



JUNOS[®] OS

LN1000 Mobile Secure Router User Guide

Release
11.2



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Junos OS LN1000 Mobile Secure Router User Guide

Release 11.1

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LN1000 Documentation and Release Notes

For a list of related LN1000 Mobile Secure Router documentation, see <http://www.juniper.net/techpubs/>.

If the information in the latest release notes differs from the information in the documentation, follow the *LN1000 Mobile Secure Router 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/>.

Objectives

This documentation contains instructions for setting up the Juniper Networks LN1000 Mobile Secure Router. The LN1000 router is based on and includes many of the features of the Juniper Networks SRX Series Services Gateways. This documentation provides information about features unique to the LN1000 router.

Audience

This documentation is designed for anyone who installs, sets up, configures, monitors, or administers an LN1000 router running Junos OS. It is intended for the following audiences:

- Customers with technical knowledge of and experience with networks and network security, the Internet, and Internet routing protocols.
- Network administrators who install, configure, and manage Internet routers.

Documentation Conventions

Table 1 on page xiv 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 defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

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

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

Convention	Description	Examples
Text like this	Represents names of configuration statements, commands, files, and directories; interface names; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none">To configure a stub area, include the stub statement at the [edit protocols ospf area area-id] hierarchy level.The console port is labeled CONSOLE.
< > (angle brackets)	Enclose optional keywords or variables.	stub <default-metric <i>metric</i> >;
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	broadcast multicast (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.	<pre>[edit] routing-options { static { route default { nexthop address; retain; } } }</pre>
;(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 .

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- Document or topic name
- URL or page number

- Software release version (if applicable)

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- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at <http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf> .
- Product warranties—For product warranty information, visit <http://www.juniper.net/support/warranty/> .
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- 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/>
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Opening a Case with JTAC

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PART 1

LN1000 Mobile Secure Router

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CHAPTER 1

LN1000 Mobile Secure Router Overview

This chapter includes the following topics:

- LN1000 Mobile Secure Router Overview on page 3
- Interface and Routing Features on the LN1000 Mobile Secure Router on page 5
- Security Features on the LN1000 Mobile Secure Router on page 7
- Administration Features on the LN1000 Mobile Secure Router on page 11

LN1000 Mobile Secure Router Overview

The LN1000 Mobile Secure Router is an embedded router that operates in both wire-line and wireless environments with communication nodes that are either mobile or stationary. The router provides reliable and secure data, voice, and video services. The LN1000-V processes WAN and LAN routing functions. The router offers multiple DiffServ classes and can interleave higher priority real-time data (voice traffic) with lower priority non real-time data. It is developed on 3U compact node slot interface (VITA) architecture as defined in the VITA 46.0 IEEE 1101.2 specifications and runs Junos OS for routing, forwarding, and security.

The software supports the following features:

- IPv4 and IPv6 unicast forwarding
- Routing, including OSPF, BGP, RIPv2, IS-IS, and static routes
- Multicast, including IGMPv2, IGMPv3, PIM, SDP, DVMRP, MLD, and source-specific
- Encapsulation, including Ethernet (MAC and tagged), PPP, and PPPoE
- PPPoE interface to radios and link quality metrics imported into OSPF
- IP address management, including status, DHCP, and DHCP Relay
- Tunneling, including GRE, IP in IP, and IPsec
- NAT and stateful firewall filters, and intrusion detection

In addition, the following features are supported on the LN1000 router:

- Support for non-volatile memory read-only (NVMRO). As a security feature unique to the LN1000 Mobile Secure Router, NVMRO physically locks all non-volatile storage against modifications. This includes the NAND system storage, the NOR boot flash, and all Juniper Networks ID EEPROMS.
- Support for advanced class-of-service (CoS) on Point-to-Point Protocol over Ethernet (PPPoE) interfaces, which includes policing and shaping, weighted round robin (WRR) queuing with prioritization, weighted random early detection (WRED), queuing based on PPPoE interfaces, in addition to the supported VLAN/interface.
- Support for up to eight ports of gigabit traffic with up to 1024 logical interfaces with eight queues per logical interface and four priorities per queue. All eight ports interface with the backplane. The LN1000 router supports most Layer 2 and Layer 3 protocols, route redistribution, tunneling, multicast, routing, CoS, and security.
- Support for location-based IP address pools for IPv4 addresses. A location pool can specify IP addresses and subnet masks for multiple locations (relative positions of cards within a shelf). You can configure an IP interface to obtain an IP address and subnet mask from a selected location pool instead of specifying an explicit IP address and subnet mask.
- Support for PPPoE-based radio-to-router protocols. Extensions to the PPPoE protocol include:
 - Messages that define how an external device provides the router with timely information about the quality of a link connection
 - A flow control mechanism that indicates how much data the router can forward

The router uses the information provided in these PPPoE messages to dynamically adjust the interface speed of PPP links. When OSPF is notified of this change, it adjusts the cost of the link and updates the routing tables accordingly.

- Support for translation of Protocol Independent Multicast (PIM) join/prune messages to Internet Group Management Protocol (IGMP) or Multicast Listener Discovery (MLD) report/leave messages. To enable the use of IGMP or MLD to forward multicast traffic across the PIM domains, you can configure the rendezvous point (RP) router that resides between the edge domain and core domain to translate PIM join/prune messages received from PIM neighbors on downstream interfaces into corresponding IGMP or MLD report/leave messages. The router then transmits the report/leave messages by proxying them to one or two upstream interfaces that you configure on the RP router.
- Support for Open Shortest Path First (OSPF) refresh and flooding reduction in stable topologies, which facilitates OSPF scaling by reducing OSPF protocol traffic overhead and maintains OSPF adjacencies and flood link-state advertisements (LSAs).

Junos OS on the LN1000 router supports many of the features that exist on the SRX Series Services Gateways. For further information about these features, refer to the SRX Series documentation located at:

<http://www.juniper.net/techpubs/hardware/junos-srx/index.html>

- Related Documentation**
- *LN1000–V Mobile Secure Router Hardware Guide*
 - *Junos OS Interfaces Configuration Guide for Security Devices* for J Series Services Routers and SRX Series Services Gateways
 - *Junos OS Routing Protocols and Policies Configuration Guide for Security Devices* for J Series Services Routers and SRX Series Services Gateways
 - *Junos OS Security Configuration Guide* for J Series Services Routers and SRX Series Services Gateways
 - *Junos OS Administration Guide for Security Devices* for J Series Services Routers and SRX Series Services Gateways

Interface and Routing Features on the LN1000 Mobile Secure Router

This section lists interface and routing features that are supported on the LN1000 router. For further information on these features, see the SRX Series Services Gateway documentation at <http://www.juniper.net/techpubs/hardware/junos-srx/index.html>.

Class of Service (CoS)

- Code-point aliases
- Classifiers
- Forwarding classes
- Transmission queues
- Schedulers
- Virtual channels
- Tunnels
- Policing

For more information, see the *Junos OS Class of Service Configuration Guide for Security Devices* for J Series Services Routers and SRX Series Services Gateways.

Interfaces

- Ethernet interface
- Fast Ethernet interface
- Generic routing encapsulation (GRE) interface
- Gigabit Ethernet interface
- Internally generated GRE interface
- Internally generated link services interface
- Internally generated IP-over-IP interface
- Internally generated Protocol Independent Multicast (PIM) encapsulation interface

- IP-over-IP encapsulation interface
- Link services interface
- Loopback interface
- Passive monitoring interface
- Point-to-Point Protocol interface
- Point-to-Point Protocol over Ethernet (PPPoE) interface

For more information, see the [Junos OS Interfaces Configuration Guide for Security Devices](#) for J Series Services Routers and SRX Series Services Gateways.

Multicast

- Primary routing mode
- Session Announcement Protocol (SAP)
- Session Description Protocol (SDP)
- Internet Group Management Protocol (IGMP)
- Protocol Independent Multicast (PIM) Static RP
- Filtering PIM Register Messages
- PIM RPF Routing Table

For more information, see [Junos OS Interfaces Configuration Guide for Security Devices](#) for J Series Services Routers and SRX Series Services Gateways.

Routing Options

- IPv4 options and broadcast Internet diagrams
- Static routing
- RIPv1, RIPv2
- RIP next generation (RIPng)
- OSPFv2
- OSPFv3
- IS-IS
- BGP
- Neighbor Discovery Protocol (NDP) and Secure Neighbor Discovery Protocol (SNDP)
- Multiple virtual routers
- Network Time Protocol (NTP)
- Virtual Router Redundancy Protocol (VRRP)

For more information, see the [Junos OS Interfaces Configuration Guide for Security Devices](#) for J Series Services Routers and SRX Series Services Gateways.

Stateless Firewall Filters

- Stateless firewall filters

For more information, see *Junos OS Routing Protocols and Policies Configuration Guide for Security Devices* for J Series Services Routers and SRX Series Services Gateways.

Security Features on the LN1000 Mobile Secure Router

This section lists security features that are supported on the LN1000 router. For information about the interfaces that are supported on your device, see the *Junos OS Interfaces Configuration Guide for Security Devices*. For further information on these features, see the documentation for the SRX Series Services Gateway at <http://www.juniper.net/techpubs/hardware/junos-srx/index.html>.

Application Layer Gateways (ALGs)

- FTP
- Trivial File Transfer Protocol (TFTP)
- Domain Name System (DNS)
- Point-to-Point Tunneling Protocol (PPTP)
- REAL
- Remote procedure call (RPC)
- Remote shell (RSH)
- Real-Time Streaming Protocol (RTSP)
- Structured Query Language (SQL)
- TALK

For more information, see *Junos OS Security Configuration Guide* for J Series Services Routers and SRX Series Services Gateways.

Attack Detection and Prevention

- Bad IP option
- Block fragment traffic
- FIN flag without ACK flag set protection
- ICMP flood protection
- ICMP fragment protection
- Large size ICMP packet protection
- Loose source route option
- IP record route option
- IP security option

- IP address spoof
- IP stream option
- IP strict source route option
- IP address sweep
- IP timestamp option
- Land attack protection
- Ping of death attack protection
- Port scan
- Source IP based session limit
- SYN-ACK-ACK proxy protection
- SYN and FIN flags set protection
- SYN flood protection
- SYN fragment protection
- Teardrop attack protection
- TCP packet without flag set protection
- Unknown protocol protection
- UDP flood protection
- WinNuke attack protection

For more information, see [Junos OS Security Configuration Guide](#) for J Series Services Routers and SRX Series Services Gateways.

Firewall Authentication

- Web authentication
- Pass-through authentication
- Local authentication server
- RADIUS authentication server
- LDAP authentication server
- SecurID authentication server

For more information, see [Junos OS Security Configuration Guide](#) for J Series Services Routers and SRX Series Services Gateways.

Flow-based and Packet-based Processing

- Flow-based processing
- Packet-based processing
- Stateless packet-based services option

For more information, see [Junos OS Security Configuration Guide](#) for J Series Services Routers and SRX Series Services Gateways.

Intrusion Detection and Prevention (IDP)

- IDP Policy
- Intrusion prevention system (IPS) rulebase
- Differentiated Services code point (DSCP) marking
- IDP signature database
- Application identification
- IDP logging

For more information, see [Junos OS Security Configuration Guide](#) for J Series Services Routers and SRX Series Services Gateways. For information on IDP monitoring and debugging, see the [Junos OS CLI Reference](#) for J Series Services Routers and SRX Series Services Gateways.

IPsec

- Policy-based and route-based VPNs
- Tunnel mode
- Authentication Header (AH) protocol
- Encapsulating Security Payload (ESP) protocol
- IKE phase 1
- IKE phase 2
- Manual key management
- Autokey management
- Antireplay (packet replay attack prevention)
- Dead peer detection (DPD)

For more information, see [Junos OS Security Configuration Guide](#) for J Series Services Routers and SRX Series Services Gateways.

Network Address Translation (NAT)

- Destination IP address translation
- Static NAT
- Rule-based NAT
- Source IP address translation
- Configuring proxy Address Resolution Protocol (ARP)

- Persistent NAT
- Disable source NAT port randomization

For more information, see [Junos OS Security Configuration Guide](#) for J Series Services Routers and SRX Series Services Gateways.

Public Key Infrastructure (PKI)

- Internet Key Exchange (IKE) support
- Entrust, Microsoft, and Verisign certificate authorities (CAs)
- Automatic generation of self-signed certificates
- Distinguished Encoding Rules (DER), Privacy-Enhanced Mail (PEM), Public-Key Cryptography Standard 7 (PKCS7), and X509 certificate encoding
- Manual installation of DER-encoded and PEM-encoded CRLs
- Online certificate revocation list (CRL) retrieval through LDAP and HTTP
- CRL update at user-specified interval

For more information, see [Junos OS Security Configuration Guide](#) for J Series Services Routers and SRX Series Services Gateways.

Security Policy

- Address books
- Policy application sets
- Schedulers
- Policy applications
- Internet Control Message Protocol (ICMP) predefined policy application
- Internet-related predefined policy applications
- Microsoft predefined policy applications
- Dynamic routing protocols predefined policy applications
- Streaming video predefined policy applications
- Sun remote procedure protocol (RPC) predefined policy applications
- Security and tunnel predefined policy applications
- IP-related predefined policy applications
- Instant messaging predefined policy applications
- Management predefined policy applications
- Mail predefined policy applications
- UNIX predefined policy applications
- Miscellaneous predefined policy applications

- Custom policy Applications
- Policy application timeouts

For more information, see *Junos OS Security Configuration Guide* for J Series Services Routers and SRX Series Services Gateways.

Zones

- Security zone
- Functional zone

For more information, see *Junos OS Security Configuration Guide* for J Series Services Routers and SRX Series Services Gateways.

Administration Features on the LN1000 Mobile Secure Router

This section lists the administration features that are supported on the LN1000 router. For further information on these features, see the documentation for the SRX Series Services Gateway at <http://www.juniper.net/techpubs/hardware/junos-srx/index.html>.

Administrator Authentication

- RADIUS
- TACACS+
- Local authentication

For more information, see *Junos OS Administration Guide for Security Devices* for J Series Services Routers and SRX Series Services Gateways.

Alarms

- Chassis alarms
- Interface alarms
- System alarms

For more information, see *Junos OS Administration Guide for Security Devices* for J Series Services Routers and SRX Series Services Gateways.

DHCP

- Dynamic Host Configuration Protocol (DHCP) server address pools
- DHCP server static mapping
- DHCP client
- DHCP server
- DHCP relay agent

For more information, see [Junos OS Administration Guide for Security Devices](#) for J Series Services Routers and SRX Series Services.

Diagnostic Tools

- Ping host
- Ping MPLS
- Traceroute
- CLI terminal
- J-flow version 8

For more information, see [Junos OS Administration Guide for Security Devices](#) for J Series Services Routers and SRX Series Services Gateways.

File Management Options

- Clean up unnecessary files
- Delete individual files
- Delete backup software image
- Download system files
- Encrypt/decrypt configuration files
- Manage account files

For more information, see [Junos OS Administration Guide for Security Devices](#) for J Series Services Routers and SRX Series Services Gateways.

Network Operations and Troubleshooting Automation

- Extensible Stylesheet Language Transformations (XSLT) commit scripts
- Operation scripts
- Event policies

For more information, see [Junos OS Administration Guide for Security Devices](#) for J Series Services Routers and SRX Series Services Gateways.

Secure Web Access

- Certificate authorities (CAs)
- Hypertext Transfer Protocol (HTTP)

For more information, see [Junos OS Administration Guide for Security Devices](#) for J Series Services Routers and SRX Series Services Gateways.

System Log Files

- Configuring system log messages
- Sending system log messages to a file
- Sending system log messages to a user terminal
- Archiving system logs
- Disabling system logs
- Viewing system log messages
- Viewing data plane logs
- Session Logging with NAT

For more information, see [Junos OS Administration Guide for Security Devices](#) for J Series Services Routers and SRX Series Services Gateways.

Upgrade and Reboot Options

- Software upgrades and downgrades
- Boot device configuration
- Boot device recovery
- Chassis components control
- Chassis restart

For more information, see [Junos OS Administration Guide for Security Devices](#) for J Series Services Routers and SRX Series Services Gateways.

User Interfaces

- J-Web user interface
- Command-line interface (CLI)
- Network and Security Manager (NSM)
- Junos Scope application
- Junos XML protocol

For more information, see [Junos OS Administration Guide for Security Devices](#) for J Series Services Routers and SRX Series Services Gateways.

CHAPTER 2

Installing the Software

This chapter includes the following topics:

- Installing Software on an LN1000 Mobile Secure Router on page 15
- Setting Non-Volatile Memory Read-Only on page 15
- Installing Software Upgrades from the Network on page 16
- Configuring the Software on page 17

Installing Software on an LN1000 Mobile Secure Router

The LN1000 router is shipped with the Junos OS preinstalled on the internal NAND flash drive and ready to configure when you power on the device. A backup copy of the software is on a USB storage device. You configure the LN1000 router by issuing Junos OS command-line interface (CLI) commands, either on a console device attached to the CONSOLE port on the Routing Engine, or over a telnet connection to a network connected to the Ethernet port on the Routing Engine.

Gather the following information before you configure the device:

- Hostname you want the device to use on the network
- Domain name you want the device to use
- IP address and prefix length information for the Ethernet interface
- IP address of a default router
- IP address of a DNS server
- Password for the root user

Related Documentation

- [Junos OS Administration Guide for Security Devices](#) for J Series Services Routers and SRX Series Services Gateways

Setting Non-Volatile Memory Read-Only

Before you upgrade the software or firmware on the LN1000 Mobile Secure Router, the non-volatile memory read-only (NVMRO) switch must be clear to enable writing to system storage. NVMRO must also be clear to permanently save any CLI changes.

To check the current setting of NVMRO:

1. Log in to the router as root.
2. From the shell, type:

```
root@host# sysctl kern.nvmro  
kern.nvmro: 1
```

The value must be 0 to upgrade any files on the router. If the value is 0, proceed to “Installing Software Upgrades from the Network” on page 16. If the value is 1, all storage on the router is locked. You must reset the NVMRO switch located on the rear transition module (RTM) to allow installation. See the *LN1000–V Mobile Secure Router Hardware Guide* for the location of this switch.

3. Power off the system:

```
root@host# cli request system power-off
```

When you see the following message, the system is safely powered off:

```
syncing disks... All buffers synced.  
Uptime: 20h14m55s  
Turning system power off
```

Follow the instructions in the *LN1000–V Mobile Secure Router Hardware Guide* to access the RTM and toggle the NVMRO switch.

- To clear NVMRO (allow writing/updating), turn the switch on.
- To set NVMRO (lock all storage), turn the switch off.

4. Reinstall the RTM and boot the router.

Related Documentation

- *LN1000–V Mobile Secure Router Hardware Guide*

Installing Software Upgrades from the Network

To install software upgrades by downloading files to the router:

1. Clean up the system:

```
root@host>request system storage cleanup
```

You are prompted to confirm deletion of a list of files:

2. Install the new package on the router, entering the following command:

```
root@host>request system software add unlink no-copy source
```

Replace *source* with */pathname/package/package-name* (for example, */var/tmp/junos-in-9.6R2.1.tar.gz*).

The **unlink** option removes the package at the earliest opportunity so that the router has enough capacity to complete the installation.

The **no-copy** option specifies that a software package is installed, but a copy of the package is not saved.

The system automatically reboots.



CAUTION: During the upgrade process, the keyboard is locked to prevent interruption of the firmware upgrade process. If the system loses power during the upgrade, the upgrade will fail and the router may become unresponsive. Contact Juniper Networks for assistance.

3. When the router reboots, log in to the router and verify the correct operation of the new software image. You must do this before you can change NVMRO back to the locked (read-only) mode.



NOTE: If the diagnostics fail three times, the IPMI powers down and therefore cannot display the reasons for the failure. When the temperature thresholds are reached, IPMI sends notification to the shelf manager.

Configuring the Software

The installation procedure connects the device to the network but does not enable it to forward traffic.

To configure the software:



NOTE: Make sure NVMRO is clear for the configuration changes to be saved permanently. If not, the changes are lost on reboot.

1. Verify that the device is powered on.
2. Log in as the root user.
3. Start the CLI.

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

4. Enter configuration mode.

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

5. Set the root authentication password by entering a cleartext password, or an encrypted password, or an SSH public key string (DSA or RSA).

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

6. Configure an administrator account on the device.

```
[edit]
root@# set system login user admin class super-user authentication
      plain-text-password
```

7. Configure the password for the administrator account.

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

8. Commit the configuration to activate it on the device.

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

9. Log in as the administrator you configured in Step 6.

10. Configure the name of the device. If the name includes spaces, enclose the name in double quotation marks (" ").

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

11. Configure the IP address and prefix length for the device's Ethernet interface. You can optionally use the location-based IP address Pools configuration. For further information, see Chapter 4, Location-Based IP Address Pools.

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

12. Configure the traffic interfaces (ge-0/0/1–ge-0/0/7).

```
[edit]
admin@# set interfaces ge-0/0/1 unit 0 family inet address address/prefix-length
admin@# set interfaces ge-0/0/5 unit 0 family inet address address/prefix-length
```

13. Optionally, configure the default route.

```
[edit]
admin@# set routing-options static route 0.0.0.0/0 next-hop gateway
```

14. Configure basic security zones and bind them to traffic interfaces.

```
[edit]
admin@# set security zones security-zone trust interfaces ge-0/0/5
admin@# set security zones security-zone untrust interfaces ge-0/0/0
```

15. Configure basic security policies.

```
[edit]
admin@# set security policies from-zone trust to-zone untrust policy policy-name
      match source-address any destination-address any application any
root@# set security policies from-zone trust to-zone untrust policy policy-name then
      permit
```

16. Check the configuration for validity.

```
[edit]
admin@# commit check
configuration check succeeds
```

17. Commit the configuration to activate it on the device.

```
[edit]  
admin@# commit  
commit complete
```

18. Optionally, display the configuration to verify that it is correct.

```
admin@# show
```

19. When you have finished configuring the device, exit configuration mode.

```
[edit]  
admin@host# exit  
admin@host>
```


CHAPTER 3

Configuring Gigabit Ethernet Interfaces to Match Your Topology

This chapter includes the following topics:

- Configuring a Gigabit Ethernet Interface on page 21
- Swapping Small Form-Factor Pluggable (SFP) Devices on page 22

Configuring a Gigabit Ethernet Interface

The LN1000 has eight Gigabit Ethernet interfaces that can terminate into a copper or fiber Ethernet PHY device SFP (small form-factor pluggable). Depending on the type of device into which you are terminating these Gigabit Ethernet interfaces, you can configure them to operate in SGMII or 1000Base-X mode. When configured in SGMII mode, you can run ports speeds of 10/100/1000 Mbs in full or half duplex modes. When configured in 1000Base-X mode, you can run these ports in 1000 Mbs mode. Use the **mac-mode** statement in Chapter 8 to configure these options.

The LN1000-V rear transition module (RTM) supports both copper and fiber SFPs.

- If you are running an LN1000 with the LN1000-V RTM and are using copper SFPs, configure the mac-mode to SGMII.
- If you are running an LN1000 with the LN1000-V RTM and are using fiber SFPs, configure the mac-mode to 1000Base-X.

Junos OS uses the following defaults:

- mac-mode set to 1000Base-X
- auto-negotiation set to ON

To add or change mac-mode fields:

```
set interfaces ge-0/0/1 gigether-options mac-mode sgmii|1000base-x
```

If you want to delete mac-mode, use the following command:

```
delete interfaces ge-0/0/1 gigether-options mac-mode
```

If you want to run in a different configuration to match your topology, you can use the existing Junos **auto-negotiation** and **link-speed** statements and the new **mac-mode** statement.

To enable or disable autonegotiation, use the following commands:

- Enabling autonegotiation:
set interface ge-x/x/x gigether-options autoneg
- Disabling autonegotiation:
set interface ge-x/x/x gigether-options no-autoneg

The **delete interface ge-x/x/x gigether-options autoneg** command does not disable autonegotiation. The **delete** command is not applicable for this option.

To change the mac-mode fields:

delete interfaces ge-0/0/1 gigether-options mac-mode

Both the speed and link-mode attributes must be modified together in the same configuration commit in order for either change to take effect.

Related Documentation

- For further information, see the [Junos OS Network Interfaces Configuration Guide](#)

Swapping Small Form-Factor Pluggable (SFP) Devices

To swap SFPs, perform the following tasks:

1. Log in as the root user.
2. Start the CLI.

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

3. Enter configuration mode.

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

4. Administratively disable the interface:

```
[edit]
root@# set interface name disable
```

5. Commit the configuration.

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

6. Physically remove and reinsert the SFP.

7. Set the configuration of the interface:

```
[edit]
root@# set interface name gigether-options no-auto-negotiation
```

8. Commit the configuration.

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

9. Administratively enable the interface:

```
[edit]  
root@# delete interface name disable
```

10. Commit the configuration.

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


CHAPTER 4

Location-Based IP Address Pools

This chapter includes the following topics:

- Location-Based IP Address Pools Overview on page 25
- Configuring Location-Based IP Address Pools on page 26
- Example: Configuring a Location-Based IP Address Pool on page 26
- Verifying and Managing Location-Based IP Address Pools on page 27

Location-Based IP Address Pools Overview

The LN1000 router is a full-featured Juniper Networks router running Junos OS with eight gigabit Ethernet interfaces that exists on a single module. It operates in a network device (such as a shelf) that contains multiple locations (slots). Each location supports eight gigabit Ethernet interfaces. These locations can be populated with multiple cards. Each card within this shelf is a separate entity (for example, a router or access device) in the internal network of the shelf.

The management system for the shelf downloads a separate configuration to each card when they are initialized. To enable this download, you must first configure an IP interface on each card with an IP address and subnet mask that are predefined for each location in the shelf.

You can use the Junos location-based IP address pools feature to configure the initial IP interface of the LN1000 router. The configuration is preserved when the shelf management system downloads a separate configuration to this interface, unless it is explicitly overwritten using existing CLI configuration commands (such as **load override**). If you move an LN1000 router to a different slot within the shelf, initialization restarts, in which case you might have to reconfigure the initial IP interface with the IP address and subnet mask specified for the new location. The shelf management system can then download a new configuration to the new interface.

A location pool can specify IP addresses and subnet masks for multiple locations (relative positions of cards within a shelf). You can configure an IP interface to obtain an IP address and subnet mask from a selected location pool instead of specifying an explicit IP address and subnet mask.

You can configure a maximum of 10 location-based IP address pools, each with a unique name. A pool can contain a maximum of 32 IP addresses. A pool entry contains a location

index that has a unique value within its pool and an IP address and subnet mask that do not have to be unique. You can also define additional attributes for the pool entry as required.

In the existing IP interface configuration, you can specify a location-based IP address pool instead of an explicit IP address and subnet mask. You can configure an IP interface using one of these IP address specifications types, but not both. An IPv4 address can be configured for an IP interface as well as an IP pool.

Configuring Location-Based IP Address Pools

To configure IP address pools, perform the following tasks:

1. Configure a pool entry that contains a location index, an IP address, and subnet mask.
2. Configure one IP address and subnet mask from the pool entry assigned to the IP interface.
3. Configure up to 10 location-based address pools, each with a unique name.
4. Configure one IP address from each pool assigned to the IP interface.

Example: Configuring a Location-Based IP Address Pool

This configuration example creates two IPv4 and one IPv6 location-based IP address pools, and selects one IPv4 and one IPv6 pool each for an IP interface.

```
[edit]
access {
  address-assignment {
    location-pool {
      ipv4poolX {
        family inet {
          location {
            1 address 10.0.0.1/24;
            2 address 10.0.0.2/24;
            3 address 172.0.0.3/24;
            4 address 172.0.0.4/24;
            5 address 192.0.0.5/24;
            32 address 192.0.0.32/24;
          }
        }
      }
      ipv4poolY {
        family inet {
          location {
            1 address 10.0.0.11/24;
            3 address 172.0.0.33/24;
            5 address 192.0.0.54/24;
          }
        }
      }
      ipv6poolZ {
        family inet6 {
```

```

        location {
            1 address fec0:1:1::1/64;
            3 address fec0:1:1::3/64;
            5 address fec0:1:1::5/64;
        }
    }
}
[edit]
interfaces ge-0/0/0 {
    unit 0 {
        family inet {
            location-pool-address ipv4poolX;
        }
        family inet6 {
            location-pool-address ipv6poolZ;
        }
    }
}

```

Using this configuration example, a router in slot 3 has an IPv4 address of 172.0.0.3/24 and an IPv6 address of fec0:1:1::3/64 assigned to gigabit Ethernet interface 0/0/0. If you move the router to slot 5, it has an IPv4 address of 192.0.0.5/24 and an IPv6 address of fec0:1:1::5/64 assigned to gigabit Ethernet interface 0/0/0.

Verifying and Managing Location-Based IP Address Pools

Purpose Display location-based IP address pools.

Action user@host> **show access address-assignment location-pool ip4pool2**

Meaning If you specify a pool name, the pool entries for that pool are displayed. If a pool name is not specified, all pool entries are displayed.

```

family inet {
    location 1 {
        address 1.1.1.1/24;
    }
    location 2 {
        address 1.2.2.1/24;
    }
    location 3 {
        address 1.3.3.1/24;
    }
    location 4 {
        address 1.4.4.1/24;
    }
}

```

Related Documentation

- For more information, see the [Junos OS System Basics Configuration Guide](#)

CHAPTER 5

Configuring Point-to-Point Protocol over Ethernet

This chapter includes the following topics:

- PPPoE Overview on page 29
- Configuring PPPoE Interfaces on page 31
- Verifying a PPPoE Configuration on page 33

PPPoE Overview

PPPoE establishes a point-to-point connection between the client and the server, also called an *access concentrator*. Multiple hosts can be connected to the services router, and their data can be authenticated, encrypted, and compressed before the traffic is sent to the PPPoE session on the services router. PPPoE is easy to configure and enables services to be managed on a per-user basis rather than on a per-site basis.

The PPPoE interface to the access concentrator can be a Fast Ethernet interface or a Gigabit Ethernet interface. If the interface is either Fast Ethernet or Gigabit Ethernet, use a PPPoE encapsulation.

PPPoE Stages

PPPoE has two stages, the discovery stage and the PPPoE session stage. In the discovery stage, the client discovers the access concentrator by identifying the Ethernet media access control (MAC) address of the access concentrator and establishing a PPPoE session ID. In the PPPoE session stage, the client and the access concentrator build a point-to-point connection over Ethernet, based on the information collected in the discovery stage. The LN1000 router acts as an access concentrator.

PPPoE Discovery Stage

A router initiates the PPPoE discovery stage by broadcasting a PPPoE active discovery initiation (PADI) packet. To provide a point-to-point connection over Ethernet, each PPPoE session must learn the Ethernet MAC address of the access concentrator and establish a session with a unique session ID. Because the network might have more than one access concentrator, the discovery stage enables the client to communicate with all of them and select one.

The PPPoE discovery stage consists of the following steps:

1. PPPoE active discovery initiation (PADI)—The client initiates a session by broadcasting a PADI packet on the LAN to request a service.
2. PPPoE active discovery offer (PADO)—Any access concentrator that can provide the service requested by the client in the PADI packet replies with a PADO packet that contains its own name, the unicast address of the client, and the service requested. An access concentrator can also use the PADO packet to offer other services to the client.
3. PPPoE active discovery request (PADR)—From the PADOs it receives, the client selects one access concentrator based on its name or the services offered and sends it a PADR packet to indicate the service or services needed.
4. PPPoE active discovery Session-confirmation (PADS)—When the selected access concentrator receives the PADR packet, it accepts or rejects the PPPoE session.
 - To accept the session, the access concentrator sends the client a PADS packet with a unique session ID for a PPPoE session and a service name that identifies the service under which it accepts the session.
 - To reject the session, the access concentrator sends the client a PADS packet with a service name error and resets the session ID to zero.

PPPoE Session Stage

The PPPoE session stage starts after the PPPoE discovery stage has completed. The access concentrator can start the PPPoE session after it sends the PADS packet to the client, or the client can start the PPPoE session after it receives a PADS packet from the access concentrator. The router supports multiple PPPoE sessions on each interface.

Each PPPoE session is uniquely identified by the Ethernet address of the peer and the session ID. After the PPPoE session is established, data is sent as in any other PPP encapsulation. The PPPoE information is encapsulated within an Ethernet frame and is sent to a unicast address. In this stage, both the client and the server must allocate resources for the PPPoE logical interface.

After a session is established, the client or the access concentrator can send a PPPoE active discovery termination (PADT) packet anytime to terminate the session. The PADT packet contains the destination address of the peer and the session ID of the session to be terminated. After this packet is sent, the session is closed to PPPoE traffic.

Optional CHAP Authentication

For interfaces with PPPoE encapsulation, you can configure interfaces to support the PPP Challenge Handshake Authentication Protocol (CHAP). When you enable CHAP on an interface, the interface can authenticate its peer and be authenticated by its peer.

If you configure an interface to handle incoming CHAP packets only (by including the **passive** statement at the **[edit interfaces *interface-name* ppp-options chap]** hierarchy level), the interface does not challenge its peer. However, if the interface is challenged, it responds to the challenge. If you do not include the **passive** statement, the interface always challenges its peer.

Configuring the PPPoE Interfaces MTU

You can configure the maximum transmission unit (MTU) of the interface by including the **mtu** statement at the **[edit interfaces pp0]** hierarchy level:

```
[edit interfaces pp0]
mtu bytes;
```

Disabling the Sending of PPPoE Keepalive Messages

When configuring the client, you can disable the sending of keepalive messages on a logical interface by including the **no-keepalives** statement:

```
no-keepalives;
```

Configuring PPPoE Interfaces

To configure PPPoE, perform the following tasks:

1. Configure PPPoE encapsulation for an Ethernet interface.
2. Specify the logical Ethernet interface as the underlying interface for the PPPoE session.
3. Configure the operational mode as server.
4. Identify the access concentrator by a unique name.
5. Optionally, specify how many seconds to wait before attempting to reconnect.
6. Provide a name for the type of service provided by the access concentrator.
7. Optionally, configure the maximum transmission unit (MTU) of the interface.
8. Optionally, configure the PPPoE interface address.
9. Optionally, configure the MTU size for the protocol family.
10. Optionally, disable the sending of keepalive messages on the logical interface.

Setting the Appropriate Encapsulation on the PPPoE Interface

For PPPoE on an Ethernet interface, you must configure encapsulation on the logical interface and use PPP over Ethernet encapsulation.

To configure logical interface encapsulation properties, include the **encapsulation** statement:

```
encapsulation ppp-over-ether;
```

Configuring a PPPoE Underlying Interface

To configure the underlying Fast Ethernet, Gigabit Ethernet, and 10-Gigabit Ethernet interfaces, include the **underlying-interface** statement at the **[edit interfaces pp0 unit logical-unit-number pppoe-options]** hierarchy level:

```
[edit interfaces pp0]
unit logical-unit-number {
  pppoe-options {
```

```
        underlying-interface interface-name;  
    }  
}
```

Specify the logical Ethernet interface as the underlying interface.

Identifying the Access Concentrator

When configuring a PPPoE client, identify the access concentrator by a unique name by including the **access-concentrator** statement at the **[edit interfaces *interface-name* unit *logical-unit-number* pppoe-options]** hierarchy level:

```
[edit interfaces pp0]  
unit logical-unit-number{  
  pppoe-options {  
    access-concentrator name;  
  }  
}
```

Specify the access concentrator name.

Configuring the PPPoE Service Name

When configuring a PPPoE client, identify the type of service provided by the access concentrator—such as the name of the Internet service provider (ISP), class, or class of service—by including the **service-name** statement at the **[edit interfaces *interface-name* unit *logical-unit-number* pppoe-options]** hierarchy level:

```
[edit interfaces pp0]  
unit logical-unit-number {  
  pppoe-options {  
    service-name name;  
  }  
}
```

Configuring the PPPoE Server Mode

When configuring a PPPoE server, identify the mode by including the **server** statement at the **[edit interfaces *interface-name* unit *logical-unit-number* pppoe-options]** hierarchy level:

```
[edit interfaces pp0]  
unit logical-unit-number {  
  pppoe-options {  
    server;  
  }  
}
```

Configuring the PPPoE Source and Destination Addresses

When configuring a PPPoE client or server, assign source and destination addresses—for example, **192.168.1.1/32** and **192.168.1.2**. To assign the source and destination addresses, include the **address** and **destination** statements at the **[edit interfaces pp0 family inet]** hierarchy level:

```
[edit interfaces pp0 family inet]  
address address {
```

```

    destination address;
}

```

Deriving the PPPoE Source Address from a Specified Interface

For a router supporting PPPoE, you can derive the source address from a specified interface—for example, the loopback interface, **lo0.0**—and assign a destination address—for example, **192.168.1.2**. The specified interface must include a logical unit number and have a configured IP address. To derive the source address and assign the destination address, include the **unnumbered-address** and **destination** statements at the **[edit interfaces pp0 family inet]** hierarchy level:

```

[edit interfaces pp0 family inet]
unnumbered-address interface-name destination address;

```

Configuring the PPPoE IP Address by Negotiation

You can have the PPPoE client router obtain an IP address by negotiation with the remote end. This method might require the access concentrator to use a RADIUS authentication server. To obtain an IP address from the remote end by negotiation, include the **negotiate-address** statement:

```
negotiate-address;
```

Configuring the Protocol MTU PPPoE

You can configure the maximum transmission unit (MTU) size for the protocol family. Specify a range from 0 through 5012 bytes. Ensure that the size of the media MTU is equal to or greater than the sum of the protocol MTU and the encapsulation overhead. To set the MTU, include the **mtu** statement at the **[edit interfaces pp0 family (inet | inet6 | mpls)]** hierarchy level:

```

[edit interfaces pp0 family (inet | inet6 | mpls) ]
mtu bytes;

```

Verifying a PPPoE Configuration

Purpose To verify a PPPoE configuration, you can issue the following operational mode commands:

- Action**
- **show interfaces f0/0/port extensive**
 - **show interfaces pp0**
 - **show pppoe interfaces**
 - **show pppoe statistics**

For more information about these operational mode commands, see the [Junos OS Interfaces Command Reference](#).

CHAPTER 6

Configuring PPPoE-Based Radio-to-Router Protocols

This chapter includes the following topics:

- PPPoE-Based Radio-to-Router Protocols Overview on page 35
- Configuring PPPoE-Based Radio-to-Router Protocols on page 36
- Example: Configuring the PPPoE-Based Radio-to-Router Protocol on page 37
- Verifying PPPoE Interfaces on page 39
- Displaying Statistics for PPPoE on page 40
- Credit Flow Control for PPPoE on page 40
- Example: PPPoE Credit-Based Flow Control Configuration on page 41
- Verifying Credit-Flow Control on page 41
- Setting Tracing Options for PPPoE on page 42

PPPoE-Based Radio-to-Router Protocols Overview

Support for PPPoE-based radio-to-router protocols includes the following extensions to the PPPoE protocol:

- Messages that define how an external device provides the router with timely information about the quality of a link connection
- A flow control mechanism that indicates how much data the router can forward

The router uses the information provided in these PPPoE messages to dynamically adjust the interface speed. When OSPF is notified of this change, it adjusts the cost of the link and updates the routing tables accordingly.

The radio provides ground-to-ground or ground-to-air communications with like devices. When the radio picks up a signal from another device, it initiates a PPPoE session with a directly connected router. The PPPoE session encapsulates the packets that are relayed over a PPP link between the local and remote routers. The remote radio then forwards traffic over an independent PPPoE session between the remote radio and the router to which it is connected. The two routers exchange LCP and IPCP messages to configure the link and exchange OSPF messages to establish the network topology.

The router and radio are deployed in highly dynamic environments, such as moving vehicles. The quality of the radio link between the routers can vary significantly as a vehicle moves behind an obstruction. Each radio monitors the link every 50 milliseconds for changes in the link bandwidth, quality, and utilization. If any changes are detected, the radios announce the new set of metrics to the respective routers through a PPPoE Active Discovery Quality (PADQ) message, which is a nonstandard extension to the PPPoE Discovery Protocol [RFC2516]. The router transforms these metrics into a bandwidth value for the PPP link and compares it to the value currently in use. When the router detects that the difference exceeds a user-specified threshold, it adjusts the speed of the PPP link. An event message notifies OSPF of the change, which then triggers OSPF to announce any resulting routing topology changes to its neighbors.

The PPPoE-based radio-to-router protocol notifies the router about neighbors joining or leaving the network and to create and maintain OSPF adjacencies over the dynamic links established between them. The costs assigned to these links are based on network conditions and flow control information sent by the radios. The calculations and requests to update interface speeds are performed by routines in a common library.

When PPPoE is used for applications, such as mobile radio, the radio links have variable bandwidth. So a mobile radio can function in a PPPoE environment, PPPoE messaging includes PADQ messages, which enable a link cost to be propagated to OSPF through the evaluation of various link quality metrics. The router uses information from these notifications along with user-configured parameters to calculate interface link costs that are used by the routing protocols.

A radio can send an optional PADQ at any time to query or report link quality metrics. When transmitting PPP streams over radio links, the quality of the link directly affects the throughput. The PADQ packet is used by the radio modem to report link metrics.

To support the credit-based flow control extensions described in RFC4938, PPPoE peers can also grant each other forwarding credits. The grantee can forward traffic to the peer only when it has a sufficient number of credits to do so. Credit-based forwarding allows both sides of the session to agree to use a non-default credit scaling factor during the PADR and PADS message exchange. Although this is used on both sides of the session, this feature provides the radio client with a flow control mechanism that throttles traffic by limiting the number of credits it grants to the router.

**Related
Documentation**

- For information on configuring a PPPoE server, see “Configuring Point-to-Point Protocol over Ethernet” in the [Junos OS Interfaces Command Reference](#).

Configuring PPPoE-Based Radio-to-Router Protocols

To configure the PPPoE-based radio-to-router protocol:

1. Configure PPPoE encapsulation for an Ethernet interface.
2. Configure radio-router on the logical Ethernet interface.
3. Specify the logical Ethernet interface as the underlying interface for the PPPoE session.
4. Configure the operational mode as server.

5. Optionally, identify the access concentrator by a unique name.
6. Optionally, specify how many seconds to wait before attempting to reconnect.
7. Optionally, provide a name for the type of service provided by the access concentrator.
8. Optionally, configure the maximum transmission unit (MTU) of the interface.
9. Optionally, configure the MTU size for the protocol family.
10. Optionally, disable the sending of keepalive messages on the logical interface.

Related Documentation

- For information on configuring a PPPoE server, see “Configuring Point-to-Point Protocol over Ethernet” in the *Junos OS Interfaces Command Reference*.

Example: Configuring the PPPoE-Based Radio-to-Router Protocol

This example shows how to configure the PPPoE-based radio-to-router protocol.

- Requirements on page 37
- Overview on page 37
- Configuration on page 37
- Verification on page 39

Requirements

Before you begin:

1. Configure network interfaces. See Example: Creating an Ethernet Interface.
2. Configure PPPoE interfaces. See Example: Configuring PPPoE Interfaces.
3. Configure PPPoE encapsulation on an Ethernet interface. See Example: Configuring PPPoE Encapsulation on an Ethernet Interface.
4. Configure PPPoE encapsulation on an ATM-over-ADSL interface. See Example: Configuring PPPoE Encapsulation on an ATM-over-ADSL Interface.
5. Configure CHAP authentication on a PPPoE interface. See Example: Configuring CHAP Authentication on a PPPoE Interface.

Overview

In this example, you configure the ge-3/0/3 interface and set the bandwidth, resource, latency, and quality to **100**. You also set the threshold value to **10**, and then configure options on the logical interface.

Configuration

CLI Quick Configuration

To quickly configure the PPPoE-based radio-to-router protocol, copy the following commands and paste them into the CLI:

```
[edit]
set interfaces ge-3/0/3 unit 1 radio-router bandwidth 100 resource 100 latency 100 quality
100 threshold 10
```

```
set interfaces pp0 unit 1 pppoe-options underlying-interface ge-3/0/3 server
set interfaces pp0 unit 1 family inet unnumbered-address lo0.0 destination 192.168.1.2
set interfaces pp0 unit 1 family inet6 address lo0.0 destination fec0:1:1::2
```

**Step-by-Step
Procedure**

The following example requires you to navigate various levels in the configuration hierarchy. For instructions on how to do that, see *Using the CLI Editor in Configuration Mode*.

To configure the PPPoE-based radio-to-router protocol:

1. Enable the PPPoE-based radio-to-router protocol.

```
[edit]
user@host# edit interfaces ge-3/0/3 unit 1 radio-router
```

2. Set the interface speed for the virtual link.

```
[edit interfaces ge-3/0/3 unit 1 radio-router]
user@host# set bandwidth 100 resource 100 latency 100 quality 100
```

3. Set the calculated and current interface speeds, as a percentage.

```
[edit interfaces ge-3/0/3 unit 1 radio-router]
user@host# set threshold 10
```

4. Configure options on the logical interface.

```
[edit interfaces pp0 unit 1]
user@host# set pppoe-options underlying-interface ge-3/0/3
user@host# set pppoe-options server
user@host# set family inet unnumbered-address lo0.0 destination 192.168.1.2
user@host# set family inet6 address lo0.0 destination fec0:1:1::2
```

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

For brevity, this **show interfaces** command output includes only the configuration that is relevant to this example. Any other configuration on the system has been replaced with ellipses (...).

```
[edit]
user@host# show interfaces ge-3/0/3 {
  unit 1
    radio-router {
      bandwidth 100;
      resource 100;
      latency 100;
      quality 100;
      threshold 10;
    }
  }
}
...
pp0 {
  unit 1 {
    pppoe-options {
```

```

    underlying-interface ge-3/0/3;
    server;
  }
  family inet {
    unnumbered-address lo0.0 destination 192.168.1.2;
  }
  family inet6;
}

```

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

Verification

To confirm that the configuration is working properly, perform this task:

- Verifying the PPPoE-based Radio-to-Router Protocol on page 39

Verifying the PPPoE-based Radio-to-Router Protocol

Purpose	Verify the PPPoE-Based radio-to-router protocol.
Action	From operational mode, enter the show interfaces command.
Related Documentation	<ul style="list-style-type: none"> • Junos OS Feature Support Reference for SRX Series and J Series Devices • Understanding the PPPoE-Based Radio-to-Router Protocol

Verifying PPPoE Interfaces

Purpose	Display PPPoE interfaces information.
Action	<ul style="list-style-type: none"> • To display PPPoE interface information: <pre> user@host> show pppoe interfaces pp0.51 detail pp0.51 Index 75 State: Session up, Session ID: 1, Service name: None, Configured AC name: None, Session AC name: None, Remote MAC address: 00:11:22:33:44:55, Session uptime: 00:04:18 ago, Auto-reconnect timeout: Never, Idle timeout: Never, Underlying interface: ge-0/0/1.0 Index 70 PADQ Current bandwidth: 750 Kbps, Maximum 1000 Kbps Quality: 85, Resources 65, Latency 100 msec. Dynamic bandwidth: 3 Kbps </pre> • To display PPPoE terse interface information: <pre> user@host> show pppoe interfaces terse pp0.51 Interface Admin Link Proto Local Remote pp0.51 up up inet 5.1.1.1 --> 5.1.1.2 inet6 fe80::21f:12ff:fed2:2918/64 feee::5:1:1:1/126 </pre>

Related Documentation • For more information, see the [Junos OS System Basics and Services Command Reference](#)

Displaying Statistics for PPPoE

Purpose Display PPPoE statistics.

Action `user@host> show interfaces pp0.51 statistics`

Sample Output

```
Logical interface pp0.51 (Index 75) (SNMP ifIndex 137)
  Flags: Point-To-Point SNMP-Traps 0x0 Encapsulation: PPPoE
  PPPoE:
    State: SessionUp, Session ID: 1,
    Session AC name: None, Remote MAC address: 00:22:83:84:2f:03,
    Underlying interface: ge-0/0/4.1 (Index 74)
    Input packets : 20865
    Output packets: 284636
  Keepalive settings: Interval 10 seconds, Up-count 1, Down-count 3
  Keepalive: Input: 0 (never), Output: 943 (00:00:06 ago)
  LCP state: Opened
  NCP state: inet: Opened, inet6: Opened, iso: Not-configured, mp1s:
  Not-configured
  CHAP state: Closed
  PAP state: Closed
  Security: Zone: Null
  Protocol inet, MTU: 1492
    Flags: None
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: 5.1.1.2, Local: 5.1.1.1
  Protocol inet6, MTU: 1492
    Flags: None
    Addresses, Flags: Is-Preferred
      Destination: fe80::/64, Local: fe80::21f:12ff:fed2:2918
    Addresses, Flags: Is-Preferred Is-Primary
      Destination: feee::5:1:1:0/126, Local: feee::5:1:1:1
```

Credit Flow Control for PPPoE

To support the credit-based flow control extensions described in RFC4938, PPPoE peers can grant each other forwarding credits. The grantee is allowed to forward traffic to the peer only when it has a sufficient number of credits to do so. When credit-based forwarding is used on both sides of the session, the radio client can throttle traffic by limiting the number of credits it grants to the router.

The **interfaces** statement includes the **radio-router** attribute, which contains the parameters used for rate-based scheduling and OSPF link cost calculations. It also includes the **credit** attribute to indicate that credit-based packet scheduling is supported on the PPPoE interfaces that reference this underlying interface. Interfaces that set the **encapsulation** attribute support the PPPoE Active Discovery Grant (PADG) and PPPoE Active Discovery Credit (PADC) messages in the same way that the **radio-router** attribute provides active support for the PPPoE Active Discovery Quality (PADQ) message.

The **credit interval** parameter controls how frequently the router generates credit announcement messages. For PPPoE this corresponds to the interval between PADG credit announcements for each session.

Example: PPPoE Credit-Based Flow Control Configuration

This example shows a PPPoE credit-based flow control configuration.

```
[edit interfaces ge-0/0/1]
unit 0 {
  encapsulation ppp-over-ether;
  radio-router {
    credit {
      interval 10;
    }
    bandwidth 80;
    threshold 5;
  }
}
```

Verifying Credit-Flow Control

Purpose Display PPPoE credit-flow control information about credits on each side of the PPPoE session when credit processing is enabled on the interface.

Action user@host> show pppoe interface detail

```
pp0.51 Index 73
State: Session up, Session ID: 3,
Service name: None,
Configured AC name: None, Session AC name: None,
Remote MAC address: 00:22:83:84:2e:81,
Session uptime: 00:05:48 ago,
Auto-reconnect timeout: Never, Idle timeout: Never,
Underlying interface: ge-0/0/4.1 Index 72
PADG Credits: Local: 12345, Remote: 6789, Scale factor: 128 bytes
PADQ Current bandwidth: 750 Kbps, Maximum 1000 Kbps
Quality: 85, Resources 65, Latency 100 msec.
Dynamic bandwidth: 3 Kbps

pp0.1000 Index 71
State: Down, Session ID: 1,
Service name: None,
Configured AC name: None, Session AC name: None,
Remote MAC address: 00:00:00:00:00:00,
Auto-reconnect timeout: Never, Idle timeout: Never,
Underlying interface: ge-0/0/1.0 Index 70
PADG Credits: enabled
Dynamic bandwidth: enabled
```

Related Documentation

- For more information, see the *Junos OS System Basics and Services Command Reference*

Setting Tracing Options for PPPoE

To trace the operations of the router's PPPoE process, include the `traceoptions` statement at the `[edit protocols pppoe]` hierarchy level:

```
[edit protocols pppoe]
traceoptions {
  file filename <files number> <match regular-expression> <size size> <world-readable |
    no-world-readable>;
  flag flag;
  level severity-level;
  no-remote-trace;
}
```

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

You can specify the following flags in the **traceoptions** statement:

- **all**—All areas of code
- **config**—Configuration code
- **events**—Event code
- **gres**—Gres code
- **init**—Initialization code
- **interface-db**—Interface database code
- **memory**—Memory management code
- **protocol**—PPPoE protocol processing code
- **rtsock**—Routing socket code
- **session-db**—Session management code
- **signal**—Signal handling code
- **state**—State handling code
- **timer**—Timer code
- **ui**—User interface code

**Related
Documentation**

- For general information about tracing, see the tracing and logging information in the [Junos OS System Basics Configuration Guide](#).

CHAPTER 7

Configuring the R2CP Radio-to-Router Protocol

- R2CP Radio-to-Router Protocol Overview on page 43
- Configuring the R2CP Radio-to-Router Protocol on page 44
- Verifying R2CP Interfaces on page 47
- Configuring Large Delay Buffers in CoS on page 48

R2CP Radio-to-Router Protocol Overview

The Network Centric Waveform (NCW) radio-specific radio-to-router control protocol (R2CP) is similar to the PPPoE radio-to-router protocol. Both of these protocols exchange dynamic metric changes in the network that the routers use to update the OSPF topologies.

In radio-router topologies, the router connects to the radio over a Gigabit Ethernet link and the radio transmits packets over the radio frequency (RF) link. The radio periodically sends metrics to the router, which uses RF link characteristics and other data to inform the router on the shaping and OSPF link capacity. The router uses this information to shape the data traffic and provide the OSPF link cost for its SPF calculations. The radio functions like a Layer 2 switch and can only identify remote radio-router pairs using the Layer 2 MAC addresses. With R2CP the router receives metrics for each neighboring router, identified by the MAC address of the remote router. The R2CP daemon translates the MAC addresses to link the local IPv6 address and sends the metrics for each neighbor to OSPF. Processing these metrics is similar to the handling of PPPoE PADQ metrics. Unlike PPPoE, which is a point-to-point link, these R2CP neighbors are treated as nodes in a broadcast LAN.

You must configure each neighbor node with a per unit scheduler for CoS. The scheduler context defines the attributes of Junos class-of-service. To define CoS for each radio, you can configure virtual channels to limit traffic. You need to configure virtual channels for as many remote radio-router pairs as there are in the network. You configure virtual channels on a logical interface. Each virtual channel can be configured to have a set of eight queues with a scheduler and an optional shaper. When the radio initiates the session with a peer radio-router pair, a new session is created with the remote MAC address of the router and the VLAN over which the traffic flows. Junos OS chooses from the list of free virtual channels and assigns the remote MAC and the eight CoS queues and the

scheduler to this remote MAC address. All traffic destined to this remote MAC address is subjected to the CoS that is defined in the virtual channel.

A virtual channel group is a collection of virtual channels. Each radio can have only one virtual channel group assigned uniquely. If you have more than one radio connected to the router, you must have one virtual channel group for each local radio-to-router pair. Although a virtual channel group is assigned to a logical interface, a virtual channel is not the same as a logical interface. The only features supported on a virtual channel are queuing, packet scheduling, and accounting. Rewrite rules and routing protocols apply to the entire logical interface.

All nodes in the R2CP network are in a broadcast LAN. The point-to-multipoint over LAN protocol supports advertising different bandwidth information for neighbors on a broadcast link. The network link is a point-to-multipoint link in the OSPFv3 link state database, which uses existing OSPF neighbor discovery to provide automatic discovery without configuration. It enables each node to advertise a different metric to every other node in the network to accurately represent the cost of communication. The **p2mp-over-lan** interface type under the OSPFv3 interface configuration enables you to configure the interface. OSPFv3 then uses LAN procedures for neighbor discovery and flooding, but represents the interface as point-to-multipoint in the link state database.

The interface type and router LSA are available under the following hierarchies:

[protocols ospf3 area *area-id* interface *interface-name*]

[routing-instances *routing-instances-name* protocols ospf3 area *area-id* interface *interface-name*]

For example:

```
protocols {
  ospf3 {
    area 0.0.0.0 {
      interface ge-0/0/2.0 {
        interface-type p2mp-over-lan;
      }
    }
  }
}
```

**Related
Documentation**

- Configuring the R2CP Radio-to-Router Protocol on page 44

Configuring the R2CP Radio-to-Router Protocol

To configure the R2CP protocol:

1. Configure the interfaces.

The following example creates four logical interfaces on ge-0/0/2, using unit 52 for R2CP control messages and units 101-193 for data traffic. The **per-unit-scheduler** statement is required for R2CP.

```

interfaces {
  ge-0/0/2 {
    per-unit-scheduler;
    vlan-tagging;
    unit 52 {
      vlan-id 52;
      family inet {
        address 52.1.1.1/24;
      }
    }
    unit 101 {
      vlan-id 101;
      family inet {
        address 101.1.1.1/24;
      }
    }
    unit 102 {
      vlan-id 102;
      family inet {
        address 102.1.1.1/24;
      }
    }
    unit 103 {
      vlan-id 103;
      family inet {
        address 103.1.1.1/24;
      }
    }
  }
}

```

2. Configure the R2CP protocol.

The following example configures g2-0/0/2.52 as the interface for R2CP control messages, vg1 as the virtual-channel group, and ge-0/0/2.101-103 as data interfaces using the radio-interface statement.

```

protocols {
  r2cp {
    radio myRadio {
      interface ge-0/0/2.52;
      virtual-channel-group vg1;
      radio-interface ge-0/0/2.101;
      radio-interface ge-0/0/2.102;
      radio-interface ge-0/0/2.103;
    }
  }
}

```

3. Configure class of service.

The following example defines virtual-channels, their initial shaping-rates, and the virtual-channel-group to which they belong. It also makes the association between radio-interface interfaces and virtual-channel-group. In the class of service configuration, the **vc-shared-scheduler** configuration statement is required for each interface configured as a radio interface in the R2CP protocol configuration.

```
class-of-service {
  virtual-channels {
    vc1;
    vc2;
    vc3;
    vc4;
  }
  virtual-channel-groups {
    vg1 {
      vc1 {
        scheduler-map sm;
        shaping-rate 15m;
        default;
      }
      vc2 {
        scheduler-map sm;
        shaping-rate 20m;
      }
      vc3 {
        scheduler-map sm;
        shaping-rate 20m;
      }
      vc4 {
        scheduler-map sm;
        shaping-rate 20m;
      }
    }
  }
}
forwarding-classes {
  queue 0 DATA-queue;
}
interfaces {
  ge-0/0/2 {
    unit 101 {
      virtual-channel-group vg1;
      vc-shared-scheduler;
    }
    unit 102 {
      virtual-channel-group vg1;
      vc-shared-scheduler;
    }
    unit 103 {
      virtual-channel-group vg1;
      vc-shared-scheduler;
    }
  }
}
scheduler-maps {
  sm {
    forwarding-class DATA-queue scheduler sm-scheduler;
  }
}
schedulers {
  sm-scheduler {
    transmit-rate percent 20;
    buffer-size percent 20;
  }
}
```

```

        priority low;
    }
}
}

```

Related Documentation • For information on configuring network interfaces, see the [Junos OS Network Interfaces Configuration Guide](#)

Verifying R2CP Interfaces

Purpose Display R2CP interfaces information.

Action • To display R2CP interface information:

```
root@host> show r2cp interfaces
```

```
Interface: ge-0/0/3.51
Nodes: 0
```

• To display R2CP information:

```
root@host> show r2cp radio extensive
```

Node Packet Type	Sent	Received	Errors
MIM	-	1	0
ROM	1	-	-
Heartbeats	0	0	0
Node Term	0	0	0
Node Term Ack	0	0	-
Heartbeat Timeouts	0		
Node Term Timeouts	0		

Session Packet Type	Sent	Received	Errors
Init	-	1	0
Init ACK	1	-	-
Update	-	0	0
Terminate	0	0	0
Terminate ACK	0	0	0
Terminate Timeouts	0		

• To display R2CP session information:

```
root@host> show r2cp sessions extensive
```

```
Session: 1
Destination MAC address 01:02:03:04:05:06
Status: Established VLANs 201
Virtual channel: 2
Session Update: last received: 3.268 seconds
Current bandwidth: 22000 Kbps, Maximum 22000 Kbps
Quality: 100, Resources 100, Latency 100 msec.
Effective bandwidth: 952 Kbps, last change: 51.484 seconds
Updates below threshold: 1
```

Session Packet Type	Sent	Received	Errors
Init	-	1	0
Init ACK	1	-	-
Update	-	0	0
Terminate	0	0	0
Terminate ACK	0	0	0
Terminate Timeouts	0		

Related Documentation • For more information, see the *Junos OS System Basics and Services Command Reference*

Configuring Large Delay Buffers in CoS

You can configure very large delay buffers using the **buffer-size-temporal** command combined with the **q-pic-large-buffer** command. The **buffer-size temporal** option in combination with **q-pic-large-buffer** can create extra-large delay buffer allocations for one or several queues on an interface.

Configuring Large Delay Buffers

The following configuration applies to the examples that follow:

1. Configure two VLANs (one ingress, one egress) on one interface. No interface shaping rate is initially defined for this configuration.

```
[edit]
set interfaces ge-0/0/3 per-unit-scheduler
set interfaces ge-0/0/3 vlan-tagging
set interfaces ge-0/0/3 unit 102 vlan-id 102
set interfaces ge-0/0/3 unit 102 family inet address 1.1.102.2/24
set interfaces ge-0/0/3 unit 201 vlan-id 201
set interfaces ge-0/0/3 unit 201 family inet address 2.2.201.2/24
set routing-options static route 33.33.1.1/32 next-hop 2.2.201.3
```

2. Enable the **q-pic-large-buffer** option on the same PIC, in addition to the **buffer-size temporal** option on the queue, to create a large buffer on the queue:

```
[edit]
set chassis fpc 0 pic 0 q-pic-large-buffer
```



NOTE: The CLI does not provide a warning when you use **buffer-size temporal** without **q-pic-large-buffer**. When you use **buffer-size temporal**, verify that the configuration also includes the **q-pic-large-buffer** command.

3. Define four forwarding-classes (queue names) for the four queues:

```
[edit]
set class-of-service forwarding-classes queue 0 be-Queue0
set class-of-service forwarding-classes queue 1 video-Queue1
set class-of-service forwarding-classes queue 2 voice-Queue2
```

```
set class-of-service forwarding-classes queue 3 nc-Queue3
```

4. Configure the forwarding classes (queue names) included in a scheduler map, applied to the egress VLAN:

```
[edit]
set class-of-service interfaces ge-0/0/3 unit 201 scheduler-map schedMapM
set class-of-service scheduler-maps schedMapM forwarding-class be-Queue0
  scheduler be-Scheduler0
set class-of-service scheduler-maps schedMapM forwarding-class video-Queue1
  scheduler video-Scheduler1
set class-of-service scheduler-maps schedMapM forwarding-class voice-Queue2
  scheduler voice-Scheduler2
set class-of-service scheduler-maps schedMapM forwarding-class nc-Queue3
  scheduler nc-Scheduler3
```

5. Set the queue priorities. Only queue priorities are initially defined, not transmit rates or buffer sizes.

```
[edit]
set class-of-service schedulers be-Scheduler0 priority low
set class-of-service schedulers video-Scheduler1 priority medium-low
set class-of-service schedulers voice-Scheduler2 priority medium-high
set class-of-service schedulers nc-Scheduler3 priority high
```

Example: Simple Configuration Using Four Queues

This configuration allocates 12,500,000 bytes of buffer for each of the four queues. To avoid exceeding the limits of the delay buffer calculation, this initial example has no interface shaping rate, scheduler transmit rate, or scheduler buffer size percent configuration.

1. Specify the maximum 4-second delay buffer on each of the four queues:

```
[edit]
set class-of-service schedulers be-Scheduler0 buffer-size temporal 4m
set class-of-service schedulers video-Scheduler1 buffer-size temporal 4m
set class-of-service schedulers voice-Scheduler2 buffer-size temporal 4m
set class-of-service schedulers nc-Scheduler3 buffer-size temporal 4m
```

Specifying **buffer-size temporal** on some or all queues uses implicit (default) or explicit transmit rate percentages as the buffer-size percentages of the temporal values for those queues. Because there are no explicitly specified transmit rate percentages, divide 100 percent by the number of configured queues (queues with schedulers configured in the scheduler map) to get the implicit (default) per-queue transmit rate percentages. Each queue gets an implicit (default) transmit rate of $100\% / 4 = 25\%$.

In this example, specifying the maximum 4-second delay on each queue, with no shaping rate on the interface and implicit (default) per-queue transmit rates of 25 percent, the total buffer for all temporal 4m queues on an interface = 4 seconds * 100,000,000 maximum interface bps / 8 bits/byte = 4 seconds * 12,500,000 bytes = 50,000,000 bytes. Each queue specifying temporal 4m gets $25\% * 50,000,000 = 12,500,000$ bytes.

2. Add a shaping rate of 4 Mbps to the interface:

```
[edit]
```

set class-of-service interfaces ge-0/0/3 unit 201 shaping-rate 4m

The total buffer for all temporal 4m queues on an interface = 4 sec * 4,000,000 bps shaping-rate / 8 bits/byte = 4 sec * 500,000 bytes = 2,000,000 bytes. Therefore, each queue specifying temporal 4m receives 25% * 2,000,000 = 500,000 bytes.

When using **buffer-size temporal** on any interface queues, if you also use the **transmit-rate percent** command, or the **buffer-size percent** command, or both commands, on any of the interface queues, the buffer size calculations become more complex and the limits of available queue depth may be reached. If the configuration attempts to exceed the available memory, then at commit time two system log messages appear in the `/var/log/messages` file, the interface class-of-service configuration is ignored, and the interface class-of-service configuration reverts to the two-queue defaults:

```
Mar 11 11:02:10.239 e1ma-n4 e1ma-n4 COSMAN_FWDD: queue mem underflow for ge-0/0/3
Mar 11 11:02:10.240 e1ma-n4 e1ma-n4 cosman_compute_install_sched_params: Failed
to compute scheduler params for ge-0/0/3.Hence retaining defaults
```

When configuring **buffer-size temporal** along with **transmit-rate percent** or **buffer-size percent**, or both, you must monitor the system log to see whether the available queue depth limit has been reached.

Example: Using buffer-size temporal with Explicit transmit-rate percent Commands

To add explicit transmit rates to all four queues:

```
[edit]
set class-of-service schedulers be-Scheduler0 transmit-rate percent 10
set class-of-service schedulers video-Scheduler1 transmit-rate percent 25
set class-of-service schedulers voice-Scheduler2 transmit-rate percent 25
set class-of-service schedulers nc-Scheduler3 transmit-rate percent 40
```

For example, if an interface is shaped to 4Mbps, the transmit rate percentage of 10 for a queue means that the bandwidth share for the specific queue is 0.4 Mbps. The queues are allocated portions of the 2,000,000 bytes of total buffer available for temporal queues on this interface, proportionally to their transmit rates. The four queues get 200,000, 500,000, 500,000, and 800,000 bytes of delay buffer, respectively.

To avoid exceeding the queue depth limits and triggering system log messages and default configuration behavior, when configuring queues with **buffer-size temporal** and **transmit rate percent** and other (non-temporal) queues with **buffer-size percent**, the following configuration rule must be followed: When one or more queues on an interface are configured with **buffer-size temporal**, the sum of the temporal queues explicitly configured transmit rate percentages plus other non-temporal queues explicitly configured buffer size percentages must not exceed 100 percent.

If the total of the temporal queues transmit rate percentages and the non-temporal queues buffer-size percentages exceeds 100 percent, the **queue mem underflow** and **Failed to compute scheduler params** system log messages appear in the messages log, the explicitly configured CLI CoS configuration for the interface is ignored, and the interface reverts to a two-queue default CoS configuration.

When **buffer-size temporal** is specified on a queue, if **transmit-rate percent** is also configured on the same queue, the queue depth configured is based on the fractional bandwidth for the queue as obtained by the specified **transmit-rate percent**.

In addition to temporal delay times specified for one or more queues using buffer size temporal, there is another delay time automatically computed for the entire interface. This interface delay time is distributed across all non-temporal queues, proportionally to their implicit (default) or explicit transmit-rate percentages. If **q-pic-large-buffer** is not enabled, the interface delay time defaults to 100 ms. As shown in Table 1, when **q-pic-large-buffer** is enabled, interface delay time is calculated according to configured shaping rate for the interface. Because the shaping-rate configured in the example above was 4 Mbps (> 2,048,000 bps), the interface delay time for the configuration is 100 msec.

Table 3: Interface Delay Times Enabled By q-pic-large-buffer

Configured Shaping Rate (bps)	Interface Delay Time (msec) Used for Non-Temporal Queues with q-pic-large-buffer Enabled	Default Delay Time Used (msec) Without q-pic-large-buffer
64,000-255,999	4000	100
256,000 - 511,999	2000	100
512,000 - 102,3999	1000	100
1,024,000 - 2,047,999	500	100
>= 2,048,000	100	100

This example properly computes the delay buffer limits on both temporal and non-temporal queues:

1. Substitute **buffer-size percent** for **buffer-size temporal** on queues 0 and 1:

```
[edit]
delete class-of-service schedulers be-Scheduler0 buffer-size temporal 4m
delete class-of-service schedulers video-Scheduler1 buffer-size temporal 4m
set class-of-service schedulers be-Scheduler0 buffer-size percent 10
set class-of-service schedulers video-Scheduler1 buffer-size percent 25
```

This deletes the requirement for hard-specified 4 seconds of buffering and replaces it with a proportional limit of 10 percent (or 25 percent) of the total interface delay time for the non-temporal queues. In both cases, the queue depth is calculated based on the share of the interface bandwidth for the specific queues. Total Interface Non-Temporal Queue Memory = shaping-rate * Interface delay time (Table 1) = 4 Mbps * 0.1 seconds = 500,000 bytes per second * 0.1 seconds = 50,000 bytes, therefore queues 0 and 1 get 10% * 50,000 = 5000 bytes and 25% * 50,000 = 12,500 bytes of delay buffer, respectively.

2. Configure **buffer-size temporal** on queues 2 and 3:

```
[edit]
```

```
set class-of-service schedulers voice-Scheduler2 buffer-size temporal 4m
set class-of-service schedulers voice-Scheduler2 transmit-rate percent 25
set class-of-service schedulers nc-Scheduler3 buffer-size temporal 4m
set class-of-service schedulers nc-Scheduler3 transmit-rate percent 40
```

Queues 2 and 3 still get 500,000 and 800,000 bytes of delay buffer, respectively, as previously calculated. This configuration obeys the rule that the sum of the temporal queues transmit rate percentages ($25\% + 40\% = 65\%$), plus the non-temporal queues buffer size percentages ($10\% + 25\% = 35\%$) do not exceed 100% ($65\% + 35\% \leq 100\%$).

The following example exceeds the delay buffer limit, triggering the system log messages and the default, two-queue class-of-service behavior.

Increase the buffer-size percentage from 25 percent to 26 percent for non-temporal queue 1:

```
[edit]
set class-of-service schedulers video-Scheduler1 buffer-size percent 26
```

This violates the configuration rule that the sum of the non-temporal queues buffer-size percentages ($10\% + 26\% = 36\%$), plus the temporal queues transmit rate percentages ($25\% + 40\% = 65\%$) now exceed 100% ($36\% + 65\% = 101\%$). Therefore, the following two system log messages appear in the `/var/log/messages` file:

```
Mar 23 18:08:23 elma-n4 elma-n4 COSMAN_FWDD: %PFE-3: queue mem underflow for
ge-0/0/3 q_num(3)
Mar 23 18:08:23 elma-n4 elma-n4 cosman_compute_install_sched_params: %PFE-3:
Failed to compute scheduler params for ge-0/0/3.Hence retaining defaults
```

When the delay buffer limits are exceeded, the CLI-configured class-of-service settings are not used and the default class-of-service configuration (the default scheduler-map) is assigned to the interface. This uses two queues: the forwarding-class best-effort (queue 0) has transmit rate percent 95 and buffer-size percent 95 and the forwarding-class network-control (queue 3) has the transmit rate percent 5 and buffer-size percent 5.

```
queue 0: 1,187,500 Bytes
queue 1:    9,192 Bytes
queue 2:    9,192 Bytes
queue 3:   62,500 Bytes
```

CHAPTER 8

Summary of Junos Statements for the LN1000 Router

address

Syntax	<code>address <i>address</i>;</code>
Hierarchy Level	[edit access address-assignment location-pool <i>pool-name</i> family inet location <i>index</i>]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the IP address and subnet mask that corresponds to the slot location index
Options	<i>address</i> —IP address and subnet mask.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">Configuring Location-Based IP Address Pools on page 26

address-assignment

Syntax	<pre>address-assignment { location-pool { pool-name { family inet { location { index { address address; } } } } } }</pre>
Hierarchy Level	[edit access]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the address of a location-based IP address pool.
Options	The remaining statements are explained separately.
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">Configuring Location-Based IP Address Pools on page 26

apply-groups

Syntax	<pre>apply-groups;</pre>
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> radio-router]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Apply the groups from which to inherit configuration data. If radio-router is set without any other attributes specified, the first four values become 100 and threshold stays at 10, and capacity, margin, and delay are deprecated. If radio-router is set, do not change the OSPF reference-bandwidth value because this generates an incorrect link cost.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">Configuring PPPoE-Based Radio-to-Router Protocols on page 36

bandwidth

Syntax	<code>bandwidth <i>weight</i>;</code>
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> radio-router]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the weight of the bandwidth factor when calculating an effective interface bandwidth.
Options	<p><i>weight</i>—Factor used to calculate interface bandwidth.</p> <p>Range: 0 through 100</p> <p>Default: 100</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 Documentation	<ul style="list-style-type: none"> Configuring PPPoE-Based Radio-to-Router Protocols on page 36 R2CP Radio-to-Router Protocol Overview on page 43

credit

Syntax	<pre>credit { interval <i>seconds</i>; }</pre>
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> radio-router]
Release Information	Statement introduced in Junos OS Release 10.1.
Description	Configure the credit-based packet scheduling.
Options	The remaining statements are explained separately.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> Configuring PPPoE-Based Radio-to-Router Protocols on page 36

data-rate

Syntax	<code>data-rate <i>weight</i>;</code>
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> radio-router]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the weight of the resource factor when calculating an effective data rate.
Options	<i>weight</i> —Factor used to calculate data rate. Range: 0 through 100 Default: 100
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">Configuring PPPoE-Based Radio-to-Router Protocols on page 36

disable

Syntax	<code>disable;</code>
Hierarchy Level	[edit protocol r2cp]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Disable R2CP on the system.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">R2CP Radio-to-Router Protocol Overview on page 43

family

Syntax	<pre>family inet { location { index { address address; } } }</pre>
Hierarchy Level	[edit access <i>address-assignment</i> location-pool <i>pool-name</i>]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure protocol family information for the logical interface.
Options	<p>family—Specifies the protocol family:</p> <ul style="list-style-type: none"> inet—Specifies the Internet Protocol version 4 suite <p>The remaining statements are explained separately.</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 Documentation	<ul style="list-style-type: none"> Configuring Location-Based IP Address Pools on page 26

hub-assist

Syntax	hub-assist <i>weight</i> ;
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> radio-router]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the weight of the resource factor when calculating an effective interface bandwidth.
Options	<p>weight—Factor used to calculate interface bandwidth.</p> <p>Range: 0 through 100</p> <p>Default: 100</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 Documentation	<ul style="list-style-type: none"> Configuring PPPoE-Based Radio-to-Router Protocols on page 36

interface

Syntax	<code>interface <i>interface-name</i> unit <i>unit</i></code>
Hierarchy Level	<code>[edit protocol r2cp radio <i>radio-name</i>]</code>
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the interface that receives R2CP messages.
Options	<i>interface-name</i> —Name of the radio interface. <i>unit</i> —Radio unit number.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• R2CP Radio-to-Router Protocol Overview on page 43

interval

Syntax	<code>interval <i>seconds</i>;</code>
Hierarchy Level	<code>[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> radio-router credit]</code>
Release Information	Statement introduced in Junos OS Release 10.1.
Description	Configure the frequency that the router generates credit announcement messages.
Options	<i>seconds</i> —Interval between PADG credit announcements for each session. Range: 0 through 60 Default: 1
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring PPPoE-Based Radio-to-Router Protocols on page 36

latency

Syntax	<code>latency <i>weight</i>;</code>
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> radio-router]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the weight of the latency factor when calculating an effective interface bandwidth.
Options	<p><i>weight</i>—Factor used to calculate interface bandwidth.</p> <p>Range: 0 through 100</p> <p>Default: 100</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 Documentation	<ul style="list-style-type: none"> Configuring PPPoE-Based Radio-to-Router Protocols on page 36

location

Syntax	<pre>location { index { address <i>address</i>; } }</pre>
Hierarchy Level	[edit access address-assignment location-pool <i>pool-name</i> family inet]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the location for a router running Junos OS.
Options	<p><i>index</i>—a location number.</p> <p>The remaining statements are explained separately.</p>
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 Documentation	<ul style="list-style-type: none"> Configuring Location-Based IP Address Pools on page 26

location-pool

Syntax	<pre>location-pool { pool-name { family inet { location { index { address address; } } } } }</pre>
Hierarchy Level	[edit access address-assignment],
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the name of a location-based IP address pool.
Options	<p>pool-name—Name assigned to the location-based address pool.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">Configuring Location-Based IP Address Pools on page 26

location-pool-address

Syntax	<pre>location-pool-address pool-name;</pre>
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> family inet]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Select the location-based IP address pool from the location of the IP address and subnet mask for an IP interface.
Options	<p>pool-name—Name assigned to the location-based address pool.</p>
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">Configuring Location-Based IP Address Pools on page 26

mac-mode (Gigabit Ethernet)

Syntax	<code>mac-mode (sgmii 1000base-x);</code>
Hierarchy Level	[edit interfaces <i>interface-name</i> mac-mode]
Release Information	Statement introduced in Junos OS Release 10.0.
Description	For Gigabit Ethernet interfaces only, specify whether the MAC address for the interface is configured with the Serial Gigabit Media Independent Interface (SGMII) or 1000Base-X physical layer protocol. Speeds of 10 Mbps and 100 Mbps are valid only with a MAC mode of SGMII. Autonegotiation for MAC mode must be enabled for 1000Base-X.
Default	SGMII
Options	sgmii —Specifies the serial Gigabit Media Independent Interface. 1000base-x —Specifies the physical layer protocol.
Usage Guidelines	See Configuring a Gigabit Ethernet Interface.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.

node-terminate-count

Syntax	<code>node-terminate-count <i>count</i>;</code>
Hierarchy Level	[edit protocol r2cp]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the number of node terminate retransmits attempted when a node terminate ACK has not been received before radio/router adjacency is terminated.
Options	count —Number of node terminate retransmits Range: 1 through 5 Default: 3
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> R2CP Radio-to-Router Protocol Overview on page 43

node-terminate-interval

Syntax	<code>node-terminate-interval <i>interval</i>;</code>
Hierarchy Level	[edit protocol r2cp]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the interval between node terminate retransmits.
Options	<i>interval</i> —Interval in milliseconds. Range: 100 through 5000 Default: 1000
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• R2CP Radio-to-Router Protocol Overview on page 43

quality

Syntax	<code>quality <i>weight</i>;</code>
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> radio-router]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the weight of the quality factor when calculating an effective interface bandwidth.
Options	<i>weight</i> —Factor used to calculate interface bandwidth. Range: 0 through 100 Default: 100
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring PPPoE-Based Radio-to-Router Protocols on page 36

r2cp

Syntax	<pre> r2cp { {enable disable}; traceoptions { flag flags; file filename; } server-port port-number; node-terminate-count <i>count</i>; node-terminate-interval <i>interval</i>; session-terminate-count <i>count</i>; session-terminate-interval <i>interval</i>; radio <i>radio-name</i> { interface <i>interface</i> unit <i>unit-number</i>; radio-interface interface unit <i>number</i>; virtual-channel-group <i>vc-group</i>; } } </pre>
Hierarchy Level	[edit protocols]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the network interfaces that are used for protocol updates. By default, the protocol is disabled on all interfaces.
Options	The statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> R2CP Radio-to-Router Protocol Overview on page 43

radio

Syntax	<pre>radio <i>radio-name</i> { interface <i>interface</i> unit <i>unit-number</i>; virtual-channel-group <i>vc-group-name</i>; radio-interface <i>interface</i> unit <i>number</i>; }</pre>
Hierarchy Level	[edit protocol r2cp]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the arbitrary name that describes the R2CP radio that exchanges messages and listens for acknowledgements. The interfaces and radio interfaces must reference the same Ethernet port for a particular radio. In addition, the logical interface configured by the radio interface can only be referenced by a single radio.
Options	<p><i>radio-name</i>—Name of the R2CP radio.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• R2CP Radio-to-Router Protocol Overview on page 43

radio-interface

Syntax	<pre>radio-interface <i>interface</i> unit <i>unit</i>;</pre>
Hierarchy Level	[edit protocol r2cp radio <i>radio-name</i>]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the attributes that identify the VLANs managed through the R2CP protocol.
Options	<p><i>interface</i>—Name of the interface.</p> <p><i>unit</i>—Unit number.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• R2CP Radio-to-Router Protocol Overview on page 43

radio-router

Syntax	<pre>radio-router { bandwidth <i>weight</i>; latency <i>weight</i>; quality <i>weight</i>; resource <i>weight</i>; threshold <i>percentage</i>; credit { interval <i>seconds</i>; } }</pre>
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i>]
Release Information	Statement introduced in Junos OS Release 10.1.
Description	Configure the metric announcements that are received on the interface and processed by the router to control the flow of traffic and manage the speed of the link, resulting in a corresponding adjustment of OSPF cost.
Options	The remaining statements are explained separately.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> Configuring PPPoE-Based Radio-to-Router Protocols on page 36

resource

Syntax	<code>resource <i>weight</i>;</code>
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> radio-router]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the weight of the resource factor when calculating an effective interface bandwidth.
Options	<i>weight</i> —Factor used to calculate interface bandwidth. Range: 0 through 100 Default: 100
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> Configuring PPPoE-Based Radio-to-Router Protocols on page 36

server-port

Syntax	<code>server-port <i>port-number</i>;</code>
Hierarchy Level	[edit protocol r2cp]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the R2CP server that exchanges messages and listens for acknowledgements.
Options	<i>port-number</i> —Number of the server port. Default: UDP port 28762
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• R2CP Radio-to-Router Protocol Overview on page 43

session-terminate-count

Syntax	<code>session-terminate-count <i>count</i>;</code>
Hierarchy Level	[edit protocol r2cp radio]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the number of Session Terminate retransmits to be attempted when a Session Terminate ACK has not been received before the session terminated.
Options	<i>count</i> —Number of session terminate retransmits Range: 1 through 5 Default: 3
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• R2CP Radio-to-Router Protocol Overview on page 43

session-terminate-interval

Syntax	<code>session-terminate-interval <i>interval</i>;</code>
Hierarchy Level	[edit protocol r2cp]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the interval between Session Terminate retransmits.
Options	<i>interval</i> —Interval in milliseconds Range: 100 through 5000 Default: 1000
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> R2CP Radio-to-Router Protocol Overview on page 43

threshold

Syntax	<code>threshold <i>percentage</i>;</code>
Hierarchy Level	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> radio-router]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the percentage by which the effective interface speed for the session must change before the OSPF protocol is notified.
Options	<i>weight</i> —Factor used to calculate interface bandwidth Range: 0 through 100 Default: 100
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> Configuring PPPoE-Based Radio-to-Router Protocols on page 36

traceoptions

Syntax	<pre>traceoptions { file <i>filename</i>; flag <i>flag</i>; }</pre>
Hierarchy Level	[edit protocol r2cp]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the trace options for R2CP.
Options	<p>file <i>filename</i>—Name of the file to receive the output of the tracing operation.</p> <p>flag <i>flag</i>—Tracing operation to perform. To specify more than one tracing operation, include multiple flag statements. You can include the following flags:</p> <ul style="list-style-type: none">• all—All tracing operations• configuration—Configuration operations• event—All tracing events• interface—Interface operations• node—Node events• packet—Packet events• rtsock —Routing socket operations• session—Session events• socket—Socket events• timer—Timer events• virtual-channel—Virtual channel events
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none">• R2CP Radio-to-Router Protocol Overview on page 43

virtual-channel-group

Syntax	<code>virtual-channel-group <i>vc-group</i>;</code>
Hierarchy Level	[edit protocol r2cp radio <i>radio-name</i>]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the virtual channel group that is used when allocating a virtual circuit for each learned MAC address.
Options	<i>vc-group</i> —Name of virtual channel group.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• R2CP Radio-to-Router Protocol Overview on page 43

CHAPTER 9

Junos Statement Hierarchy for the LN1000 Router

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- [edit interfaces gigether-options] Hierarchy Level on page 71
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- [edit interfaces unit radio-router] Hierarchy Level on page 72
- [edit protocols r2cp] Hierarchy Level on page 72

[edit access address-assignment location-pool] Hierarchy Level

```
access {
  address-assignment {
    location-pool {
      pool-name {
        family inet {
          location {
            index {
              address address;
            }
          }
        }
      }
    }
  }
}
```

[edit interfaces gigether-options] Hierarchy Level

```
interfaces {
  interface-name {
    gigether-options {
      auto-negotiation | no-auto-negotiation;
      mac-mode (sgmii | 1000base-x);
    }
    speed (10m | 100m | 1g);
    link-mode (full-duplex | half-duplex);
  }
}
```

[edit interfaces unit family inet location-pool-address] Hierarchy Level

```
interfaces {  
  interface-name {  
    unit logical-unit-number {  
      family inet {  
        location-pool-address pool-name;  
      }  
    }  
  }  
}
```

[edit interfaces unit radio-router] Hierarchy Level

```
interfaces {  
  interface-name {  
    unit logical-unit-number {  
      radio-router {  
        bandwidth weight;  
        data-rate weight;  
        latency weight;  
        quality weight;  
        resource weight;  
        threshold percentage;  
      }  
    }  
  }  
}
```

[edit protocols r2cp] Hierarchy Level

```
protocols {  
  r2cp {  
    (enable | disable);  
    traceoptions {  
      flag flags;  
      file filename;  
    }  
    server-port port-number;  
    node-terminate-count count;  
    node-terminate-interval interval;  
    session-terminate-count count;  
    session-terminate-interval interval;  
    radio radio-name {  
      interface interface unit unit-number;  
      virtual-channel-group vc-group-name;  
      radio-interface interface unit unit-number;  
    }  
  }  
}
```

PART 2

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