUNOS Software to Allocate More Memory for Routing Tables” on page 742
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

on-disk-failure

Syntax	on-disk-failure { disk-failure-action (halt reboot); }
Hierarchy Level	[edit chassis routing-engine]
Release Information	Statement introduced before JUNOS Release 7.4. The disk-failure-action statement added in JUNOS Release 9.0.
Description	Instruct the router to halt or reboot if it detects hard disk errors on the Routing Engine.
Options	The remaining statement is explained separately.
Usage Guidelines	See “Configuring the JUNOS Software to Enable a Routing Engine to Reboot on Hard Disk Errors” on page 749.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

online-expected

Syntax	online-expected;
Hierarchy Level	[edit chassis lcc <i>number</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	(TX Matrix and TX Matrix Plus routing matrix only) On a TX Matrix router, configure a T640 router so that if it does not come online, an alarm is sent to the TX Matrix router. On a TX Matrix Plus router, configure a T1600 router so that if it does not come online, an alarm is sent to the TX Matrix Plus router.
Usage Guidelines	<p>For a TX Matrix router, see “Configuring the JUNOS Software to Enable the TX Matrix Router to Generate an Alarm If a T640 Router Stays Offline” on page 763.</p> <p>For a TX Matrix Plus router, see “Configuring the JUNOS Software to Enable the TX Matrix Plus Router to Generate an Alarm If a T1600 Router Stays Offline” on page 770.</p>
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Topics	<ul style="list-style-type: none"> ■ offline ■ TX Matrix Router and T640 Router Configuration Overview on page 756 ■ TX Matrix Plus Router and T1600 Router Configuration Overview on page 764

packet-scheduling

Syntax (packet-scheduling | no-packet-scheduling);

Hierarchy Level [edit chassis]

Release Information Statement introduced before JUNOS Release 7.4.

Description Enable packet-scheduling mode, in which the Packet Director application-specific integrated circuit (ASIC) schedules packet dispatches to compensate for transport delay differences. This preserves the interpacket gaps as the packets are distributed from the Packet Director ASIC to the Packet Forwarding Engine.

Default no-packet-scheduling



NOTE: The packet-scheduling feature is available on M1 60 routers only.

Options no-packet-scheduling—Do not schedule packets.

packet-scheduling—Schedule packets to preserve interpacket gaps.

Usage Guidelines See “Configuring the JUNOS Software to Enable an M1 60 Router to Operate in Packet Scheduling Mode” on page 742.

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

payload

Syntax

```
payload {
  ip {
    layer-3;
    layer-4;
  }
}
```

Hierarchy Level [edit chassis fpc *slot-number* pic *pic-number* hash-key family multiservice]

Release Information Statement introduced in JUNOS Release 9.6.

Description (MX Series Ethernet Services routers only) Include payload data in a hash key for the multiservice protocol family when configuring PIC-level symmetrical load balancing on an 802.3ad Link Aggregation Group.

Options ip—Include IPv4 payload data in the hash key. This option has the following suboptions:

- layer-3—Include Layer 3 IP information in the hash key.
- layer-4—Include Layer 4 IP information in the hash key.

Usage Guidelines See “Configuring PIC-Level Symmetrical Hashing for Load Balancing on 802.3ad LAGs for MX Series Routers” on page 689.

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

pem

Syntax	<pre>pem { minimum <i>number</i>; }</pre>
Hierarchy Level	[edit chassis]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Configure the minimum number of PEMs on an M320 router. With this configuration, PEM absent alarms are generated only if the PEM count falls below the minimum specified.
Options	<i>number</i> —Minimum number of PEMs on the router. Range: 0 through 3
Usage Guidelines	See “Configuring the JUNOS Software to Support Entry-Level Configuration on an M320 Router with a Minimum Number of SIBs and PIMs” on page 753.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Topics	■ sib

pic (M Series and T Series Routers)

Syntax

```

pic pic-number {
    ce1 {
        e1 port-number {
            channel-group group-number timeslots slot-number;
        }
    }
    ct3 {
        port port-number {
            t1 link-number {
                channel-group group-number timeslots slot-number;
            }
        }
    }
    framing (sdh | sonet);
    idle-cell format {
        itu-t;
        payload-pattern payload-pattern-byte;
    }
    max-queues-per-interface (8 | 4);
    no-concatenate;
}

```

Hierarchy Level [edit chassis fpc *slot-number*]

Release Information Statement introduced before JUNOS Release 7.4.

Description Configure properties for an individual PIC.

Options *pic-number*—Slot number in which the PIC is installed.
Range: 0 through 3

The remaining statements are explained separately.

Usage Guidelines See “Configuring the JUNOS Software to Enable SONET/SDH Framing for SONET/SDH PICs” on page 729, “Configuring the JUNOS Software to Enable a SONET PIC to Operate in the Channelized (Multiplexed) Mode” on page 732, “Configuring the JUNOS Software to Support Channelized DS3-to-DS0 Naming for Channel Groups and Time Slots” on page 733, and “Configuring the JUNOS Software to Support Channel Groups and Time Slots for Channelized E1 PICs” on page 736.

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

pic (TX Matrix and TX Matrix Plus Routers)

Syntax	<pre> pic <i>pic-number</i> { atm-cell-relay-accumulation; atm-l2circuit-mode (cell aal5 trunk <i>trunk</i>); framing (sdh sonet); idle-cell-format { itu-t; payload-pattern <i>payload-pattern-byte</i>; } max-queues-per-interface (8 4); no-concatenate; q-pic-large-buffer (large-scale small-scale); } </pre>
Hierarchy Level	[edit chassis lcc <i>number</i> fpc <i>slot-number</i>]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	On a TX Matrix or TX Matrix Plus router, configure properties for an individual PIC.
Options	<p><i>pic-number</i>—Slot number in which the PIC is installed.</p> <p>Range: 0 through 3</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Enable SONET/SDH Framing for SONET/SDH PICs” on page 729.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Topics	<ul style="list-style-type: none"> ■ TX Matrix Router and T640 Router Configuration Overview on page 756 ■ TX Matrix Plus Router and T1600 Router Configuration Overview on page 764


port

Syntax	<code>port <i>port-number</i>;</code>
Hierarchy Level	<code>[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> ct3]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the channelized T3 port number on the PIC.
Options	<i>pic-number</i> —Port number. Range: 0 through 1
Usage Guidelines	See “Configuring the JUNOS Software to Support Channelized DS3-to-DS0 Naming for Channel Groups and Time Slots” on page 733.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

power

Syntax	<code>power (off on);</code>
Hierarchy Level	<code>[edit chassis fpc <i>slot-number</i>]</code>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure the Flexible PIC Concentrator (FPC) to stay offline or to come online automatically.
Default	on
Options	off—Take the FPC offline, and configure it to stay offline, as, for example, after a system reboot. on—Bring the FPC online, and configure it to come online automatically, as, for example, after a system reboot.
Usage Guidelines	See “Configuring the JUNOS Software to Make a Flexible PIC Concentrator Stay Offline” on page 682.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

q-pic-large-buffer

Syntax	q-pic-large-buffer (large-scale small-scale); }
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i>] [edit chassis lcc <i>number</i> fpc <i>slot-number</i> pic <i>pic-number</i> (Routing Matrix)]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Configure delay buffers.
<hr/> <div>  <p>NOTE: When you commit the configuration after including the <code>q-pic-large-buffer</code> statement for a PIC, the JUNOS Software temporarily takes the PIC offline and brings it back online before the new configuration is activated and becomes the current operational configuration.</p> </div> <hr/>	
Default	small-scale
Options	<p>large-scale—(Optional) Set the average packet size used to calculate the number of notification queue entries in the IQ PIC to 256 bytes. Useful for slower interfaces (T1, E1, and NxDS0 interfaces configured on Channelized IQ PICs and Gigabit Ethernet VLANs configured on Gigabit Ethernet IQ PICs).</p> <p>small-scale—(Optional) Set the average packet size used to calculate the number of notification queue entries in the IQ PIC to 40 bytes.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Enable Larger Delay Buffers for T1, E1, and DS0 Interfaces Configured on Channelized IQ PICs” on page 751.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Topics	<p><i>JUNOS Class of Service Configuration Guide</i></p> <ul style="list-style-type: none"> ■ TX Matrix Router and T640 Router Configuration Overview on page 756 ■ TX Matrix Plus Router and T1600 Router Configuration Overview on page 764

red-buffer-occupancy

Syntax	<pre>red-buffer-occupancy { weighted-averaged <instant-usage-weight-exponent weight-value>; }</pre>
Hierarchy Level	<pre>[edit chassis fpc slot-number pic pic-number], [edit chassis lcc number fpc slot-number pic pic-number] (Routing Matrix)</pre>
Release Information	Statement introduced in JUNOS Release 8.3.
Description	Configure computation of buffer occupancy weighted RED (WRED) based on weighted-averaging of buffer occupancy on an IQ PIC.
Options	<p>weighted-averaged—Configure weighted-averaging of buffer occupancy on an IQ PIC. This option has the following suboption:</p> <p>instant-usage-weight-exponent weight-value—(Optional) Establish an exponent and instant buffer usage weight value to use for weighted average calculations of buffer occupancy.</p> <p>Range: For IQ PICs, 1 through 31.</p> <p>Values in excess of 31 are configurable, and appear in show commands, but are replaced with the operational maximum value of 31 on IQ PICs.</p>
Usage Guidelines	See the <i>JUNOS Class of Service Configuration Guide</i> .
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>

routing-engine

Syntax	<pre> routing-engine { on-disk-failure { disk-failure-action (halt reboot); } } </pre>
Hierarchy Level	[edit chassis]
Release Information	<p>Statement introduced before JUNOS Release 7.4.</p> <p>The <code>disk-failure-action</code> statement added in JUNOS Release 9.0.</p>
Description	<p>Configure a Routing Engine to halt or reboot automatically when a hard disk error occurs. A hard disk error may cause a Routing Engine to enter a state in which it responds to local pings and interfaces remain up, but no other processes are responding. Rebooting or halting prevents this.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Enable a Routing Engine to Reboot on Hard Disk Errors” on page 749.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Topics	<i>JUNOS High Availability Configuration Guide</i>

sfm

Syntax	<code>sfm slot-number power off;</code>
Hierarchy Level	[edit chassis]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	<p>For routers with SFMs, configure an SFM to stay offline.</p> <p>By default, if you use the <code>request chassis sfm</code> CLI command to take an SFM offline, the SFM will attempt to restart when you enter a <code>commit</code> CLI command. To prevent a restart, configure an SFM to stay offline. This feature is useful for repair situations. The SFM remains offline until you delete this statement.</p>
Options	<p><i>slot-number</i>—Slot number in which the SFM is installed.</p> <p><i>power off</i>—Take the SFM offline and configure it to remain offline.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Make an SFM Stay Offline” on page 683.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Topics	<i>JUNOS High Availability Configuration Guide</i>

service-package

Syntax	service-package (layer-2 layer-3);
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> adaptive-services]
Release Information	Statement introduced before JUNOS Release 7.4. Statement introduced on MX Series Ethernet Services Routers with MS-DPCs in JUNOS Release 9.6.
Description	For adaptive services interfaces, enable a service package on the specified Physical Interface Card (PIC).
Options	layer-2—Enable a Layer 2 service package on the specified PIC. layer-3—Enable a Layer 3 service package on the specified PIC. Default: layer-3 is the default option for the service-package statement.
Usage Guidelines	See “Configuring the JUNOS Software to Enable Service Packages on Adaptive Services Interfaces” on page 727 and “Configuring the JUNOS Software to Support Layer 2 Services on MX Series Ethernet Services Routers with MS-DPCs” on page 728.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Topics	<i>JUNOS Services Interfaces Configuration Guide</i> and <i>JUNOS Feature Guide</i>

sib

Syntax	sib { minimum <i>number</i> ; }
Hierarchy Level	[edit chassis]
Release Information	Statement introduced in JUNOS Release 7.4.
Description	Configure the minimum number of SIBs on an M320 router. With this configuration, SIB absent alarms are generated only if the SIB count falls below the minimum specified.
Options	<i>number</i> —Minimum number of SIBs on the router. Range: 0 through 3
Usage Guidelines	See “Configuring the JUNOS Software to Support Entry-Level Configuration on an M320 Router with a Minimum Number of SIBs and PIMs” on page 753.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Topics	■ pem

sonet

Syntax	sonet { device-count <i>number</i> ; }
Hierarchy Level	[edit chassis aggregated-devices]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure properties for SONET/SDH aggregated devices on the router.
Usage Guidelines	See “Configuring the JUNOS Software for Supporting Aggregated Devices” on page 683.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

sparse-dlcis

Syntax	sparse-dlcis;
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i>];
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Support a full data-link connection identifier (DLCI) range (1 through 1022). This enables you to use circuit cross-connect (CCC) and translation cross-connect (TCC) features by means of Frame Relay on T1 and E1 interfaces.
Usage Guidelines	See the “Configuring the JUNOS Software to Support the Sparse DLCI Mode on Channelized STM1 or Channelized DS3 PICs” on page 732.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

symmetric-hash

Syntax	symmetric-hash { complement; }
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>slot-number</i> hash-key family inet], [edit chassis fpc <i>slot-number</i> pic <i>slot-number</i> hash-key family multiservice]
Release Information	Statement introduced in JUNOS Release 9.6.
Description	(MX Series Ethernet Services routers only) Configure the symmetric hash or symmetric hash complement at the PIC level for configuring symmetrical load balancing on an 802.3ad Link Aggregation Group.
Options	complement—Include the complement of the symmetric hash in the hash key.
Usage Guidelines	See “Configuring PIC-Level Symmetrical Hashing for Load Balancing on 802.3ad LAGs for MX Series Routers” on page 689.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

synchronization

Syntax synchronization {
 primary (external-a | external-b);
 secondary (external-a | external-b);
 signal-type (t1 | e1);
 switching-mode (revertive | non-revertive);
 transmitter-enable;
 validation-interval *seconds*;
 y-cable-line-termination;
 }

Hierarchy Level [edit chassis]

Release Information Statement introduced in JUNOS Release 7.6.
 Statement introduced on the M120 router in JUNOS Release 9.3.

Description (M320, M40e, and M120 routers only) Configure an external synchronization interface to synchronize the internal Stratum 3 clock to an external source, and then synchronize the chassis interface clock to that source.

Options primary—First external timing source specified in the configuration hierarchy. This statement has the following suboptions:

- external-a—Use **external-a** as the primary clock synchronization source.
- external-b—Use **external-b** as the primary clock synchronization source.

secondary—Second external timing source specified in the configuration hierarchy.

- external-a—Use **external-a** as the secondary clock synchronization source.
- external-b—Use **external-b** as the secondary clock synchronization source.

signal-type—Specify the line encoding mode for interfaces: either **t1** or **e1**. For the M40e router, only the **t1** **signal-type** mode is supported.

Default: t1

switching-mode—Specify **revertive** if a lower-priority synchronization can be switched to a valid, higher-priority synchronization.

Default: non-revertive

transmitter-enable— (M320 routers only) Control whether the diagnostic timing signal is transmitted.

validation-interval—Validate the synchronized deviation. If revertive switching is enabled and a higher-priority clock is validated, the clock module is directed to the higher-priority clock, and all configured and active synchronizations are validated. The validation timer resumes after the current validation interval expires.

Range: (M320 and M40e routers) **90** through **86400** seconds (M120 routers) **30** through **86400** seconds

Default: (M320 and M40e routers): 90 seconds (M120 routers):30 seconds

y-cable-line-termination—(M320 routers only) Specify that a single signal be wired to both Control Boards (CBs) using a Y-cable.

Usage Guidelines See “Configuring the JUNOS Software to Support an External Clock Synchronization Interface for the M320, M40e, and M120 Routers” on page 731.

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

system-priority

Syntax	<code>system-priority <i>priority</i>;</code>
Hierarchy Level	[edit chassis aggregated-devices ethernet lacp]
Release Information	Statement introduced in JUNOS Release 9.3.
Description	Define LACP system priority for aggregated Ethernet interfaces at the global (chassis) level.
Options	<p><i>priority</i>—Priority for the aggregated Ethernet system. A smaller value indicates a higher priority.</p> <p>Range: 0 through 65535</p> <p>Default: 127</p>
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Topics	■ Configuring the JUNOS Software for Supporting Aggregated Devices on page 683

t1

Syntax	<pre>t1 <i>link-number</i> { channel-group <i>group-number</i> timeslots <i>slot-number</i>; }</pre>
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> ct3 port <i>port-number</i>];
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure channelized T1 port and channel specifications.
Options	<p><i>link-number</i>—T1 link.</p> <p>Range: 0 through 27 for DS0 naming</p> <p>The remaining statements are explained separately.</p>
Usage Guidelines	See “Configuring the JUNOS Software to Support Channelized DS3-to-DS0 Naming for Channel Groups and Time Slots” on page 733.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>

timeslots

Syntax	<code>timeslots slot-number;</code>
Hierarchy Level	<pre>[edit chassis fpc slot-number pic pic-number ct3 port port-number t1 link-number channel-group channel-number], [edit chassis fpc slot-number pic pic-number ce1 e1link-number channel-group channel-number] [edit chassis lcc lcc-index fpc slot-number pic pic-number ct3 port port-number t1 link-number channel-group channel-number], [edit chassis lcc lcc-index fpc slot-number pic pic-number ce1 e1link-number channel-group channel-number]</pre>
Release Information	Statement introduced before JUNOS Release 7.4.
Description	For E1 or T1 interfaces, allocate the specific time slots by number.
Options	<p><i>slot-number</i>—Actual time slot number(s) allocated.</p> <p>Range: 1 through 24 for T1 and 1 through 32 for E1</p> <p>Default: All time slots for T1 and all time slots for E1</p>
Usage Guidelines	See “Configuring the JUNOS Software to Support Channelized DS3-to-DS0 Naming for Channel Groups and Time Slots” on page 733 and “Configuring the JUNOS Software to Support Channel Groups and Time Slots for Channelized E1 PICs” on page 736.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>

traffic-manager

Syntax traffic-manager {
 egress-shaping-overhead *number*;
 ingress-shaping-overhead *number*;
 mode {
 egress-only;
 ingress-and-egress;
 session-shaping;
 }
 }

Hierarchy Level [edit chassis fpc *slot-number* pic *pic-number*],
 [edit chassis lcc *number* fpc *slot-number* pic *pic-number*] (Routing Matrix)

Release Information Statement introduced in JUNOS Release 8.3.

Description Enable CoS queueing, scheduling, and shaping.

Options **egress-shaping-overhead *number***—When traffic management (queueing and scheduling) is configured on the egress side, the number of CoS shaping overhead bytes to add to the packets on the egress interface.

Replace *number* with a value from 0 through 255 bytes.

ingress-shaping-overhead *number*—When L2TP session shaping is configured, the number of CoS shaping overhead bytes to add to the packets on the ingress side of the L2TP tunnel to determine the shaped session packet length.

When session shaping is not configured and traffic management (queueing and scheduling) is configured on the ingress side, the number of CoS shaping overhead bytes to add to the packets on the ingress interface.

Replace *number* with a value from 0 through 255 bytes.

mode—Configure CoS traffic manager mode of operation. This option has the following suboptions:

- **egress-only**—Enable CoS queueing and scheduling on the egress side for the PIC that houses the interface. This is the default mode for an Enhanced Queueing (EQ) DPC on MX Series routers.



NOTE: If ingress packet drops are observed at a high rate for an IQ2 or IQ2E PIC, configure the **traffic-manager** statement to work in the **egress-only** mode.

- **ingress-and-egress**—Enable CoS queueing and scheduling on both the egress and ingress sides for the PIC. This is the default mode for IQ2 and IQ2E PICs on M Series and T Series routers.

**NOTE:**

- For EQ DPCs, you must configure the **traffic-manager** statement with **ingress-and-egress** mode to enable ingress CoS on the EQ DPC.
- EQ DPCs have 250ms buffering, with only egress queueing (default mode). When **ingress-and-egress** is configured, the buffer is partitioned as 50ms for the ingress direction and 200ms for the egress direction.

- **session-shaping**—(M10i and M120 routers only) Configure the IQ2 PIC mode for session-aware traffic shaping to enable L2TP session shaping.

Usage Guidelines See the *JUNOS Class of Service Configuration Guide*.

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

tunnel-services

Syntax tunnel-services {
bandwidth (1g | 10g);

Hierarchy Level [edit chassis fpc slot-number pic number]

Release Information Statement introduced in JUNOS Release 8.2.

Description For MX Series Ethernet Services Routers, configure the amount of bandwidth for tunnel services.

Options The statements are explained separately.

Usage Guidelines See “Configuring the JUNOS Software to Support Tunnel Interfaces on MX Series Ethernet Services Routers” on page 740.

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

vrf-mtu-check

Syntax	vrf-mtu-check;
Hierarchy Level	[edit chassis]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	On M Series routers (except the M320 router), configure path maximum transmission unit (MTU) checks on the outgoing interface for unicast traffic routed on a virtual private network (VPN) routing and forwarding (VRF) instance.
Default	Disabled.
Usage Guidelines	See “Configuring the JUNOS Software to Enable MTU Path Check for a Routing Instance on M Series Routers” on page 746.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Topics	<i>JUNOS Network Interfaces Configuration Guide</i>

vtmapping

Syntax	vtmapping (klm itu-t);
Hierarchy Level	[edit chassis fpc slot-number pic pic-number]
Release Information	Statement introduced before JUNOS Release 7.4.
Description	Configure virtual tributary mapping.
Default	klm
Options	klm—KLM standard. itu-t—International Telephony Union standard.
Usage Guidelines	See “Configuring the JUNOS Software to Support Channelized STM1 Interface Virtual Tributary Mapping” on page 738.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

Part 6

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