Juniper Networks | Engineering Simplicity

Junos® OS

OpenConfig User Guide

Published
2020-03-25

Junos

Juniper Networks, Inc.
1133 Innovation Way
Sunnyvale, California 94089
USA
408-745-2000
www.juniper.net

Junos® OS OpenConfig User Guide

The information in this document is current as of the date on the title page.

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

END USER LICENSE AGREEMENT

The Juniper Networks product that is the subject of this technical documentation consists of (or is intended for use with) Juniper Networks software. Use of such software is subject to the terms and conditions of the End User License Agreement ("EULA") posted at https://support.juniper.net/support/eula/. By downloading, installing or using such software, you agree to the terms and conditions of that EULA.

Table of Contents

About the Documentation

IN THIS SECTION

Use this guide to configure and model both configurational and operational data of your switches and routers using OpenConfig data models.

Documentation and Release Notes

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

If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

Juniper Networks Books publishes books by Juniper Networks engineers and subject matter experts. These books go beyond the technical documentation to explore the nuances of network architecture, deployment, and administration. The current list can be viewed at https://www.juniper.net/books.

Using the Examples in This Manual

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

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

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

Merging a Full Example

To merge a full example, follow these steps:

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

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

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

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

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

Merging a Snippet

To merge a snippet, follow these steps:

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

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

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

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

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

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

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

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

Documentation Conventions

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

Table 1: Notice Icons

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

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

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the **configure** command: user@host> **configure**
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*

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

Convention	Description	Examples
Italic text like this	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# **set system domain-name** *domain-name*
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• To configure a stub area, include the **stub** statement at the **[edit protocols ospf area area-id]** hierarchy level. • The console port is labeled **CONSOLE**.
< > (angle brackets)	Encloses optional keywords or variables.	**stub <default-metric *metric*>;**
| (pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	**broadcast | multicast** **(*string1* | *string2* | *string3*)**
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	**rsvp { # Required for dynamic MPLS only**
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	**community name members [*community-ids*]**

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

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

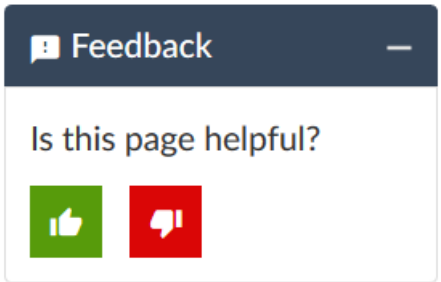
Table 2: Text and Syntax Conventions *(continued)*

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

Documentation Feedback

We encourage you to provide feedback so that we can improve our documentation. You can use either of the following methods:

- Online feedback system—Click TechLibrary Feedback, on the lower right of any page on the Juniper Networks TechLibrary site, and do one of the following:



  - Click the thumbs-up icon if the information on the page was helpful to you.
  - Click the thumbs-down icon if the information on the page was not helpful to you or if you have suggestions for improvement, and use the pop-up form to provide feedback.
- E-mail—Send your comments to techpubs-comments@juniper.net. Include the document or topic name, URL or page number, and software version (if applicable).

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active Juniper Care or Partner Support Services support contract, or are

covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

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

Self-Help Online Tools and Resources

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

- Find CSC offerings: https://www.juniper.net/customers/support/
- Search for known bugs: https://prsearch.juniper.net/
- Find product documentation: https://www.juniper.net/documentation/
- Find solutions and answer questions using our Knowledge Base: https://kb.juniper.net/
- Download the latest versions of software and review release notes: https://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: https://kb.juniper.net/InfoCenter/
- Join and participate in the Juniper Networks Community Forum: https://www.juniper.net/company/communities/
- Create a service request online: https://myjuniper.juniper.net

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

Creating a Service Request with JTAC

You can create a service request with JTAC on the Web or by telephone.

- Visit https://myjuniper.juniper.net.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see https://support.juniper.net/support/requesting-support/.

1

CHAPTER

OpenConfig Overview

OpenConfig Overview

OpenConfig is a collaborative effort in the networking industry to move toward a more dynamic, programmable method for configuring and managing multivendor networks. OpenConfig supports the use of vendor-neutral data models to configure and manage the network. These data models define the configuration and operational state of network devices for common network protocols or services. The data models are written in YANG, a standards-based, data modeling language that is modular, easy to read, and supports remote procedure calls (RPCs). Using industry standard models greatly benefits an operator with devices in a network from multiple vendors. The goal of OpenConfig is for operators to be able to use a single set of data models to configure and manage all the network devices that support the OpenConfig initiative.

OpenConfig for Junos OS supports the YANG data models and uses RPC frameworks to facilitate communications between a client and the router. You have the flexibility to configure your router directly by using Junos OS, or by using a third-party schema, such as OpenConfig. OpenConfig modules define a data model through its data, and the hierarchical organization of and constraints on that data. Each module is uniquely identified by a namespace URL to avoid possible conflicts with the Junos OS name.

The configuration and operational statements in Junos OS have corresponding path statements in OpenConfig. The following is a list of data modules for which mapping of OpenConfig and Junos OS configuration and operational statements is supported:

- BGP
- Interfaces
- LACP
- LLDP
- Local routing
- MPLS
- Network instance
- Platform
- Routing policy
- VLAN

When you configure OpenConfig statements on devices running Junos OS, the following features are *not* supported:

- Using **configure batch** or **configure private** mode
- Configuring statements under the **[edit groups]** hierarchy

For more information on the OpenConfig initiative, see http://www.openconfig.net/.

RELATED DOCUMENTATION

OpenConfig Data Model Version | 15

Understanding YANG on Devices Running Junos OS

NETCONF XML Management Protocol Developer Guide

OpenConfig Data Model Version

Table 3 on page 15 lists the OpenConfig data model versions.

Table 3: OpenConfig Data Model Versions

OpenConfig Data Model	Junos OS Release	OpenConfig Supported Version	Supported Platform
• AAA (**openconfig-aaa.yang**) • AAA Types (**openconfig-aaa-types.yang**) • AAA TACACS (**openconfig-aaa-tacacs.yang**) • AAA RADIUS (**openconfig-aaa-radius.yang**)	19.3	0.4.1	Juniper Networks ACX Series, EX Series, MX Series, PTX Series, and QFX Series
• BGP (**openconfig-bgp.yang**) • BGP NEIGHBOR (**openconfig-bgp-neighbor.yang**) • BGP POLICY (**openconfig-bgp-policy.yang**) • BGP TYPES (**openconfig-bgp-types.yang**)	16.1	2.0.1	Juniper Networks MX Series and PTX Series
	17.1	2.1.1	
	17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3		Juniper Networks MX Series, PTX Series, and QFX Series
	18.4, 19.1, 19.2	4.0.1	

Table 3: OpenConfig Data Model Versions *(continued)*

OpenConfig Data Model	Junos OS Release	OpenConfig Supported Version	Supported Platform
• BGP COMMON (**openconfig-bgp-common.yang**) • BGP COMMON MULTIPROTOCOL (**openconfig-bgp-common-multiprotocol.yang**) • BGP COMMON STRUCTURE (**openconfig-bgp-common-structure.yang**) • BGP GLOBAL (**openconfig-bgp-global.yang**) • BGP PEER GROUP (**openconfig-bgp-peer-group.yang**)	17.1	2.1.1	Juniper Networks MX Series and PTX Series
	17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3		Juniper Networks MX Series, PTX Series, and QFX Series
	18.4, 19.1, 19.2	4.0.1	
BGP ERRORS (**openconfig-bgp-errors.yang**)	18.4, 19.1, 19.2	4.0.1	Juniper Networks MX Series and PTX Series
• IF AGGREGATE (**openconfig-if-aggregate.yang**) • IF ETHERNET (**openconfig-if-ethernet.yang**) • IF IP (**openconfig-if-ip.yang**) • IF IP EXT (**openconfig-if-ip-ext.yang**) • INTERFACES (**openconfig-interfaces.yang**)	16.1, 17.1, 17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2	1.0.1	Juniper Networks MX Series and PTX Series
INET TYPES (**openconfig-inet-types.yang**)	17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4	0.1.0	Juniper Networks MX Series, PTX Series, and QFX Series
IKE INTERFACES (**openconfig-ike.yang**)	18.1R3, 18.2DCB, 18.2X75-D5	1.0.0	Juniper Networks MX Series

Table 3: OpenConfig Data Model Versions *(continued)*

OpenConfig Data Model	Junos OS Release	OpenConfig Supported Version	Supported Platform
• ISIS (**openconfig-isis.yang**) • ISIS LSDB TYPES (**openconfig-isis-lsdb-types.yang**) • ISIS LSP (**openconfig-isis-lsp.yang**) • ISIS POLICY (**openconfig-isis-policy.yang**) • ISIS ROUTING (**openconfig-isis-routing.yang**) • ISIS TYPES (**openconfig-isis-types**)	17.2X75, 17.4, 18.1, 18.2, 18.3	0.2.1	Juniper Networks MX Series and PTX Series
	18.4, 19.1, 19.2	0.3.3	
LACP (**openconfig-lacp.yang**)	16.1, 17.1	1.0.2	Juniper Networks MX Series and PTX Series
	17.2, 17.2X75, 17.3, 17.4, 18.1		Juniper Networks MX Series, PTX Series, and QFX Series
	18.2, 18.3, 18.4, 19.1, 19.2	1.1.0	
• LLDP (**openconfig-lldp.yang**) • LLDP TYPES (**openconfig-lldp-types.yang**)	16.1, 17.1, 17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2	0.1.0	Juniper Networks MX Series and PTX Series
LOCAL ROUTING (**openconfig-local-routing.yang**)	16.1, 17.1	1.0.0	Juniper Networks MX Series and PTX Series
	17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2		Juniper Networks MX Series, PTX Series, and QFX Series

Table 3: OpenConfig Data Model Versions *(continued)*

OpenConfig Data Model	Junos OS Release	OpenConfig Supported Version	Supported Platform
MPLS (**openconfig-mpls.yang**)	16.1, 17.1	1.0.0	Juniper Networks MX Series and PTX Series
	17.2		Juniper Networks MX Series, PTX Series, and QFX Series
	17.3	1.0.1	
	17.2X75, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2	2.2.0	
• MPLS IDP (**openconfig-mpls-ldp.yang**) • MPLS IGP (**openconfig-mpls-igp.yang**) • MPLS RSVP (**openconfig-mpls-rsvp.yang**) • MPLS SR (**openconfig-mpls-sr.yang**) • MPLS STATIC (**openconfig-mpls-static.yang**) • MPLS TE (**openconfig-mpls-te.yang**) • MPLS TYPES (**openconfig-mpls-types.yang**)	16.1, 17.1	1.0.0	Juniper Networks MX Series and PTX Series
	17.2, 17.3		Juniper Networks MX Series, PTX Series, and QFX Series
	17.2X75, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2	2.2.0	
NETWORK INSTANCE (**openconfig-network-instance.yang**)	17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2	0.4.0	Juniper Networks MX Series, PTX Series, and QFX Series
	17.2X75	0.4.1	

Table 3: OpenConfig Data Model Versions *(continued)*

OpenConfig Data Model	Junos OS Release	OpenConfig Supported Version	Supported Platform
• NETWORK INSTANCE I2 (**openconfig-network-instance-l2.yang**) • NETWORK INSTANCE I3 (**openconfig-network-instance-l3.yang**) • NETWORK INSTANCE TYPES (**openconfig-network-instance-types.yang**)	17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2	0.4.0	Juniper Networks MX Series, PTX Series, and QFX Series
• PLATFORM (**openconfig-platform.yang**) • PLATFORM TYPES (**openconfig-platform-types.yang**)	16.1, 17.1, 17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2	0.3.0	Juniper Networks MX Series and PTX Series
PLATFORM TRANSCEIVERS (**openconfig-platform-transceiver.yang**)	19.1, 19.2	0.1.0	Juniper Networks MX Series
POLICY TYPES (**openconfig-policy-types.yang**)	16.1, 17.1	2.0.0	Juniper Networks MX Series and PTX Series
	17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2		Juniper Networks MX Series, PTX Series, and QFX Series
• RIB BGP (**openconfig-rib-bgp.yang**) • RIB BGP EXT (**openconfig-rib-bgp-ext.yang**) • RIB BGP TYPES (**openconfig-rib-bgp-types.yang**)	16.1, 17.1	0.2.0	Juniper Networks MX Series and PTX Series
	17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2		Juniper Networks MX Series, PTX Series, and QFX Series

Table 3: OpenConfig Data Model Versions *(continued)*

OpenConfig Data Model	Junos OS Release	OpenConfig Supported Version	Supported Platform
ROUTING POLICY (**openconfig-routing-policy.yang**)	16.1, 17.1	2.0.0	Juniper Networks MX Series and PTX Series
	17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2		Juniper Networks MX Series, PTX Series, and QFX Series
RPC API (**openconfig-rpc-api.yang**)	, 19.1, 19.2	0.1.0	Juniper Networks MX Series, PTX Series, and QFX Series
SEGMENT ROUTING (**openconfig-segment-routing.yang**)	17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2	0.0.3	Juniper Networks MX Series and PTX Series
TELEMETRY (**openconfig-telemetry.yang**)	16.1, 17.1, 17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2	0.2.0	Juniper Networks MX Series, PTX Series, and QFX Series
TERMINAL DEVICE (**openconfig-terminal-device.yang**)	19.1, 19.2	0.3.1	Juniper Networks MX Series, PTX Series, and QFX Series
TRANSPORT TYPES (**openconfig-transport-types.yang**)	16.1	0.2.0	Juniper Networks MX Series and PTX Series
	17.1, 17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2	0.3.1	

Table 3: OpenConfig Data Model Versions *(continued)*

OpenConfig Data Model	Junos OS Release	OpenConfig Supported Version	Supported Platform
TYPES (**openconfig-types.yang**)	16.1	0.1.1	Juniper Networks MX Series and PTX Series
	17.1	0.2.0	Juniper Networks MX Series and PTX Series
	17.2, 17.3		Juniper Networks MX Series, PTX Series, and QFX Series
	17.2X75, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2	0.3.2	
• VLAN CONFIGURATION SUPPORT (**openconfig-vlan.yang**) • VLAN TYPES (**openconfig-vlan-types.yang**)	16.1, 17.1, 17.2	1.0.1	Juniper Networks EX Series and QFX Series
	17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2		
YANG TYPES (**openconfig-yang-types.yang**)	17.2X75, 17.3, 17.4, 18.1, 18.2, 18.3, 18.4, 19.1, 19.2	0.1.0	Juniper Networks MX Series, PTX Series, and QFX Series

RELATED DOCUMENTATION

OpenConfig Overview | 14

Understanding YANG on Devices Running Junos OS

NETCONF XML Management Protocol Developer Guide

Installing the OpenConfig Package

Starting in Junos OS Release 18.3R1, the Junos OS image includes the OpenConfig package; therefore, you do not need to install OpenConfig separately on your device.

By default, the OpenConfig schema is not available through CLI. To unhide the OpenConfig knob from the CLI, run the following command:

set system schema openconfig unhide

> **NOTE:** The **show system yang package** command in the operational mode does not display native Junos OS OpenConfig package. This is because the Junos OS image includes the OpenConfig package.

OpenConfig package includes the following files:

- OpenConfig set of data models—Data models are written in YANG.
- Translation scripts—Translates OpenConfig configuration schemas to Junos OS configuration schemas for each supported Junos OS release.
- Deviation modules—Specifies the unsupported nodes within the schema for each supported Junos OS release.
- Augmentation module—Specifies additions to various OpenConfig specified models.
- Dynamic rendering files—Maps operational state data for each supported Junos OS release.

In releases before Junos OS Release 18.3R1, OpenConfig for Junos OS software package have the following naming convention:

```
junos-openconfig-XX.YY.ZZ.JJ-signed.tgz (Junos OS)
junos-openconfig-x86-32-XX.YY.ZZ.JJ.tgz (Junos OS with Upgraded FreeBSD)
```

where:

- *XX* represents the OpenConfig major release number.
- *YY* represents the OpenConfig minor release number.
- *ZZ* represents the OpenConfig patch release number.
- *JJ* represents the Juniper Networks release number.

> **NOTE:** The **junos-openconfig-x86-32-*XX.YY.ZZ.JJ*.tgz** package supports both 32 and 64 bit systems.

To install the OpenConfig for Junos OS software package, use the following command:

request system software add

For example:

```
user@router> request system software add junos-openconfig-XX.YY.ZZ.JJ-signed.tgz
```

or

```
user@router> request system software add junos-openconfig-x86-32-XX.YY.ZZ.JJ.tgz
```

For more details on the OpenConfig for Junos OS software package, see Release Notes available with the package on the Juniper Software Download website.

Release History Table

Release	Description
18.3R1	Starting in Junos OS Release 18.3R1, the Junos OS image includes the OpenConfig package; therefore, you do not need to install OpenConfig separately on your device.

RELATED DOCUMENTATION

Understanding YANG on Devices Running Junos OS

NETCONF XML Management Protocol Developer Guide

Software Installation and Upgrade Guide

Release Information for Junos OS with Upgraded FreeBSD

schema | **350**

2

CHAPTER

gRPC Overview

Understanding OpenConfig and gRPC on Junos Telemetry Interface

IN THIS SECTION

Starting in Junos OS Release 16.1R3, you can use a set of remote procedure call (RPC) interfaces to configure the Junos Telemetry Interface and stream telemetry data using the gRPC framework. OpenConfig supports the use of vendor-neutral data models for configuring and managing multivendor networks. gRPC is an open source framework that provides secure and reliable transport of data.

> **NOTE:** JTI support for PTX10008 routers is documented for Junos OS Evolved Release 19.4R1, but not supported.

> **NOTE:** OpenConfig for Junos OS and gRPC are supported only on MPCs on MX Series and on PTX Series routers starting with Junos OS Release 16.1R3.
>
> Starting with Junos OS Release 17.2R1, OpenConfig and gRPC are also supported on QFX10000 switches, QFX5200 switches, and PTX1000 routers.
>
> Starting with Junos OS Release 17.3R1, Junos Telemetry Interface is supported on the Routing Control and Board (RCB) on PTX3000 routers, QFX5110 switches, and EX4600 and EX9200 switches.
> OpenConfig and gRPC are not supported on MX80 and MX104 routers.
>
> Starting with Junos OS Release 17.4R1, MX2008 routers are supported.

Starting with Junos OS Release 18.3R1, ON_CHANGE streaming of LLDP telemetry sensor information is supported through gRPC for MX Series and PTX Series routers.

Starting with Junos OS Release 18.3R1, QFX5120-AY and EX4650 switches are also supported.

Starting with Junos OS Release 18.4R1, EX4600 switches are also supported.

Starting with Junos OS Release 18.4R1, MX480, MX960, MX2010, MX2020, MX2008 and MX-ELM routers are also supported.

Starting with Junos OS Release 19.1R1, MX Series routers operating with MS-MIC and MS-MPC, QFX10002 switches, and PTX10002 routers are also supported.

Starting in Junos OS Evolved Release 19.1R1, OpenConfig (OC) and Junos Telemetry Interface (JTI) are supported. Both gRPC APIs and the customer-facing CLI remain the same as for the Junos OS. As was standard for Junos OS, Network Agent (NA) and OC packages are part of the Junos OS Evolved image.

Starting with Junos OS Evolved 19.1R1, Packet Forwarding Engine sensors on PTX10003 routers are also supported.

Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800, and vSRX Series Services Gateways.

Starting with Junos OS Release 19.2R1, gNMI services for streaming Packet Forwarding Engine statistics is supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches.

Starting with Junos OS Release 19.2R1, gNMI services for streaming statistics is supported on QFX5100, QFX5110, QFX5120, QFX5200 and QFX5210 switches.

Starting with Junos OS Release 19.3R1, gRPC service for exporting statistics is supported on MX Series routers hosting MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards.

Starting with Junos OS Evolved Release 19.3R1, gRPC service for exporting statistics is supported on QFX5220-128C and QFX5220-32CD switches.

Network Agent Software

Implementing OpenConfig with gRPC for Junos Telemetry Interface requires that you download and install a package called Network Agent if your Juniper Networks device is running a version of Junos OS with Upgraded FreeBSD. For all other versions of Junos OS, the Network Agent functionality is embedded in the software. Network Agent functions as a gRPC server and terminates the OpenConfig RPC interfaces. It is also responsible for streaming the telemetry data according to the OpenConfig specification. To view the OpenConfig specification for telemetry, see the OpenConfig Telemetry specification. For more information about OpenConfig for Junos OS, see the *OpenConfig User Guide*.

The Network Agent component also supports server-based Secure Sockets Layer (SSL) authentication. Client-based SSL authentication is not supported. You must install SSL certificates on your Juniper Networks device.

For information about installing the Network Agent package, see "Installing the Network Agent Package" on page 50.

Using OpenConfig for Junos OS to Enable Junos Telemetry Interface

OpenConfig for Junos OS specifies an RPC model to enable the Junos Telemetry Interface. You must download and install the OpenConfig for Junos OS package on your Juniper Networks device This package also includes the required YANG models. Using a Web browser, navigate to the All Junos Platforms software download URL on the Juniper Networks webpage: https://www.juniper.net/support/downloads/. From the **Network Management** tab, scroll down to select **OpenConfig**. Select the **Software** tab. Select the appropriate version of OpenConfig module. Two versions are available, one for devices running Junos OS with Upgraded FreeBSD and another for devices running all other versions of Junos OS. For more information, see "Installing the OpenConfig Package" on page 21 and *Understanding Junos OS YANG Modules*.

The programmatic interface **OpenConfigTelemetry** that is installed by the Network Agent package defines the telemetry gRPC service. The **telemetrySubscribe** RPC specifies the following subscription parameters:

- OpenConfig path that identifies the system resource to stream telemetry data, for example: **/interfaces/interface/state/counters/**
- Interval at which data is reported and streamed to the collector server, in milliseconds, for example: **sample_frequency = 4000**

The **telemetrySubscribe** RPC is used by a streaming server, or collector, to request an inline subscription for data at the specified path. The device should then send telemetry data back on the same connection as the subscription request.

Using gRPC to Stream Data

Per the OpenConfig specification, only gRPC-based transport is supported for streaming data. The gRPC server that is installed by the Network Agent package terminates the gRPC sessions from the management system that runs the client. RPC calls trigger the creation of Junos OS sensors that either stream data periodically or report events, which are then funneled onto the appropriate gRPC channel by Network Agent.

> **NOTE:** Starting in Junos OS Release 18.2R1, when an external streaming server, or collector, provisions sensors to export data through gRPC on devices running Junos OS, the sensor configuration is committed to the **junos-analytics** instance of the ephemeral configuration database, and the configuration can be viewed by using the **show ephemeral-configuration instance junos-analytics** operational command. In earlier releases, the sensor configuration is committed to the default instance of the ephemeral configuration database.

See Table 4 on page 28 for a list and descriptions of the RPCs implemented to support the Junos Telemetry Interface.

Table 4: Telemetry RPCs

RPC Name	Description
telemetrySubscribe	Specify telemetry parameters and stream data for the specified list of OpenConfig paths.
getTelemetrySubscriptions	Retrieve the list of subscriptions that are created through **telemetrySubscribe**.

Table 4: Telemetry RPCs *(continued)*

RPC Name	Description
cancelSubscription	Unsubscribe a subscription created through **telemetrySubscribe**.

Data streamed through gRPC is formatted in OpenConfig key/value pairs in protocol buffers (gpb) messages. In this universal format, keys are strings that correspond to the path of the system resources in the OpenConfig schema for the device being monitored. The values correspond to integers or strings that identify the operational state of the system resource, such as interface counters, and the state of the resource.

> **NOTE:** Starting in Junos OS Release 18.2R1, data streamed through gRPC can be formatted as protobuf in addition to key/value pairs for OpenConfig-based routing engine (RE) sensors. These sensors are in addition to the packet forwarding engine (PFE) sensors.

The following shows the universal key/value format:

```
message KeyValue {
    string key        = 1 [(telemetry_options).is_key = true];
    uint64 int_value  = 2;
    string str_value  = 3;
    string prefix_str = 4;
}

message TelemetryStream {
    // router name or export IP address
    required string system_id     = 1 [(telemetry_options).is_key = true];

    // line card / RE (slot number)
    optional uint32 component_id  = 2 [(telemetry_options).is_key = true];

   // PFE (if applicable)
    optional uint32 sub_component_id = 3 [(telemetry_options).is_key = true];

   // timestamp (common to all entries in the kv array)
    optional uint64 timestamp     = 4 [(telemetry_options).is_timestamp = true];

    // key / value pairs
    repeated KeyValue kv;
}
```

The following example shows how a set of counters for an interface can be represented:

```
key = “/interfaces/counters/rx-bytes”,     int_value = 1000
key = “/interfaces/counters/tx-bytes”,     int_value = 2000
key = “/interfaces/counters/rx-packets”, int_value = 10
key = “/interfaces/counters/rx-bytes” ,    int_value = 20
key = “/interfaces/counters/oper-state”, str_value = “up”
```

The Network Agent package provides a mapping table that maps field names to the OpenConfig key strings.

Exporting Packet Forwarding Engine Traffic Sensor Data

Starting with Junos OS Release 17.4R1, you can export Packet Forwarding Engine traffic statistics through the Junos Telemetry Interface for MX Series and PTX Series routers. Both UDP and gRPC are supported.

This sensor tracks reporting of Packet Forwarding Engine statistics counters and provides visibility into Packet Forwarding Engine error and drop statistics. The resource name for the sensor is **/junos/system/linecard/packet/usage/**. The OpenConfig paths report data specific to CPU, NPU and center chip (CC). The following paths are supported:

- **/components/component[name='FPC*id*:NPU*id*']/properties/property[name='*counter*']/state/value**, where FPC refers to the Flexible PIC Concentrator and NPU refers to the network processing unit (packet forwarding engine). A sample resource path is **/components/component[name='FPC0:NPU3']/properties/property[name='ts-output-pps']/state/value** where **hwds-data-error** is the counter for **Hardware Discards: Data Error**.
- **/components/component[name='FPC*id*:CC*id*']/properties/property[name='*counter*']/state/value** , where FPC refers to the Flexible PIC Concentrator and CC refers to the center chip. A sample resource path is **/components/component[name='FPC0:CC1']/properties/property[name='lpbk-packets'']/state/value** where **lpbk-packets** is the count of **Forward packets** specific to FPC0, center chip 1.
- **/components/component[name='FPC*id*']/properties/property[name='*counter*']/state/value** , where FPC refers to the Flexible PIC Concentrator. A sample resource path is **/components/component[name='FPC0']/properties/property[name='lts-input-packets'']/state/value** where **lts-input-packets** is the CPU counter **Local packets input**.

To provision the sensor to export data through gRPC, use the **telemetrySubcribe** RPC to specify telemetry parameters. For streaming through UDP, all parameters are configured at the **[edit services analytics]** hierarchy level.

The following is a map of counters to output fields in the **show pfe statistics traffic** command or **show pfe statistics traffic detail** command (supported only on MX Series routers).

```
CPU stats: (FPCX:CPUY)
Packet Forwarding Engine local traffic statistics:
    Local packets input                 :                    2
    Local packets output                :                    1
    Software input control plane drops  :                    0
    Software input high drops           :                    0
    Software input medium drops         :                    0
    Software input low drops            :                    0
    Software output drops               :                    0
    Hardware input drops                :                    0


Counter
lts-input-packets             Local packets input
lts-output-packets            Local packets output
lts-sw-input-control-drops    Software input control plane drops
lts-sw-input-high-drops       Software input high drops
lts-sw-input-medium-drops     Software input medium drops
lts-sw-input-low-drops        Software input low drops
lts-sw-output-low-drops       Software output drops


NPU stats: (FPCX:CCY)
    Input  packets:                 1169                    0 pps
    Output packets:                    0                    0 pps
    Fabric Input  :            277235149                16078 pps
    Fabric Output :            277235149                16079 pps


Counter
ts-input-packets               Input  packets
ts-input-packets-pps           Input  packets in pps
ts-output-packets              Output packets
ts-output-packets-pps          Output packets in pps
ts-fabric-input-packets        Fabric Input
ts-fabric-input-packets-pps    Fabric Input in pps
ts-fabric-output-packets       Fabric Output
ts-fabric-output-packets-pps   Fabric Output in pps

Packet Forwarding Engine loopback statistics:
    Forward packets :                    0                    0 pps
```

```
    Forward bytes   :                    0                    0 bps
    Drop packets    :                    0                    0 pps
    Drop bytes      :                    0                    0 bps


Counter
lpbk-packets                  Forward packets
lpbk-packets-pps              Forward packets pps
lpbk-packets-byte             Forward bytes
lpbk-packets-bps              Forward bytes   bps

lpbk-drop-packets             Drop packets
lpbk-drop-packets             Drop packets pps
lpbk-drop-packets             Drop bytes
lpbk-drop-packets             Drop bytes bps



Lu chips stats: FPCx:NPUY
Counter
lts-hw-input-drops
hwds-normal           Hardware discards normal discard
hwds-fabric           Hardware discards fabric drops
hwds-info-cell        Hardware discards info cell drops
hwds-timeout          Hardware discards timeour
hwds-truncated-key    Hardware discards truncated key
hwds-bits-to-test     Hardware discards bits to test
hwds-stack-underflow  Hardware discards stack underflow
hwds-stack-overflow   Hardware discards stack overflow
hwds-data-error       Hardware discards data error
hwds-extended         Hardware discards extended discard
hwds-invalid-iif      Hardware discards invalid interface
hwds-input-checksum   Hardware discards input checksum
hwds-output-mtu
hwds-inet-bad-route
hwds-inet6-bad-route
hwds-filter-discard
hwds-dlu-not-routable
```

Enabling “ON CHANGE” Sensor Support Through gRPC Network Management Interface (gNMI)

Periodical streaming of OpenConfig operational states and counters has been supported since Junos OS Release 16.1, exporting telemetry data from Juniper equipment to an external collector. While useful in collecting all the needed information and creating a baseline “snapshot,” periodical streaming is less useful for time-critical missions. In such instances, you can configure ON_CHANGE streaming for an external collector to receive information only when operational states experience a change in state.

To support ON_CHANGE streaming, a new specification called gRPC Network Management Interface (gNMI) is implemented for the modification and retrieval of configurations from a network element. Additionally, the gNMI specification can be used to generate and control telemetry streams from a network element to a data collection system. Using the new gNMI specification, one gRPC service definition can provide a single implementation on a network element for both configuration and telemetry as well as a single NMS element to interact with a device by means of telemetry and configuration RPCs.

The Junos file package (junos-telemetry-interface) includes the gnmi.proto file and GnmiJuniperTelemetryHeader.proto Juniper extension for gNMI support.

Information about the RPCs supporting this feature can be found in the gNMI Proto file version 0.4.0 (the supported version) and the specification released

- https://github.com/openconfig/reference/blob/master/rpc/gnmi/gnmi-specification.md
- https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto

The telemetry RPC **subscribe** under gNMI service supports ON_CHANGE streaming. RPC **subscribe** allows a client to request the target to send it values of particular paths within the data tree. Values may be streamed (STREAM), sent one-off on a long-lived channel (POLL), or sent one-off as a retrieval (ONCE).

If a subscription is made for a top level container with a sample frequency of 0, leaves with ON_CHANGE support are streamed based on events. Other leaves will not be streamed.

> **NOTE:** In order to permit a device to decide which nodes will be streamed as ON_CHANGE and which will SAMPLE, the collector must subscribe for TARGET_DEFINED with sample_interval.

Enabling “ONCE” Mode for Sensor Support Through gRPC Network Management Interface (gNMI)

In addition to STREAM mode of gNMI subscription, ONCE mode is also supported. Use ONCE mode to export sensor data from a network device only once. When the subscription is received on the Juniper network device, Junos telemetry interface (JTI) ensures that the collector streams all leaves once. There is no zero suppression. All counters, those holding a value and those with a value of 0, are exported once. Upon successful completion of the response for all the resource paths, Network Agent closes the collector connection. Multiple parallel collectors can request the same or different sensors through the RPC subscribe and specify ONCE mode. JTI infra responds to each collector. ONCE mode is supported only for Openconfig sensors and not for native (UDP) sensors.

In the sample subscription below, the mode is set to ONCE for the sensor path **"/interfaces/"**. Data will be streamed for one full reap. After all responsible processes stream the data, the subscription channel will close.

```
{
    "host": "1.1.1.1",
    "port": 50051,
    "user": "foo",
    "password": "foo",
    "cid": "myclient-gnmi",
    "gnmi": {
        "mode": ONCE,
        "encoding": 2
    },
    "paths": [{
        "path": "/interfaces/",
        "freq": 2000000000
    } ]
}
```

gNMI is a gRPC-based protocol for the modification and retrieval of configurations, as well as a tool to tap telemetry streams out of a network element in order to manage and monitor it.

The Junos file package (junos-telemetry-interface) includes the gnmi.proto file and GnmiJuniperTelemetryHeader.proto Juniper extension for gNMI support.

You can find information about the RPCs supporting this feature in the gNMI Proto file version 0.7.0 (the supported version).

You can find the gNMI service gRPC RPCs that network vendors can implement in the gNMI specification. See the gNMI Proto file and the gNMI specifications here:

- https://github.com/openconfig/reference/blob/master/rpc/gnmi/gnmi-specification.md
- https://github.com/openconfig/gnmi/blob/master/proto/gnmi/gnmi.proto

Enabling Client Streaming and Bidirectional Streaming of Telemetry Sensor Information

Starting with Junos OS Release 18.1R1, OpenConfig support through Remote Procedure Calls (gRPC) and JTI is extended to support client streaming and bidirectional streaming of telemetry sensor information on MX Series and PTX Series routers.

APIs are implemented in Junos based on Protobuf specifications for OpenConfig. These APIs perform configuration, operational state retrieval, and telemetry on Junos routers using gRPC as the transport mechanism.

With client streaming, the client sends a stream of requests to the server instead of a single request. The server typically sends back a single response containing status details and optional trailing metadata. With bidirectional streaming, both client and server send a stream of requests and responses. The client starts the operation by invoking the RPC and the server receives the client metadata, method name, and deadline. The server can choose to send back its initial metadata or wait for the client to start sending requests. The client and server can read and write in any order. The streams operate completely independently.

Junos devices can be managed through API (RPC) prototypes:

- rpc Capabilities (CapabilityRequest)

  Returns (CapabilityResponse). Allows the client to retrieve the set of capabilities that is supported by the target.

- rpc Get (GetRequest)

  Returns (GetResponse). Retrieves a snapshot of data from the target.

- rpc Set (SetRequest)

  Returns (SetResponse). Allows the client to modify the state of data on the target.

- rpc Subscribe (stream SubscribeRequest)

  Returns (stream SubscribeResponse). Allows a client to request the target to send it values for particular paths within the data tree. These values may be streamed (STREAM) or sent one-off on a long-lived channel (POLL), or sent as a one-off retrieval (ONCE). If a subscription is made for a top-level container with a sample frequency of 0, leaves with ON_CHANGE support are streamed based on events. Other leaves will not be streamed.

Juniper Extension Toolkit (JET) support provides insight to users regarding the status of clients connected to JSD. JET support for gRPC includes expanding the maximum number of clients that can connect to JSD

from 8 to 30 (the default remains 5). To specify the maximum number of connections, include the **max-connections** statement at the [**edit system services extension-service request-response grpc**] hierarchy level.

To provide information regarding the status of clients connected to JSD, issue the enhanced **show extension-service client information** command and include the **clients** or **servers** options. The **clients** option displays request-response client information. The **servers** option displays request-response server information.

Enabling Streaming of Telemetry Sensor Information for SR-TE policies (BGP or Static)

Starting with Junos OS Release 18.3R1, OpenConfig support through gRPC and JTI provides continuous statistics streaming via the same sensor irrespective of the route that is active (BGP or static) for a given Segment Routing Traffic Engineering (SR-TE) policy.

This feature provides support for BGP [DRAFT-SRTE] and statically configured SR-TE policies at ingress routers.

To provision the sensor to export data through gRPC streaming, use the telemetrySubscribe RPC to specify telemetry parameters. Include the resource path **/mpls/signaling-protocols/segment-routing/** to export these statistics.

In addition to configuring the sensor, you must enable statistics collection through the Junos OS. To do this, include the **statistics** configuration statement at the [**edit protocols source-packet-routing telemetry**] hierarchy level. Optionally, you can limit statistics by including the **no-transit** or **no-ingress** parameter.

See *Configure a NETCONF Proxy Telemetry Sensor in Junos* for instructions on configuring a sensor.

See "Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface)" on page 57 for further information about resource paths.

Support for LSP Statistics

You can provision the LSP statistics sensor **/junos/services/label-switched-path/usage/** to monitor per-MPLS LSP statistics. Telemetry data is streamed from Junos devices and exported through JTI to external collectors at configurable intervals through gRPC without involving polling.

Initial support of this feature in Junos OS Release 15.1F6 supported ingress LSPs only when a subscription was made to **/junos/services/label-switched-path/usage/**. With bypass support added to this feature in

Junos OS Release 17.4R1, this subscription now streams both ingress LSP and bypass LSP statistics to a collector.

Statistics that are streamed are similar to the output displayed by the operational mode commands **show mpls lsp bypass statistics** and **show mpls lsp ingress statistics**.

For bypass LSPs, the following are exported:

- Bypass LSP originating at the ingress router of the protected LSP.
- Bypass LSP originating at the transit router of the protected LSP.
- Bypass LSP protecting the transit LSP as well as the locally originated LSP.

When the bypass LSP is active, traffic is exported both on the bypass LSP and the ingress (protected) LSP.

To provision a sensor to export data through gRPC, use the telemetrySubscribe RPC to specify telemetry parameters. Streaming telemetry data through gRPC also requires the OpenConfig for Junos OS module. Both OpenConfig and Network Agent packages are bundled into the Junos OS image by default.

See *Configuring a Junos Telemetry Interface Sensor (CLI Procedure)* for information about configuring a UDP (native) sensor.

See Table 5 on page 37 for the level of LSP sensor support by platform.

Table 5: LSP Support by Platform

Platform	Ingress LSP, UDP Feature Introduced	Ingress LSP, gRPC St Feature Introduced
ACX6360		
MX80/MX104	Junos OS Release 15.1F6 Junos OS Release 16.1R3 Junos OS Release 17.2R1	
MX Series with MPC	Junos OS Release 15.1F6	Junos OS Release 16.1F Junos OS Release 17.2F
PTX5000 with FPC3		Junos OS Release 18.2F

Table 5: LSP Support by Platform *(continued)*

Platform	Ingress LSP, UDP Feature Introduced	Ingress LSP, gRPC Str Feature Introduced
PTX3000 with FPC3	Junos OS Release 15.1F6 Junos OS Release 16.1R3 Junos OS Release 17.2R1	Junos OS Release 16.1F Junos OS Release 17.2F Junos OS Release 18.2F
PTX Series with FPC1/2	Junos OS Release 15.1F6 Junos OS Release 16.1R3 Junos OS Release 17.2R1	Junos OS Release 16.1F Junos OS Release 17.2F Junos OS Release 18.2F
PTX1000	Junos OS Release 16.1R3	Junos OS Release 16.1F Junos OS Release 17.2F
PTX10000	Junos OS Release 17.3R1	Junos OS Release 17.3F
PTX10001-20C		
PTX10002	Junos OS Release 19.1R1	Junos OS Release 19.1F
VMX	Junos OS Release 17.3R1	Junos OS Release 17.3F
MX150	Junos OS Release 17.4R1	Junos OS Release 17.4F
EX4600	Junos OS Release 18.4R1	
EX4650	Junos OS Release 18.3R1	Junos OS Release 18.3F
EX9200	Junos OS Release 17.3R1	
QFX10000		
QFX5200	Junos OS Release 17.2R1	Junos OS Release 17.2F
QFX10002	Junos OS Release 19.1R1	Junos OS Release 19.1F

Table 5: LSP Support by Platform *(continued)*

Platform	Ingress LSP, UDP Feature Introduced	Ingress LSP, gRPC Str Feature Introduced
QFX5100	Junos OS Release 18.2R1	Junos OS Release 18.2R
QFX5110	Junos OS Release 18.2R1	Junos OS Release 18.2R
QFX5120-48Y	Junos OS Release 18.3R1	Junos OS Release 18.3R
QFX5200	Junos OS Release 18.2R1	Junos OS Release 18.2R

Dynamic Tunnel Statistics Support

Starting with Junos OS Release 17.4R1, you can export counter statistics for Packet Forwarding Engine dynamic tunnels to an outside collector using either native (UDP) or OpenConfig telemetry sensors through JTI.

The statistics are used to report various network element performance metrics in a scalable and efficient way, providing visibility into Packet Forwarding Engine errors and drops.

A timestamp indicating when the counters were last reset is included with all the exported data to allow collectors to determine if and when a reset event happened; for example, if the P acket Forwarding Engine hardware restarted.

Exported statistics are similar to the output of the operational mode command **show nhdb hw dynamic-ip-tunnels**.

To provision statistics export through gRPC, use the telemetrySubcribe RPC to create a subscription and specify telemetry parameters. Include the resource path **/junos/services/ip-tunnel[name='tunnel-name']/usage/counters[name='counter-name']/** in the subscription.

Streaming telemetry data through gRPC also requires the OpenConfig for Junos OS module. Starting in Junos OS Release 18.3R1, OpenConfig and Network Agent packages are bundled into the Junos OS image by default. Both packages support JTI.

To configure export of statistics through UDP, include the sensor **/junos/services/ip-tunnel/usage/** in the *sensor (Junos Telemetry Interface)* configuration statement at the [**edit services analytics**] hierarchy level. All parameters for UDP sensors are configured at that hierarchy level. MX80 and MX104 routers support only UDP streaming. They do not support gRPC.

FPC and Optics Support

Starting in Junos OS Release 19.2R1, JTI supports streaming of Flexible PIC Concentrator (FPC) and optics statistics for the MX Series using Remote Procedure Calls (gRPC). gRPC is a protocol for configuration and retrieval of state information. Support includes the addition of a new process (SensorD daemon) to export telemetry data for integration with AFTTelementry and LibTelemetry libraries in the OpenConfig model called AFT platform.

The following base resource paths are supported:

- **/junos/system/linecard/environment/**
- **/junos/system/linecard/optics/**

To provision the sensor to export data through gRPC, use the telemetrySubcribe RPC to specify telemetry parameters. Streaming telemetry data through gRPC also requires the OpenConfig for Junos OS module. Starting in Junos OS Release 18.3R1, OpenConfig and Network Agent packages are bundled into the Junos OS image by default. Both packages support JTI.

JTI Broadband Edge Statistics Support for Junos Fusion on MX Series

Starting in Junos OS Release 19.2R1, subscriber-based telemetry streaming is enabled when an MX router is configured for Broadband Network Gateway (BNG) and Junos Fusion where subscribers are connected through Junos Fusion Satellite devices. You can use remote procedure calls (gRPC) to export broadband edge (BBE) telemetry statistics to external collectors.

You can stream all BBE resource paths except for the following:

- **/junos/system/subscriber-management/access-network/ancp**
- **/junos/system/subscriber-management/client-protocols/l2tp**
- **/junos/system/subscriber-management/infra/network/l2tp/**

To stream BBE statistics, include a resource path starting with **/junos/system/subscriber-management/** in your gRPC subscription.

To provision the sensor to export data through gRPC, use the **telemetrySubscribe** RPC to specify telemetry parameters.

CPU and NPU Sensor Support for MX Series Routers with MPC10E-15C-MRATE Line Cards

Junos OS Release 19.3R1 supports CPU and network processing unit (NPU) sensors on MX Series routers with MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards. JTI enables the export of statistics from these sensors to outside collectors at configurable intervals using gRPC services.

Unlike the Junos kernel implementation for the CPU and NPU sensors in previous Junos releases, this feature uses the OpenConfig AFT model. Because of this, there is a difference in the resource path and key-value (kv) pair output compared to the Junos kernel output.

Use the following resource path to export statistics:

/junos/system/linecard/cpu/memory/

/junos/system/linecard/npu/memory/

/junos/system/linecard/npu/utilization/

To provision the sensor to export data through gRPC services, use the **telemetrySubcribe** RPC to specify telemetry parameters. Streaming telemetry data through gRPC also requires the OpenConfig for Junos OS module. Starting in Junos OS Release 18.3R1, OpenConfig and Network Agent packages are bundled into the Junos OS image by default. Both packages support JTI.

For more information about gRPC resource paths, see Guidelines for gRPC Sensors (Junos Telemetry Interface).

Interface Express Sensor

The interface express sensor is supported by JTI to export interface operational **UP** and **DOWN** status at a user-configurable rate. This sensor leverages statistics out of the physical interface sensor, providing faster and more frequent operational status statistics. Only the physical interfaces' operational status from the Flexible PIC Concentrator (FPC) is collected and reported. Statistics from the Routing Engine interface are not reported.

You can use the sensor to export statistics either through UDP (native) export or through gRPC services.

For either export method, include the following resource path:

- **/junos/system/linecard/intf-exp/**

Junos OS Release 18.1R1 supports interface express sensor for PTX1000, PTX3000, PTX5000, and PTX10000 routers.

Junos OS Release 19.3R1 supports interface express sensor for MX960, MX2010, and MX2020 routers.

For more information about gRPC resource paths, see Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface).

Diameter Application Protocol and Diameter Peer Sensors for Subscribers

JTI supports streaming statistics for subscribers for the diameter application protocols Network Access Server Application (NASREQ), policy and charging rules function (PCRF), and Online Charging System (OCS). There are also new diameter peer sensors that provide response time measurements for messages exchanged between an MX router and the peer for each of the diameter applications. Statistics are exported using JTI and the Juniper AAA Model, which covers telemetry export using gRPC, gNMI, or Juniper proprietary RPC or UDP.

To stream diameter application statistics, include the resource paths:

- For NASREQ statistics, **/junos/system/subscriber-management/aaa/diameter/clients/nasreq**
- For PCRF statistics, **/junos/system/subscriber-management/aaa/diameter/clients/gx**
- For OCS statistics, **/junos/system/subscriber-management/aaa/diameter/clients/gy**

To stream response time measurements for the diameter applications, include the resource paths in a subscription or using the **sensor** configuration statement:

- For NASREQ measurements, **/junos/system/subscriber-management/aaa/diameter/peers/peer[peer_address='*peer-address*']/nasreq/response-time**
- For PCRF measurements, **/junos/system/subscriber-management/aaa/diameter/peers/peer[peer_address='*peer-address*']/gx/response-time**
- For OCS measurements, **/junos/system/subscriber-management/aaa/diameter/peers/peer[peer_address='*peer-address*']/gy/response-time**

To enable these statistics for an MX Series router for native (UDP) export, include the **sensors** statement at the [**edit services analytics**] hierarchy level.

To provision the sensor to export data through gNMI, use the Subscribe RPC defined in the gnmi.proto to specify request parameters.

To provision the sensor to export data through gRPC, use the **telemetrySubscribe** RPC to specify telemetry parameters. Streaming telemetry data through gRPC also requires the OpenConfig for Junos OS module. Starting in Junos OS Release 18.3R1, OpenConfig and Network Agent packages are bundled into the Junos OS image by default. Both packages support JTI.

Junos OS Release 19.3R1 supports diameter application protocol sensors forMX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers.

For more information about gRPC and gNMI resource paths, see Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface).

Interface Burst Monitoring

Junos OS Evolved Release 19.3R1supports interface burst monitoring on Junos telemetry interface (JTI) to monitor physical interfaces for bursts on QFX5220-128C and QFX5220-32CD switches. Use interface burst monitoring to help troubleshoot problems, make decisions, and adjust resources as needed.

The sampling is done in the millisecond granularity during the export interval (window). The export interval is configured in the sensor with the subscription from the collector. When the sensor is installed, a timer is started in the Packet Forwarding Engine to poll the hardware in 30-100ms intervals. Rates in the first export batch will be 0.

The peak byte is the average of the number of bytes seen in a sampling interval. For bursts lasting less than the sampling interval, the peak byte is averaged out over the interval. Exported statistics also include the time peak bytes are detected, as well as the direction (transmit or receive). The maximum byte rate detected during the export interval among all the samples is considered as the burst. If there are multiple bursts of the same number of bytes rate in the interval, then the first occurring burst is considered as the maximum burst and the timestamp of that burst is considered as the burst timestamp.

Data for all physical interfaces that are UP is exported. Aggregate interfaces are not supported.

You can export interface burst statistics from the Juniper device to an outside collector by including the sensor **/junos/system/linecard/bmon-sw/** in a subscription using remote procedure call (gRPC) services. Only one collector is supported with this sensor.

To provision the sensor to export data through gRPC services, use the **telemetrySubcribe** RPC to specify telemetry parameters. Streaming telemetry data through gRPC also requires the OpenConfig for Junos OS module.

> **NOTE:** This feature does not detect microbursts.

Transceiver Diagnostics

Junos OS Release 19.4R1 supports transciever diagnostic sensors for ON_CHANGE and streaming statistics using JTI and gRPC services or gNMI services on MX960, MX2010, MX2020, PTX1000, PTX5000, and

the PTX10000 line of routers. Use transceiver diagnostics to help troubleshoot problems, make decisions, and adjust resources as needed.

This feature supports OpenConfig transceiver model **openconfig-platform-transceiver.yang 0.5.0**.

Use the base resource path **/components/component/transceiver/** in a gRPC or gNMI subscription to export statistics from the Juniper device to an outside collector.

Fields that change continuously, such as temperature, input power, and output power, and laser bias current are not supported for ON_CHANGE.

Physical Ethernet Interface Sensor

Junos OS Release 19.4R1 supports physical Ethernet interface statistics for ON_CHANGE and streaming statistics using JTI and gRPC services or gNMI services on MX960, MX2020, PTX1000, and PTX5000 routers.

This feature supports OpenConfig model **openconfig-if-ethernet.yang** (physical interface level) version 2.6.2 (no configuration).

Use the base resource path **/interfaces/interface/ethernet/state/** in a gRPC or gNMI subscription to export statistics from the Juniper device to an outside collector.

VLAN Sensors

Junos OS Release 19.4R1 supports streaming VLAN statistics for ON_CHANGE using JTI and gRPC services on EX4650 and QFX5120 switches.

This feature supports OpenConfig model openconfig-vlan.yang configuration version 1.0.2.

Use the base resource path **/vlans/** in a gRPC subscription to export statistics from the Juniper device to an outside collector.

Other end points you can use in a subscription include:

- **/vlans/vlan/state/name**
- **/vlans/vlan/state/vlan-id**
- **/vlans/vlan/members/**
- **/vlans/vlan/members/member/interface-ref/state/interface/**
- **/vlans/vlan/members/member/interface-ref/state/interface/switched-vlan/state/interface-mode**

- **/vlans/vlan/members/member/interface-ref/state/interface/switched-vlan/state/native-vlan**
- **/vlans/vlan/members/member/interface-ref/state/interface/switched-vlan/state/access-vlan**
- **/vlans/vlan/members/member/interface-ref/state/interface/switched-vlan/state/trunk-vlan**
- **/vlans/vlan/members/member/interface-ref/state/interface/vlan/state/vlan-id**

Release History Table

Release	Description
19.4R1	Junos OS Release 19.4R1 supports transciever diagnostic sensors for ON_CHANGE and streaming statistics using JTI and gRPC services or gNMI services on MX960, MX2010, MX2020, PTX1000, PTX5000, and the PTX10000 line of routers.
19.4R1	Junos OS Release 19.4R1 supports physical Ethernet interface statistics for ON_CHANGE and streaming statistics using JTI and gRPC services or gNMI services on MX960, MX2020, PTX1000, and PTX5000 routers.
19.4R1	Junos OS Release 19.4R1 supports streaming VLAN statistics for ON_CHANGE using JTI and gRPC services on EX4650 and QFX5120 switches.
19.3R1-Evolved	Starting with Junos OS Evolved Release 19.3R1, gRPC service for exporting statistics is supported on QFX5220-128C and QFX5220-32CD switches.
19.3R1-Evolved	Junos OS Evolved Release 19.3R1supports interface burst monitoring on Junos telemetry interface (JTI) to monitor physical interfaces for bursts on QFX5220-128C and QFX5220-32CD switches.
19.3R1	Starting with Junos OS Release 19.3R1, gRPC service for exporting statistics is supported on MX Series routers hosting MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards.
19.3R1	Junos OS Release 19.3R1 supports CPU and network processing unit (NPU) sensors on MX Series routers with MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards.
19.3R1	Junos OS Release 19.3R1 supports interface express sensor for MX960, MX2010, and MX2020 routers.
19.3R1	Junos OS Release 19.3R1 supports diameter application protocol sensors forMX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers.
19.2R1	Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800, and vSRX Series Services Gateways.
19.2R1	Starting with Junos OS Release 19.2R1, gNMI services for streaming Packet Forwarding Engine statistics is supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches.
19.2R1	Starting with Junos OS Release 19.2R1, gNMI services for streaming statistics is supported on QFX5100, QFX5110, QFX5120, QFX5200 and QFX5210 switches.

19.2R1	Starting in Junos OS Release 19.2R1, JTI supports streaming of Flexible PIC Concentrator (FPC) and optics statistics for the MX Series using Remote Procedure Calls (gRPC).
19.2R1	Starting in Junos OS Release 19.2R1, subscriber-based telemetry streaming is enabled when an MX router is configured for Broadband Network Gateway (BNG) and Junos Fusion where subscribers are connected through Junos Fusion Satellite devices.
19.1R1 EVO	Starting in Junos OS Evolved Release 19.1R1, OpenConfig (OC) and Junos Telemetry Interface (JTI) are supported. Both gRPC APIs and the customer-facing CLI remain the same as for the Junos OS. As was standard for Junos OS, Network Agent (NA) and OC packages are part of the Junos OS Evolved image.
19.1R1	Starting with Junos OS Release 19.1R1, MX Series routers operating with MS-MIC and MS-MPC, QFX10002 switches, and PTX10002 routers are also supported.
19.1R1	Starting with Junos OS Evolved 19.1R1, Packet Forwarding Engine sensors on PTX10003 routers are also supported.
18.4R1	Starting with Junos OS Release 18.4R1, MX480, MX960, MX2010, MX2020, MX2008 and MX-ELM routers are also supported.
18.3R1	Starting with Junos OS Release 18.3R1, ON_CHANGE streaming of LLDP telemetry sensor information is supported through gRPC for MX Series and PTX Series routers.
18.3R1	Starting with Junos OS Release 18.3R1, QFX5120-AY and EX4650 switches are also supported.
18.3R1	Starting with Junos OS Release 18.4R1, EX4600 switches are also supported.
18.3R1	Starting in Junos OS Release 18.3R1, OpenConfig and Network Agent packages are bundled into the Junos OS image by default. Both packages support JTI.
18.3R1	Starting in Junos OS Release 18.3R1, OpenConfig and Network Agent packages are bundled into the Junos OS image by default. Both packages support JTI.
18.2R1	Starting in Junos OS Release 18.2R1, when an external streaming server, or collector, provisions sensors to export data through gRPC on devices running Junos OS, the sensor configuration is committed to the **junos-analytics** instance of the ephemeral configuration database, and the configuration can be viewed by using the **show ephemeral-configuration instance junos-analytics** operational command.
18.1R1	Starting with Junos OS Release 18.1R1, OpenConfig support through Remote Procedure Calls (gRPC) and JTI is extended to support client streaming and bidirectional streaming of telemetry sensor information on MX Series and PTX Series routers.

18.1R1	Starting with Junos OS Release 18.3R1, OpenConfig support through gRPC and JTI provides continuous statistics streaming via the same sensor irrespective of the route that is active (BGP or static) for a given Segment Routing Traffic Engineering (SR-TE) policy.
18.1R1	Junos OS Release 18.1R1 supports interface express sensor for PTX1000, PTX3000, PTX5000, and PTX10000 routers.
17.4R1	Starting with Junos OS Release 17.4R1, MX2008 routers are supported.
17.4R1	Starting with Junos OS Release 17.4R1, you can export Packet Forwarding Engine traffic statistics through the Junos Telemetry Interface for MX Series and PTX Series routers. Both UDP and gRPC are supported.
17.4R1	With bypass support added to this feature in Junos OS Release 17.4R1, this subscription now streams both ingress LSP and bypass LSP statistics to a collector.
17.4R1	Starting with Junos OS Release 17.4R1, you can export counter statistics for Packet Forwarding Engine dynamic tunnels to an outside collector using either native (UDP) or OpenConfig telemetry sensors through JTI.
17.3R1	Starting with Junos OS Release 17.3R1, Junos Telemetry Interface is supported on the Routing Control and Board (RCB) on PTX3000 routers, QFX5110 switches, and EX4600 and EX9200 switches.
17.2R1	Starting with Junos OS Release 17.2R1, OpenConfig and gRPC are also supported on QFX10000 switches, QFX5200 switches, and PTX1000 routers.
16.1R3	Starting in Junos OS Release 16.1R3, you can use a set of remote procedure call (RPC) interfaces to configure the Junos Telemetry Interface and stream telemetry data using the gRPC framework.
16.1R3	OpenConfig for Junos OS and gRPC are supported only on MPCs on MX Series and on PTX Series routers starting with Junos OS Release 16.1R3.
15.1F6	Initial support of this feature in Junos OS Release 15.1F6 supported ingress LSPs only when a subscription was made to **/junos/services/label-switched-path/usage/**.

RELATED DOCUMENTATION

Installing the Network Agent Package (Junos Telemetry Interface) | **50**

Release Information for Junos OS with Upgraded FreeBSD

Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface) | **57**

statistics

telemetry

Installing the Network Agent Package (Junos Telemetry Interface)

Starting with Junos OS Release 16.1R3, the Junos Network Agent software package provides a framework to support OpenConfig and gRPC for the Junos Telemetry Interface on MX Series routers and PTX5000 routers. The Network Agent package functions as a gRPC server that terminates the OpenConfig remote procedure call (RPC) interfaces and streams the telemetry data according to the OpenConfig specification. The Junos Network Agent package, which runs on the Routing Engine, implements local statistics collection and reports data to active telemetry stream subscribers.

Starting with Junos OS Release 17.2R1, the Junos Network Agent Package is also supported on QFX10000 switches and QFX5200 switches.

Starting with Junos OS Release 17.3R1, the Junos Network Agent Package is supported on QFX5110 switches and EX9200 switches.

Starting in Junos OS Release 18.3R1, the Junos OS image includes the Network Agent. You do not need to install Network Agent separately. This is true for Junos OS with upgraded FreeBSD and legacy Junos OS.

The Junos Network Agent is available as a separate package only for Junos OS with Upgraded FreeBSD. This package also includes the required YANG models. For other versions of Junos OS, Network Agent functionality is embedded in the software. For more information about Junos OS with Upgraded FreeBSD, see *Release Information for Junos OS with Upgraded FreeBSD*.

Network Agent for Junos OS software package has the following naming conventions:

- Package Name—This is **Network-Agent**.
- Architecture—This field indicates the CPU architecture of the platforms, such as **x86**.
- Application Binary Interface (ABI)—This field indicates the “word length” of the CPU architecture. The alue is **32** for 32-bit architectures.
- Release—This field indicates the Junos OS release number, such as **16.1R3.16**.
- Package release and spin number—This field indicates the package version and spin number, such as **C1.1**.

All Junos Network Agent packages are in tarred and gzipped (**.tgz**) format.

> **NOTE:** Each version of the Network Agent package is supported on a single release of Junos OS only. The Junos OS version supported is identified by the Junos OS release number included in the Network Agent package name.

An example of a valid Network Agent package name is:

- **network-agent-x86-32-16.1R4.12-C1.1.tgz**

Use the 32-bit Network Agent package for both 32-bit and 64-bit versions of Junos OS or Junos OS Evolved.

Before you begin:

- Install Junos OS Release 16.1R3 or later.
- Install the OpenConfig for Junos OS module. Using a Web browser, navigate to the All Junos Platforms software download URL on the Juniper Networks webpage: https://www.juniper.net/support/downloads/. From the **Network Management** tab, scroll down to select **OpenConfig**. Select the **Software** tab. Select the **OpenConfig Package (Junos with upgraded FreeBSD)**. For more information, see "Installing the OpenConfig Package" on page 21.
- Install Secure Sockets Layer (SSL) certificates of authentication on your Juniper Networks device.

> **NOTE:** Only server-based SSL authentication is supported. Client-based authentication is not supported.

To download and install the Network Agent package:

1. Using a Web browser, navigate to the All Junos Platforms software download URL on the Juniper Networks webpage: https://www.juniper.net/support/downloads/.
2. Select the name of the Junos OS platform for the software that you want to download.
3. Select the release number (the number of the software version that you want to download) from the **Release** drop-down list to the right of the Download Software page.
4. Select the **Software** tab.
5. In the **Tools** section of the **Software** tab, select the **Junos Network Agent** package for the release.
6. Log in to the Juniper Networks authentication system using the username (generally your e-mail address) and password supplied by a Juniper Networks representative.

7. Download the software to a local host.

8. Copy the software to Juniper Networks device or to your internal software distribution site.

9. Install the new **network-agent** package on the device by issuing the **request system software add *package-name*** from the operational mode:

   For example:

   ```
   user@host > request system software add network-agent-x86-32-16.1R3.16-C1.0.tgz
   ```

   > **NOTE:** The command uses the **validate** option by default. This option validates the software package against the current configuration as a prerequisite to adding the software package to ensure that the device reboots successfully. This is the default behavior when the software package being added is a different release.

10. Issue the **show version | grep na\ telemetry** command to verify that the Network Agent package was successfully installed.

    ```
    user@host> show version | grep na\ telemetry
    JUNOS na telemetry
    [20161109.201405_builder_junos_161_r3]
    ```

For information about configuring gRPC services on your Juniper Networks device, see "gRPC Services for Junos Telemetry Interface" on page 53.

Release History Table

Release	Description
18.3R1	Starting in Junos OS Release 18.3R1, the Junos OS image includes the Network Agent.
17.3R1	Starting with Junos OS Release 17.3R1, the Junos Network Agent Package is supported on QFX5110 switches and EX9200 switches.
17.2R1	Starting with Junos OS Release 17.2R1, the Junos Network Agent Package is also supported on QFX10000 switches and QFX5200 switches.
16.1R3	Starting with Junos OS Release 16.1R3, the Junos Network Agent software package provides a framework to support OpenConfig and gRPC for the Junos Telemetry Interface on MX Series routers and PTX5000 routers.

RELATED DOCUMENTATION

Understanding OpenConfig and gRPC on Junos Telemetry Interface | 25

gRPC Services for Junos Telemetry Interface

IN THIS SECTION

Configuring gRPC for the Junos Telemetry Interface

Starting with Junos OS Release 16.1R3 on MX Series routers and PTX3000 and PTX5000 routers, you can stream telemetry data for various network elements through gRPC, an open source framework for handling remote procedure calls based on TCP. The Junos Telemetry Interface relies on a so-called push model to deliver data asynchronously, which eliminates polling. For all Juniper devices that run a version of Junos OS with upgraded FreeBSD kernel, you must install the Junos Network Agent software package, which provides the interfaces to manage gRPC subscriptions. For Juniper Network devices that run other all other versions of the Junos OS, this functionality is embedded in the Junos OS software. For more information about installing the Junos Network Agent package, see "Installing the Network Agent Package" on page 50.

The Junos Telemetry Interface and gRPC streaming are supported on QFX10000 and QFX5200 switches, and PTX1000 routers starting with Junos OS Release 17.2R1.

The Junos Telemetry Interface and gRPC streaming are supported on QFX5110, EX4600, and EX9200 switches starting with Junos OS Release 17.3R1.

Before you begin:

- Install Junos OS Release 16.1R3 or later on your Juniper Networks device.
- If your Juniper Networks device is running a version of Junos OS with an upgraded FreeBSD kernel, install the Junos Network Agent software package.
- Install the OpenConfig for Junos module. For more information see, "Installing the OpenConfig Package" on page 21.

To configure your system for gRPC services:

1. Specify the API connection setting either as unsecured or as based on Secure Socket Layer (SSL) technology. You can specify only one type of connection.

   For example, to set the API connection as unsecured:

   ```
   [edit system services]
   user@host# set extension-service request-response grpc
   ```

   For example, to set the API connection based on a SSL:

   ```
   [edit system services]
   ```

```
user@host# set extension-service request-response grpc ssl
```

For an SSL-based connection, you must specify a local-certificate name or you can rely on the default IP address (::) to enable Junos to “listen” for all IPv4 and IPv6 addresses on incoming connections. If you would rather specify an IP address, follow stp b. below.

a. Specify a local certificate-name. The certificate can be any user-defined value from the certificate configuration (not shown here). The certificate name should used in thisexample is **jsd_certificate**:

```
[edit system services extension-service request-response grpc]
user@host# set ssl local-certificate jsd_certificate
```

> **NOTE:** Enter the name of a certificate you have configured with the **local *certificate-name*** statement at the **[edit security certificates]** hierarchy level.

b. (Optional) Specify an IP address to listen to for incoming connections. for example, **192.0.2.0**:

```
[edit system services extension-service request-response grpc]
user@host# set ssl ip-address 192.0.2.0
```

> **NOTE:** If you do not specify an IP address, the default address of :: is used to listen for incoming connections.

2. Specify port 32767 for accepting incoming connections through gRPC.

> **NOTE:** Port 32767 is the required port for gRPC streaming for both unsecured and SSL-based connections.

```
[edit system services extension-service request-response grpc]
user@host# set ssl port 32767
```

SEE ALSO

Configuring Bidirectional Authentication for gRPC for Junos Telemetry Interface

Starting with Junos OS Release 17.4R1, you can configure bidirectional authentication for gRPC sessions used to stream telemetry data. Previously, only authentication of the server, that is, Juniper device, was supported. Now the external client, that is management station that collects data, can also be authenticated using SSL certificates. The JET service process (**jsd**), which supports application interaction with Junos OS, uses the credentials provided by the external client to authenticate the client and authorize a connection.

Before you begin:

- If your Juniper device is running a version of Junos OS with an upgraded FreeBSD kernel, install the Junos Network Agent software package.
- Install the OpenConfig for Junos module. For more information see, "Installing the OpenConfig Package" on page 21.
- Configure the gRPC server. For more information, see "Configuring gRPC for the Junos Telemetry Interface" on page 54.

To configure authentication for the external client, that is, management station that collects telemetry data streamed from the Juniper device:

1. Enable bidirectional authentication and specify the requirements for a client certificate.

   For example, to specify the strongest authentication, which requires a certificate and its validation:

   ```
   [edit system services extention-service request-response grpc ssl]
   user@host# set mutual-authentication client-certificate-request require-certificate-and-verify
   ```

   NOTE: The default is **no-certificate**. The other options are: **request-certificate**, **request-certificate-and-verify**, **require-certificate**, **require-certificate-and-verfiy**.

   We recommend that you use **no-certificate** option in a test environment only.

2. Specify the certificate authority.

> **NOTE:** For the certificate authority, specify a certificate-authority profile you have configured at the **[edit security pki ca-profile]** hierarchy level. This profile is used to validate the certificate provided by the client.
>
> A digital certificate provides a way of authenticating users through a trusted third-party called a certificate authority (CA). The CA validates the identity of a certificate holder and "signs" the certificate to attest that it has not been forged or altered. For more information, see *Digital Certificates Overview* and *Example: Requesting a CA Digital Certificate*.

For example, to specify a certificate-authority profile named **jsd_certificate**:

```
[edit system services extention-service request-response grpc ssl mutual-authentication]
user@host# set certificate-authority jsd_certificate
```

3. Verify that an external client can successfully connect with the Juniper device through the **jsd** process and invoke OpenConfig RPCs.

   The external client passes username and password credentials as part of metadata in each RPC. The RPC is allowed if valid credentials are used. Otherwise an error message is returned.

SEE ALSO

ssl

Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface)

Starting with Junos OS Release 16.1R3, the Junos Telemetry Interface supports gRPC remote procedure calls (gRPC) to provision sensors and to subscribe to and receive telemetry data on MX Series routers and PTX3000 and PTX5000 routers.

Starting with JunosOS Release 17.2R1, QFX10002, QFX10008, and QFX10016 switches, QFX5200 switches, and PTX1000 and PTX10008 routers are also supported.

Starting with Junos OS Release 17.3R1, QFX5110 switches, EX4600, EX4600-VC, and EX9200 switches and the Routing and Control Board (RCB) on PTX3000 routers are also supported.

Starting with Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensors are supported.

Starting with Junos OS Release 18.2R1, PTX10002 routers are also supported.

Starting with Junos OS Release 17.4R1, PTX10016 routers and virtual MX Series (vMX) routers are also supported.

Starting with Junos OS Release 18.1R1, QFX5210-64C switches and QFX5100 switches are also supported.

Starting with Junos OS Release 18.1R1, ON_CHANGE streaming of ARP, ND, and IP sensor information associated with interfaces is supported through gRPC for MX Series routers and PTX Series routers.

Starting with Junos OS Release 18.3R1, ON_CHANGE streaming of LLDP telemetry sensor information is supported through gRPC for MX Series and PTX Series routers.

Starting with Junos OS Release 18.3R1, QFX5120-AY and EX4650 switches are also supported.

Starting with Junos OS Release 18.4R1, EX4600 switches are also supported.

Starting with Junos OS Release 18.4R1, MX480, MX960, MX2010, MX2020, MX2008 and MX-ELM routers are also supported.

Starting in Junos OS Evolved Release 19.1R1, OpenConfig (OC) and Junos Telemetry Interface (JTI) are supported. Both gRPC APIs and the customer-facing CLI remain the same as for the Junos OS. As was standard for Junos OS, Network Agent (NA) and OC packages are part of the Junos OS Evolved image.

Starting with Junos OS Evolved 19.1R1, Packet Forwarding Engine sensors on PTX10003 routers are also supported.

Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800, and vSRX Series Services Gateways.

Starting with Junos OS Release 19.2R1, gNMI services for streaming Packet Forwarding Engine statistics is supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches.

Starting with Junos OS Release 19.2R1, gNMI services for streaming statistics is supported on QFX5100, QFX5110, QFX5120, QFX5200 and QFX5210 switches.

Starting with Junos OS Release 19.3R1, gNMI services for streaming Packet Forwarding Engine statistics is supported on MX240, MX480 and MX960 routers.

Starting with Junos OS Release 19.3R1, gNMI services for streaming and ON_CHANGE export of Routing Engine statistics is supported on MX960, MX2010, MX2020, PTX5000, PTX1000, and PTX10000 routers.

Starting with Junos OS Release 19.3R1, gRPC service for exporting statistics is supported on MX Series routers hosting MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards. The resource paths **/junos/system/linecard/cpu/memory/**, **/junos/system/linecard/npu/memory/**, and

/junos/system/linecard/npu/utilization/ can be updated to call out individual sensors (leaves) and their respective paths for better clarity.

Starting with Junos OS Evolved Release 19.3R1, gRPC service for exporting statistics is supported on QFX5220-128C and QFX5220-32CD switches.

Starting with Junos Release 19.4R1, gRPC service for streaming Packet Forwarding Engine and Routing Engine statistics is supported on EX4300-MP switches.

> **NOTE:** JTI support for PTX10008 routers is documented for Junos OS Evolved Release 19.4R1, but not supported.

Starting with Junos Release 20.R1, gNMI service for streaming telemetry sensors for Packet Forwarding Engine statistics is supported on MX2K-MPC11E line cards on MX2010 and MX2020 routers.

See Table 6 on page 60 for information about which sensors are supported with gRPC and on which platforms.

See Table 7 on page 221 for a description of supported broadband edge (BBE) gRPC sensors, which are supported on all platforms supporting gRPC unless otherwise noted.

You can also use the Telemetry Explorer tool to search for and view information about telemetry sensors.

To activate a sensor, use the corresponding resource path. Each resource path enables data streaming for the system resource globally, that is, systemwide. You can also modify each resource path, such as to specify a specific logical or physical interface. For example, to specify a specific interface, include the following at the end of the path: **[name='interface-name']/**

Supported gRPC and gNMI Sensors

See Table 6 on page 60 for a description of supported gRPC and gNMI sensors and Table 7 on page 221 for a description of supported broadband edge (BBE) gRPC sensors, including the subscription path you use to provision the sensors.

Table 6: gRPC Sensors

resource path	Description
/components/component/	Sensor for chassis components. ON_CHANGE notification is triggered if a component (FPC) is inserted or removed or if a component's power is on or off (FPC is online or offline). Instant reporting of such events is handled with this sensor. ON_CHANGE streaming is supported on MX960, MX2010, MX2020, PTX-5000, PTX1000, and PTX10000 routers starting with Junos OS Release 18.4R1. Starting with Junos OS Release 19.1R1, periodic streaming on QFX10002 switches and PTX10002 routers is supported. Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Starting with Junos OS Release 19.4R1, ON_CHANGE statistics using gRPC services or gNMI services with MX960 routers is supported. Previously, these sensors were only supported to stream statistics. You can also add the following endpoints to the path to stream specific statistics: • **name** • **state/id** • **state/description** • **state/serial-no** • **state/part-no** The **state/type** identifies the ON_CHANGE event type. Event types are: **FRU_ADD**, **FRU_REMOVE**, **FRU_POWERON**, and **FRU_POWEROFF** For more information about ON_CHANGE statistics, see "Understanding OpenConfig and gRPC on Junos Telemetry Interface" on page 25.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/component/subcomponents/subcomponent[name='FPC*id*:NPU*id*']/properties/property/[name=' *counter*']/state/value	Sensor for packet forwarding engine statistics. The subcomponent name ***npu-id*** refers to the number of the packet forwarding engine. This sensor provides visibility into packet forwarding engine errors and drops. Supported on MX Series routers and PTX Series routers starting with Junos OS Release 17.4R1.MX960|MX2010|MX2020|PTX-5000|PTX1000|PTX10000 The value for ***counter*** is one of the following; • **lts-hw-input-drops** • **hwds-normal** • **hwds-fabric** • **hwds-info-cell** • **hwds-timeout** • **hwds-truncated-key** • **hwds-bits-to-test** • **hwds-stack-underflow** • **hwds-stack-overflow** • **hwds-inet6-bad-route** • **hwds-inet-bad-route** • **hwds-filter-discard** • **hwds-dlu-not-routable** • **hwds-data-error** • **hwds-extended** • **hwds-invalid-iif** • **hwds-input-checksum** • **hwds-output-mtu** • **lts-input-packets** • **lts-output-packets** • **lts-sw-input-control-drops** • **lts-sw-input-high-drops** • **lts-sw-input-medium-drops** • **lts-sw-input-low-drops** • **lts-sw-output-low-drops**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/component/subcomponents/subcomponent[name='FPC*ID*:CC*id*']/properties/property/[name=' *counter*']/state/value	Sensor for packet forwarding engine statistics. The subcomponent name ***cc-id*** refers to the center chip. This sensor provides visibility into packet forwarding engine errors and drops. Supported on MX Series routers and PTX Series routers starting with Junos OS Release 17.4R1. The value for ***counter*** is one of the following; • **ts-fabric-input-pps** • **ts-fabric-output-pps** • **ts-fabric-input-packets** • **ts-fabric-output-packets** • **lpbk-packets** • **lpbk-pps** • **lpbk-bytes** • **lpbk-pps** • **lpbk-drop-packets** • **lpbk-drop-pps** • **lpbk-drop-bytes** • **lpbk-drop-bps**
/components/component/subcomponents/subcomponent[name='FPC*ID*']/properties/property/[name=' *counter*']/state/value	Sensor for packet forwarding engine statistics. The subcomponent name **FPC*id*** refers to the number of the Flexible PIC Concentrator. This sensor provides visibility into packet forwarding engine errors and drops. This sensor pulls CPU counters. Supported on MX Series routers and PTX Series routers starting with Junos OS Release 17.4R1. The value for ***counter*** is one of the following; • **lts-hw-input-drops** • **lts-input-packets** • **lts-output-packets** • **lts-sw-input-control-drops** • **lts-sw-input-high-drops** • **lts-sw-input-medium-drops** • **lts-sw-input-low-drops** • **lts-sw-output-low-drops**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/component[name='CB0']/properties/property[name='*state*'/	Sensor for Control Board (CB) state information. This information can also be found using the operational mode command **show chassis hardware**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='CB0']/properties/property[name='*manufacture-date*'/	Sensor for Control Board (CB) manufacturing date information. This information can also be found using the operational mode command **show chassis hardware extensive**. Starting in Junos OS Evolved Release 19.1R1, PTX10003 routers are supported.
/components/component[name='PDU0']/properties/property[name='*state*'/	Sensor for power distribution units (PDUs) state information. This information can also be found using the operational mode command **show chassis environment**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='PDU0']/properties/property[name='*fru-model-number*'/	Sensor for field-replaceable unit (FRU) for a power distribution unit (PDU). This information can also be found using the operational mode command **show chassis hardware models**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/component[name='PDU0']/ properties/property[name='*manufacture-date*'/	Sensor for a power distribution unit (PDU) manufacturing date. This information can also be found using the operational mode command **show chassis hardware extensive**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='FPM Board']/ properties/property[name='*state*'/	Sensor for state information for a craft interface (FPM). This information can also be found using the operational mode command **show chassis hardware models**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='FPM Board']/ properties/property[name='*fru-model-number*'/	Sensor for field-replaceable unit (FRU) for a craft interface (FPM). This information can also be found using the operational mode command **show chassis hardware models**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='FPM Board']/ properties/property[name='*manufacture-date*'/	Sensor for a craft interface (FPM) manufacturing date. This information can also be found using the operational mode command **show chassis hardware extensive**. Starting in Junos OS Evolved Release 19.1R1, PTX10003 routers are supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/component[name='SIB0']/properties/property[name='*state*'/	Sensor for Switch Interface Boards (SIBs). **SIB0** and **SIB1** are supported. This information can also be found using the operational mode command **show chassis sibs**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='FPC0']/properties/property	Sensor for the Flexible PIC Concentrator (FPC). This information can also be found using the operational mode command **show chassis fpc detail**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. You can also add the following as the end path: • **[name='*state*'/** • **[name='*manufacture-date*'/** • **[name='*uptime*'/** • **[name='*Ambient Temp. EXHAUST*']** **NOTE:** This information can also be found using the operational mode command **show chassis environment fpc**. • **[name='*Ambient Temp. INLET*']** **NOTE:** This information can also be found using the operational mode command **show chassis environment fpc**. • **[name='*fru-model-number*']** **NOTE:** This information can also be found using the operational mode command **show chassis harware models**.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/component[name='FPC0:PIC0']/properties/property	Sensor for the physical interface card (PIC). This information can also be found using the operational mode command **show chassis pic fpc-slot *slot-num* pic-slot *slot-num***. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. You can also add the following as the end path: • **[name='*state*'/** • **[name='*uptime*'/**
/components/component[name='Routing Engine 0']/properties/property[name='*state*'/	Sensor for the routing engine state. This information can also be found using the operational mode command **show chassis environment routing-engine**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='Routing Engine 0']/properties/property[name='*mastership-state*'/	Sensor for the routing engine master status. This information can also be found using the operational mode command **show chassis routing-engine**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/component[name='Routing Engine 0']/properties/property[name='*mastership-priority*'/	Sensor for the routing engine mastership election priority. This information can also be found using the operational mode command **show chassis routing-engine**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='Routing Engine 0']/properties/property[name='*Ambient Left*'/ **/components/component[name='Routing Engine 0']/properties/property[name='*Ambient Right*'/**	Sensor for the routing engine ambient temperature, both left and right. This information can also be found using the operational mode command **show chassis environment routing-engine**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='Routing Engine 0']/properties/property[name='*firmware_rev*'/	Sensor for the routing engine's firmware revision. This information can also be found using the operational mode command **show chassis routing-engine bios**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='Routing Engine 0']/properties/property[name='*CPU Temperature*'/	Sensor for the routing engine's CPU temperature. This information can also be found using the operational mode command **show chassis routing-engine**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/component[name='Routing Engine 0']/properties/property[name='*memory-dram-used*'/ **/components/component[name='Routing Engine 0']/properties/ property[name='*memory-utilization-buffer*'/**	Sensors for the routing engine's memory utilization. This information can also be found using the operational mode command **show chassis routing-engine**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='Routing Engine 0']/properties/property[name='*cpu-utilization-user*'/ **/components/component[name='Routing Engine 0']/properties/ property[name='*cpu-utilization-background*'/** **/components/component[name='Routing Engine 0']/properties/ property[name='*cpu-utilization-kernel*'/** **/components/component[name='Routing Engine 0']/properties/ property[name='*cpu-utilization-interruot*'/** **/components/component[name='Routing Engine 0']/properties/property[name='*cpu-utilization-idle*'/**	Sensors for the routing engine's CPU utilization. This information can also be found using the operational mode command **show chassis routing-engine**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='Routing Engine 0']/properties/property[name='*uptime*'/	Sensor for routing engine **uptime**. This information can also be found using the operational mode command **show chassis routing-engine**. Starting in Junos OS Evolved Release 19.1R1, PTX10003 routers are supported.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/component[name='Routing Engine 0']/properties/property[name='*reboot-reason*'/	Sensor for the cause of a routing engine reboot. This information can also be found using the operational mode command **show chassis routing-engine**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='Routing Engine 0']/properties/property[name='*manufacture-date*'/	Sensor for the manufacture date of a routing engine. This information can also be found using the operational mode command **show chassis routing-engine**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='Fan Tray0']/properties/property[name='*state*'/	Sensor for the fan tray. This information can also be found using the operational mode command **show chassis environment**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='Fan Tray0']/properties/property[name='*fru-model-number*'/	Sensor for the fan tray model number. This information can also be found using the operational mode command **show chassis hardware models**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/component[name='Fan Tray0']/ properties/property[name='*manufacture-date*'/	Sensor for the manuafacture date of the fan tray. This information can also be found using the operational mode command **show chassis hardware models**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='PDU0:PSM0']/ properties/property[name='*state*'/	Sensor for the Power Distribution Module (PDU) status. This information can also be found using the operational mode command **show chassis environment**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component['Chassis']/properties/ property[name='*state*'/	Sensor for the chassis state. The chassis state is always **ONLINE**. This information can also be found using the operational mode command **show chassis environment**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component['PSM2']/properties/ property[name='*fru-model-number*'/ **/components/component['PSM2']/properties/ property[name='*manufacture-date*'/** **/components/component['PSM2']/properties/ property[name='*Temperature*'/** **/components/component['PSM2']/properties/ property[name='*state*'/**	Sensors for the power supply module (PSM) FRU model number, manufacture date, temperature, and state. This information can also be found using the operational mode command **show chassis environment**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/component/properties/property/state/value	Sensor for chassis components. Starting with Junos OS Release 19.2R1, periodic streaming using gNMI services is supported on QFX5100, QFX5110, QFX5120, QFX5200 and QFX5210 switches.
/components/component/state	Sensor for chassis component state. Starting with Junos OS Release 19.2R1, periodic streaming using gNMI services is supported on QFX5100, QFX5110, QFX5120, QFX5200 and QFX5210 switches.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/component/transceiver/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for transceiver diagnostics. This feature supports OpenConfig transceiver model **openconfig-platform-transceiver.yang 0.5.0**. Shown below, statistics are exported for **FPC19**. Multiples FPCs are supported. The component values and property values are names (like interface names). Starting with Junos OS Release 19.4R1, ON_CHANGE statistics are supported using gRPC services or gNMI services is supported on MX960, MX2010, MX2020, PTX1000, and PTX5000 routers and the PTX10000 line of routers. The following statistics are exported:: • **components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/vendor** • **components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/sonet-sdh-compliance-code** • **components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/serial-no** • **components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/present** • **components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/output-power/instant** • **components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/otn-compliance-code** • **components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/laser-bias-current/instant** • **components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/input-power/instant** • **/components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/form-factor-preconf** • **/components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/form-factor** • **/components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/ethernet-pmd-preconf** • **/components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/ethernet-pmd** • **/components/component[name='FPC19:PIC1:PORT11:Xcvr0']/transceiver/state/enabled** • **/components/component[name='FPC19:PIC1:PORT11:Xcvr0']/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	transceiver/state/date-code
/junos/chassis/aggregated-devices	Sensor for kernel link aggregation group (LAG) information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/chassis/aggregated-devices/: • **ae-lp-link-down-cnt** • **ae-unstack-cnt** • **ps-ifl-ccc-down-cnt** • **ps-lt-unstack-cnt** • **rlt-lp-link-down-cnt**
/junos/chassis/gres	Sensor for graceful Routing Engine switchover (GRES) information. Starting with Junos OS Release 19.1R1, EX9200, EX9251, EX9253, MX Series, and PTX Series are supported. You can also add the following as the end path for /junos/chassis/gres/: • **configured-state** • **error-state** • **gres-time** • **is-protocol-master** • **master-kernel-ready** • **other-re-present** • **other-re-alive** • **slave-connect-time** • **slave-kernel-ready**
/junos/chassis/issu/	Sensor for in-service software upgrade (ISSU) information. Starting with Junos OS Release 19.1R1, EX9200, EX9251, EX9253, MX Series, and PTX Series are supported. You can also add the following as the end path for /junos/chassis/issu/: • **failure-stage** • **current-issu-stage**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/events	System events sensor. Starting with Junos OS Release 18.1R1, this sensor corresponds to system log messages (syslog). Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX are also supported. The sensor must be used with an **export-profile** that has a **reporting-rate** of 0. To subscribe for specific events, you can subscribe for /junos/events/event[id='EVENT_NAME'] where event EVENT_NAME is the event id that you are interested in. Many event names can be found in the messages log file. Alternatively, you can subscribe to any resource path.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/ike-security-associations/ike-security-association/routing-instance [**name=**' ***routing-instance-name***]	Sensor for Internet Key Exchange (IKE) security statistics. When you configure a subscription request, use the **reporting-interval** parameter to configure the interval (in seconds) in which statistics are reported. Starting with Junos OS Release 18.1R1, MX Series routers are supported. • **remote-ip** • **local-ip** • **number-ipsec-sa-created** • **number-ipsec-sa-deleted** • **number-ipsec-sa-rekey** • **exchange-type** • **in-bytes** • **in-packets** • **out-bytes** • **out-packets** • **delete-payload-received** • **delete-payload-transmitted** • **dpd-request-payload-received** • **dpd-request-payload-transmitted** • **dpd-response-payload-received** • **dpd-response-payload-transmitted** • **dpd-response-payload-missed** • **dpd-response-payload-maximum-delay** • **dpd-response-seq-payload-missed** • **invalid-spi-notify-received** • **invalid-spi-notify-transmitted** • **routing-instance**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/kernel/multicast/	Sensor for kernel IP multicast information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/multicast/: • **iifmismatch-err-cnt** • **rslv-req-err-cnt**
/junos/kernel/peer-infra/	Sensor for PFEMAN connection information. Starting with Junos OS Release 19.1R1, EX9200, EX9251, EX9253, MX Series, and PTX Series are supported. You can also add the following as the end path for /junos/kernel/peer-infra/: • **pfeman-conn-drops** • **spurious-ppt-wkups**
/junos/kernel/record-meta-data/record_time	Sensor for system time at which Routing Engine metadata is created. Starting with Junos OS Release 19.1R1, EX9200, EX9251, EX9253, MX Series, and PTX Series are supported.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/kernel/tcpip/arp	Sensor for kernel Address Resolution Protocol (ARP) cache information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/tcpip/arp/: • **nbrcache-iri-max** • **nbrcache-mgmt-max** • **nbrcache-public-max** • **nbrcache-iri-cnt** • **nbrcache-mgmt-cnt** • **nbrcache-public-cnt** • **nbrcache-iri-drop-cnt** • **nbrcache-mgmt-drop-cnt** • **nbrcache-public-drop-cnt**
/junos/kernel/tcpip/ndp	Sensor for kernel Neighbor Discovery Protocol (NDP) information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/tcpip/ndp/: • **nbrcache-iri-max** • **nbrcache-mgmt-max** • **nbrcache-public-max** • **nbrcache-iri-cnt** • **nbrcache-mgmt-cnt** • **nbrcache-public-cnt** • **nbrcache-iri-drop-cnt** • **nbrcache-mgmt-drop-cnt** • **nbrcache-public-drop-cnt**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/kernel/tcpip/netisr	Sensor for kernel NETISR network queue information for IPv4, IPv6, ARP, and Ethernet. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/tcpip/netisr/: • **ether-wm-cnt** • **ether-drop-cnt** • **ether-pkt-queued** • **ether-pkt-handled** • **ip-wm-cnt** • **ip-drop-cnt** • **ip-pkt-queued** • **ip-pkt-handled** • **ip6-wm-cnt** • **ip6-drop-cnt** • **ip6-pkt-queued** • **ip6-pkt-handled** • **arp-wm-cnt** • **arp-drop-cnt** • **arp-pkt-queued** • **arp-pkt-handled**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/kernel/tcpip/nhdix	Sensor for kernel nexthop index space exhaustion information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/tcpip/nhdix/: • **nexthop-pvt-max** • **nexthop-pub-max** • **nexthop-pvt-cnt** • **nexthop-pub-cnt**
/junos/kernel/tcpip/rtb	Sensor for kernel route table information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/tcpip/rtb/: • **route-clone-cnt** • **route-clone-max**
/junos/kernel/tcpip/rtstock	Sensor for kernel routing table socket (RTSOCK) information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/rtsock/: • **total-error-cnt** • **total-veto-cnt**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/kernel/tcpip/tcp	Sensor for kernel Transport Control Protocol (TCP) information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/tcpip/tcp/: • **tcp-ddos-attack-cnt** • **tcp-conndrops-cnt** • **tcp-time-wait-conn**
/junos/kernel/tnp/	Sensor for kernel Trivial Network Protocol (TNP) information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/tnp/: • **tnp-frag-drop-cnt** • **tnp-hello-drop-cnt**
/junos/kernel/tunnel/	Sensor for kernel Reverse Path Forwarding (RPF) and non-RPF tunnel information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/tunnel/: • **looped-cnt** • **nonrpf-tunnelid-cnt** • **nonrpf-tunnelid-max** • **rpf-tunnelid-cnt** • **rpf-tunnelid-max**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/kernel/vpls/	Sensor for kernel Virtual Private LAN Service (VPLS) information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/vpls/: • **flood-token-cnt** • **flood-token-max** • **unicast-token-cnt** • **unicast-token-max**
/junos/kernel-ifstate	Sensor for Routing Engine ifstate information. Starting with Junos OS Release 19.1R1, EX9200, EX9251, EX9253, MX Series, and PTX Series are supported. You can also add the following as the end path for /junos/kernel-ifstate/: • **alive-clients-cnt** • **alive-ifstates-cnt** • **client-limit-reached** • **dead-clients-cnt** • **dead-ifstates-cnt** • **delayed-unrefs-cnt** • **delayed-unrefs-max** • **stuck-clients-cnt**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/kernel-ifstate/stats/churn-rate	Sensor for Routing Engine network object churn rate statistics. Starting in Junos OS Release 18.2R1, MX Series and PTX Series switches are supported. • **overall-churn-rate** • **route-add-rate** • **route-change-rate** • **route-delete-rate** • **nexthop-add-rate** • **nexthop-change-rate** • **nexthop-delete-rate**
/junos/kernel-ifstate/stats/peer-consumption-rate	Sensor for Routing Engine network object peer consumption rate statistics. Starting in Junos OS Release 18.2R1, MX Series and PTX Series switches are supported. • **peer-index** • **consumption-rate-counter** • **consumption-route-add-rate** • **consumption-route-delete-rate** • **consumption-nexthop-add-rate** • **consumption-nexthop-change-rate** • **consumption-nexthop-delete-rate**
/junos/kernel-ifstate/stats/record-seq-num	Sequence number of a statistic or record.
/junos/kernel-ifstate/stats/record-time	System time at which a statistic or record is created.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/kernel-ifstate/stats/vetos-statistics	Sensor for Routing Engine state statistics. Starting in Junos OS Release 18.2R1, MX Series and PTX Series switches are supported. • **veto-vm-page-count-severe** • **veto-ifstate-memory** • **veto-memory-overconsumed** • **veto-pfe-veto-max-routes** • **veto-too-many-delayed-unrefs** • **veto-nh-memory-usage** • **veto-mbuf-cluster** • **veto-flabel-space-exhaustion** • **veto-flabel-space-consumption**
/junos/routing-options/nonstop-routing	Sensor for kernel Non-Stop Routing (NSR) Junos Socket Replication (JSR) information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/routing-options/nonstop-routing/: • **jsr-split-failure-cnt** • **jsr-merge-failure-cnt** • **jsr-prl-queue-full-cnt**

Table 6: gRPC Sensors *(continued)*

resource path	Description
junos/rpm/probe-results/probe-test-results/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for probe test results for Real time Performance Monitoring (RPM) statistics. These statistics provide RPM monitoring data results collected by Juniper devices. You can use this information to assure service level agreements, improve network design, and optimize traffic engineering. Starting with Junos OS Release 18.3R1, MX Series routers are supported. The following end paths are also supported for the resource path: • **owner** • **test-name** • **target-address** • **target-url** • **source-address** • **destination-interface** • **probe-type** • **icmp-id** • **routing-instance-name** • **test-size** • **http-status** • **loss-thresh-total** • **loss-thresh-succ** • **rtt-thresh** • **rtt-jitter-thresh** • **rtt-stddev-thresh** • **igr-thresh** • **igr-jitter-thresh** • **igr-stddev-thresh** • **egr-thresh** • **egr-jitter-thresh** • **egr-stddev-thresh** • **probe-tests-hw-ts-err/invalid-client-recv-ts-cntr** • **probe-tests-hw-ts-err/invalid-client-nots-cntr** • **probe-tests-hw-ts-err/invalid-server-send-ts-cntr** • **probe-tests-hw-ts-err/invalid-server-spent-time-cntr**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **probe-single-results** • **probe-single-results/probe-time** • **probe-single-results/probe-sent-time** • **probe-single-results/probe-status** • **probe-single-results/hardware-timestamp-status** • **probe-single-results/rtt** • **probe-single-results/egress** • **probe-single-results/ingress** • **probe-single-results/round-trip-jitter** • **probe-single-results/egress-jitter** • **probe-single-results/round-trip-interarrival-jitter** • **probe-single-results/egress-interarrival-jitter** • **probe-single-results/ingress-interarrival-jitter** • **probe-test-generic-result** • **probe-test-generic-results/results-scope** • **probe-test-generic-results/probes-sent** • **probe-test-generic-results/probe-responses** • **probe-test-generic-results/loss-percentage** • **probe-test-generic-measurements** • **probe-test-generic-measurements/samples** • **probe-test-generic-measurements/min-delay** • **probe-test-generic-measurements/max-delay** • **probe-test-generic-measurements/avg-delay** • **probe-test-generic-measurements/jitter-delay** • **probe-test-generic-measurements/stddev-delay** • **probe-test-generic-measurements/sum-delay**
/junos/npu/memory	Starting with Junos OS Release 19.1R1, periodic streaming on QFX10002 switches and PTX10002 routers is supported.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/rpm/history-results/history-single-test-results/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for history results for Real time Performance Monitoring (RPM) statistics. These statistics provide RPM monitoring data results collected by Juniper devices. You can use this information to assure service level agreements, improve network design, and optimize traffic engineering. Starting with Junos OS Release 18.3R1, MX Series routers are supported. The following end paths are also supported for the resource path: • **owner** • **test-name** • **target-address** • **target-url** • **source-address** • **destination-interface** • **probe-type** • **icmp-id** • **test-size** • **http-status** • **routing-instance-name** • **loss-thresh-total** • **loss-thresh-succ** • **rtt-thresh** • **rtt-jitter-thresh** • **rtt-stddev-thresh** • **igr-thresh** • **igr-jitter-thresh** • **igr-stddev-thresh** • **egr-thresh** • **egr-jitter-thresh** • **egr-stddev-thresh** • **probe-single-results** • **probe-single-results/probe-time** • **probe-single-results/probe-sent-time** • **probe-single-results/probe-status** • **probe-single-results/hardware-timestamp-status**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **probe-single-results/rtt** • **probe-single-results/egress** • **probe-single-results/ingress** • **probe-single-results/round-trip-jitter** • **probe-single-results/egress-jitter** • **probe-single-results/ingress-jitter** • **probe-single-results/round-trip-interarrival-jitter** • **probe-single-results/egress-interarrival-jitter** • **probe-single-results/ingress-interarrival-jitter**
/junos/rpm/server/	Sensor for server results for Real time Performance Monitoring (RPM) statistics. These statistics provide RPM monitoring data results collected by Juniper devices. You can use this information to assure service level agreements, improve network design, and optimize traffic engineering. Starting with Junos OS Release 18.3R1, MX Series routers are supported. The following end paths are also supported for the resource path: • **active-servers** • **active-servers/protocol** • **active-servers/port** • **active-servers/dst-interface**
/junos/security/veriexec-state	Sensor for Veriexec state information. Starting with Junos OS Release 19.1R1, EX9200, EX9251, EX9253, MX Series, and PTX Series are supported.
/junos/services/health-monitor/config/	Sensor for the health monitoring configuraiton. Starting with Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services.
/junos/services/health-monitor/data/	Sensor for health monitoring data. Starting with Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/services/ip-tunnel[name='tunnel-name']/usage/counters[name='counter-name']/	Sensor for Packet Forwarding Engine dynamic tunnels statistics. The statistics are used to report various network element performance metrics in a scalable and efficient way, providing visibility into Packet Forwarding Engine errors and drops. A timestamp indicating when the counters were last reset is included with all the exported data to allow collectors to determine if and when a reset event happened; for example, if the Packet Forwarding Engine hardware restarted. Exported statistics are similar to the output of the operational mode command **show nhdb hw dynamic-ip-tunnels**. Starting with Junos OS Release 17.4R1, MX Series devices are supported on gRPC services, with the exception of MX80 and MX104 routers. These routers support UDP export only for this sensor. To configure UDP export, include the sensor **/junos/services/ip-tunnel/usage/** in the *sensor (Junos Telemetry Interface)* configuration statement at the [**edit services analytics**] hierarchy level.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/services/label-switched-path/usage/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for LSP statistics. On MX Series routers only, the following are also supported: bidirectional LSPs for ultimate-hop popping (UHP). Starting with Junos OS Release 17.2R1, QFX10000 switches and PTX1000 routers are also supported. Starting with Junos OS Release 17.3R1, EX9200 switches are also supported. Starting with Junos OS Release 17.4R1 on MX Series and PTX Series routers only, statistics for bypass LSPs are also exported. Previously, only statistics for ingress LSPs were exported. Starting with Junos OS Release 18.2R1, QFX5100, QFX5110, and QFX5200 switches are also supported. Starting with Junos OS Release 18.3R1, QFX5120-48Y and EX4650 switches are also supported. Starting with Junos OS Release 18.4R1, EX4600 switches are also supported. Starting with Junos OS Release 19.1R1, PTX10001-20C routers support RSVP bypass LSPs originating at the transit node Starting with Junos OS Release 19.1R1, periodic streaming on QFX10002 switches and PTX10002 routers is supported. Starting in Junos OS Evolved Release 19.1R1, PTX10003 routers are supported. Starting with Junos OS Release 19.2R1, ACX6360 routers are supported. Starting with Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services. Supported on QFX5200 switches starting with Junos OS Release 19.2R1 for streaming telemetry information using gNMI services. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. For bypass LSPs, the following are exported: • Bypass LSP originating at the ingress router of the protected LSP.

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• Bypass LSP originating at the transit router of the protected LSP. • Bypass LSP protecting the transit LSP as well as the locally originated LSP. When the bypass LSP is active, traffic is exported both on the bypass LSP and the ingress (protected) LSP. **NOTE:** When you enable a sensor for LSP statistics only, you must also configure the **sensor-based-stats** statement at the **[edit protocols mpls]** hierarchy level. MX Series routers should operate in enhanced mode. If not enabled by default, include either the **enhanced-ip** statement or the **enhanced-ethernet** statement at the **[edit chassis network-services]** hierarchy level.
/junos/twamp/client/control-connection/	Sensor for client control connection results for Two-Way Active Management Protocol (TWAMP). TWAMP (described in RFC 5357). Used to measure traffic performance between end-points, you can use this information to assure service level agreements, improve network design, and optimize traffic engineering. Starting with Junos OS Release 18.3R1, MX Series routers are supported. The following end paths are also supported for the resource path: • **control-name** • **client-address** • **client-port** • **server-address** • **server-port** • **session-count** • **auth-mode** • **server-address** • **server-port** • **test-session/session-name** • **test-session/sender-address** • **test-session/sender-port** • **test-session/reflector-address** • **test-session/reflector-port**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/twamp/client/probe-test-results/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for client probe test results for Two-Way Active Management Protocol (TWAMP). TWAMP (described in RFC 5357) is used to measure traffic performance between end-points. You can use this information to assure service level agreements, improve network design, and optimize traffic engineering. Starting with Junos OS Release 18.3R1, MX Series routers are supported. The following end paths are also supported for the resource path: • **owner** • **test-name** • **destination-interface** • **test-size** • **server-address** • **server-port** • **client-address** • **client-port** • **reflector-address** • **reflector-port** • **sender-address** • **sender-port** • **loss-thresh-total** • **loss-thresh-succ** • **rtt-thresh** • **rtt-jitter-thresh** • **rtt-stddev-thresh** • **igr-thresh** • **igr-jitter-thresh** • **igr-stddev-thresh** • **egr-thresh** • **egr-jitter-thresh** • **egr-stddev-thresh** • **probe-tests-hw-ts-err/invalid-client-recv-ts-cntr** • **probe-tests-hw-ts-err/invalid-client-nots-cntr** • **probe-tests-hw-ts-err/invalid-server-send-ts-cntr**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **probe-tests-hw-ts-err/invalid-server-spent-time-cntr** • **probe-single-results/** • **probe-single-results/probe-time** • **probe-single-results/probe-sent-time** • **probe-single-results/probe-status** • **probe-single-results/hardware-timestamp-status** • **probe-single-results/rtt** • **probe-single-results/egress** • **probe-single-results/ingress** • **probe-single-results/round-trip-jitter** • **probe-single-results/egress-jitter** • **probe-single-results/ingress-jitter** • **probe-single-results/round-trip-interarrival-jitter** • **probe-single-results/egress-interarrival-jitter** • **probe-single-results/ingress-interarrival-jitter** • **probe-test-generic-results/** • **probe-test-generic-results/results-scope** • **probe-test-generic-results/probes-sent** • **probe-test-generic-results/probe-responses** • **probe-test-generic-results/loss-percentage** • **probe-test-generic-results/probe-test-rtt** • **probe-test-generic-results/probe-test-generic-measurements/** • **probe-test-generic-results/probe-test-generic-measurements//probe-measurement-type** • **probe-test-generic-results/probe-test-generic-measurements/samples** • **probe-test-generic-results/probe-test-generic-measurements/min-delay** • **probe-test-generic-results/probe-test-generic-measurements/max-delay** • **probe-test-generic-results/probe-test-generic-measurements/avg-delay** • **probe-test-generic-results/probe-test-generic-measurements/jitter-delay** • **probe-test-generic-results/probe-test-generic-measurements/stddev-delay**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **probe-test-generic-results/probe-test-generic-measurements/sum-delay**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/twamp/client/history-test-results/history-single-test-results/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for client history test results for Two-Way Active Management Protocol (TWAMP). TWAMP (described in RFC 5357) is used to measure traffic performance between end-points. You can use this information to assure service level agreements, improve network design, and optimize traffic engineering. Starting with Junos OS Release 18.3R1, MX Series routers are supported. • **owner** • **test-name** • **destination-interface** • **test-size** • **server-address** • **server-port** • **client-address** • **client-port** • **reflector-address** • **reflector-port** • **sender-address** • **sender-port** • **loss-thresh-total** • **loss-thresh-succ** • **rtt-thresh** • **rtt-jitter-thresh** • **rtt-stddev-thresh** • **igr-thresh** • **igr-jitter-thresh** • **igr-stddev-thresh** • **egr-thresh** • **egr-jitter-thresh** • **egr-stddev-thresh** • **probe-single-results/** • **probe-single-results/probe-time** • **probe-single-results/probe-sent-time** • **probe-single-results/probe-status** • **probe-single-results/hardware-timestamp-status**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **probe-single-results/rtt** • **probe-single-results/egress** • **probe-single-results/ingress** • **probe-single-results/round-trip-jitter** • **probe-single-results/egress-jitter** • **probe-single-results/ingress-jitter** • **probe-single-results/round-trip-interarrival-jitter** • **probe-single-results/egress-interarrival-jitter** • **probe-single-results/ingress-interarrival-jitter**
/junos/twamp/server/control-connection/	Sensor for control connection results for servers for Two-Way Active Management Protocol (TWAMP). TWAMP (described in RFC 5357) is used to measure traffic performance between end-points. You can use this information to assure service level agreements, improve network design, and optimize traffic engineering. Starting with Junos OS Release 18.3R1, MX Series routers are supported. • **control-name** • **client-address** • **client-port** • **server-address** • **server-port** • **session-count** • **auth-mode** • **test-session/** • **test-session/session-name** • **test-session/sender-address** • **test-session/sender-port** • **test-session/reflector-address** • **test-session/reflector-port**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/network-instances/ network-instance[name='*instance-name*']/mpls// container-tunnels/ container-tunnel[name='*name*']state/	Sensor for container tunnel streaming notifications and normalization status. Starting in Junos OS Evolved Release 19.2R1, PTX10003 routers support streaming statistics. The following paths are also supported: • **admin-status** • **bytes** • **current-path-time** • **metric-type** • **metric** • **name** • **next-reoptimization-time** • **online-time** • **oper-status** • **path-changes** • **state-changes** • **counters/bytes** • **counters/packets**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/network-instances/ network-instance[name='*instance-name*']/mpls/lsps/ constrained-path/container-tunnels/ container-tunnel[name='*name*']state/	Sensor for container tunnel streaming notifications and normalization status. Starting with Junos OS Release 19.1R1, this sensor is supported on all platforms supporting JTI. Starting in Junos OS Evolved Release 19.2R1, PTX10003 routers are supported with the end points: • **admin-status** • **oper-status** The following paths are also supported: • **name** • **oper-state** • **member-count** • **minimum-lsp-count** • **maximum-lsp-count** • **normalize-timer** • **normalize-threshold** • **aggregate-bandwidth** • **sampled-aggregate-bandwidth** • **max-signaling-bandwidth** • **min-signaling-bandwidth** • **splitting-bandwidth** • **merging-bandwidth** • **incremental-normalization** • **failover-normalization** • **time-to-normalize** • **sampling/sampling-outlier-cutoff** • **sampling/sampling-mode** • **sampling/sampling-percentile** • **normalization-status** which includes **normalize-init**, **normalize-complete**, and **avoid-normalize**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/network-instances/ network-instance[name='*instance-name*']/mpls/lsps/ constrained-path/tunnels/tunnel[name='*name*']/ p2p-tunnel-attributes/p2p-primary-paths/ p2p-primary-path[name='*path-name*']/lsp-instances/ state/notify-status	Sensor for LSP events and properties. LSP events and properties are exported for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs. Supported on QFX5200 switches for streaming and ON_CHANGE statistics export through gNMI services starting with Junos OS Release 19.2R1.
/network-instances/ network-instance[name='*instance-name*']/mpls/lsps/ constrained-path/tunnels/tunnel[name='*name*']/ p2p-tunnel-attributes/p2p-primary-paths/ p2p-primary-path[name='*path-name*']/	Sensor for LSP events and properties. LSP events and properties are exported for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs. Starting with Junos OS Release 19.1R1, periodic streaming on QFX10002 switches and PTX10002 routers is supported. Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. The following paths are also supported: • **lsp-instances/state/bandwidth** • **lsp-instances/state/max-avg-bandwidth** • **lsp-instances/state/metric** • **lsp-instances/state/notify-status** • **state/explicit-path-name** • **state/notify-status**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/network-instances/ network-instance[name='*instance-name*']/mpls/lsps/ constrained-path/tunnels/tunnel[name='*name*']/ p2p-tunnel-attributes/p2p-primary-paths/ p2p-primary-path[name='*path-name*']/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for LSP events and properties. LSP events and properties are exported for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs. **NOTE:** Starting with Junos OS Release 17.4R1, telemetry data for LSP events and properties is reported separately for each routing instance. To export data for LSP events and properties, you must now include **/network-instances/network-instance[name='*instance-name*']/** in front of all supported paths. . Supported on MX Series and PTX Series routers and QFX10000 switches starting with Junos OS Release 17.2R1. Supported on EX4600 and EX9200 switches and QFX5110 and QFX5200 switches starting with Junos OS Release 17.3R1. Starting with Junos OS Release 18.1R1, QFX5100 switches are also supported. Starting with Junos OS Release 18.3R1, QFX5120-48Y and EX4650 switches are also supported. Starting with Junos OS Release 18.4R1, EX4600 switches are also supported. The following paths are also supported: • **lsp-instances/state/notify-status/initiated** • **lsp-instances/state/notify-status/lsp-up** • **lsp-instances/state/notify-status/lsp-down** • **lsp-instances/state/notify-status/lp-available** • **lsp-instances/state/notify-status/lp-unavailable** • **lsp-instances/state/notify-status/autobw-success** • **lsp-instances/state/notify-status/autobw-fail** • **lsp-instances/state/notify-status/patherr-recv** • **lsp-instances/state/notify-status/tunnel-local-repaired** • **lsp-instances/state/bandwidth** • **lsp-instances/state/metric** • **lsp-instances/state/max-avg-bandwidth** • **/state/associated-rsvp-sessions/associated-rsvp-session[local-index ='*index-number*']/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **state/notify-status** • **state/notify-status/originate-mbb** • **state/notify-status/cspf-noroute** • **state/notify-status/cspf-success** • **state/notify-status/gr-recovery-fail** • **state/explicit-path-name** **NOTE:** To specify a specific LSP name and source address, include **[name='lsp-name',source='address']** after **mpls/lsp/constrained-path-tunnels/tunnel/** in any of the supported paths. If do not include a specific LSP name, data is exported for all configured LSPs.
/network-instances/ network-instance[name='*instance-name*']/mpls/lsps/ constrained-path/tunnels/tunnel[name='*name*']/ p2p-tunnel-attributes/p2p-primary-paths/ p2p-primary-path[name='*path-name*'][local-index='local-index']/ state/notify-status	Sensor for self-ping failure. This sensor supports self-ping logs. Starting with Junos OS Release 19.1R1, this sensor is supported on all platforms supporting JTI.
/network-instances/ network-instance[name='*instance-name*']/mpls/lsps/ constrained-path/tunnels/tunnel[name='*name*']/ p2p-tunnel-attributes/p2p-primary-paths/ p2p-primary-path[name='*path-name*'][local-index='local-index']/ state/reason/	Sensor that indicates the reason for a self-ping failure. Starting with Junos OS Release 19.1R1, this sensor is supported on all platforms supporting JTI.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/network-instances/ network-instance[name='*instance-name*']/mpls/ signaling-protocols/rsvp-te/sessions/session/state/ notify-status/	Starting with Junos OS Release 17.4R1, telemetry data for LSP events and properties is reported separately for each routing instance. Supported on MX Series and PTX Series routers and QFX10000 switches starting with Junos OS Release 17.2R1. Supported on EX4600 and EX9200 switches and QFX5110 and QFX5200 switches starting with Junos OS Release 17.3R1. Starting with Junos OS Release 18.1R1, QFX5100 switches are also supported. Starting with Junos OS Release 18.3R1, QFX5120-48Y and EX4650 switches are also supported. Starting with Junos OS Release 18.4R1, EX4600 switches are also supported. Starting with Junos OS Release 19.1R1, periodic streaming on QFX10002 switches and PTX10002 routers is supported. Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. The following paths are also supported: • **detour-up** • **detour-down** • **patherr-recv** • **patherr-recv/admission_control_failure** • **patherr-recv/session_preeempted** • **patherr-recv/bad_loose_route** • **patherr-recv/bad_strict_route** • **patherr-recv/label_allocation_failure** • **patherr-recv/non_rsvp_capable_router** • **patherr-recv/ttl_expired** • **patherr-recv/routing_loop_detected** • **patherr-recv/requested_bandwidth_unavailable** • **patherr-recv/ttl_expired** • **pathmtu-change**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/cmerror/configuration	Sensor for error monitoring configuration. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services.
/junos/system/cmerror/counters	Sensor for error monitoring counters. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services.
/junos/system/linecard/bmon-sw/	Sensor for interface burst monitoring. Starting in Junos OS Evolved Release 19.3R1, QFX5220-128C and QFX5220-32CD switches are supported for streaming statistics on gRPC services. You can also add the following to the end of the path to stream specific statistics for interface burst monitoring: • **rx_bytes**-Total number of bytes received during the export interval. • **tx_bytes**-Total number of bytes transmitted during the export interval. • **start_ts**-Start timestamp for the data collection window. • **rx_peak_byte_rate**-Maximum bytes rate per millisecond received from all the sampling intervals in the export interval. • **rx_peak_ts**-Timestamp of the first burst. • **tx_peak_byte_rate**-Maximum bytes rate per millisecond, transmitted from all the sampling intervals in the export interval. • **tx_peak_byte_ts**-Timestamp of the first transmit burst.

Table 6: gRPC Sensors *(continued)*

resource path	Description
junos/system/linecard/npu/memory/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for network processing unit (NPU) memory. Supported on MX Series routers with MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards starting with Junos OS Release 19.3R1 for exporting telemetry information using gRPC services. This feature provides a different level of exported statistics in comparison to previous releases because it use the OpenConfig AFT model. You can also add the following to the end of the path to stream specific statistics for NPU memory: • **mem-util-edmem-size** • **mem-util-edmem-allocated** • **mem-util-edmem-utilization** • **mem-util-idmem-size** • **mem-util-idmem-allocated** • **mem-util-idmem-utilization** • **mem-util-bulk-dmem-size** • **mem-util-bulk-dmem-allocated** • **mem-util-bulk-dmem-utilization** • **mem-util-next-hop-edmem-size** • **mem-util-next-hop-edmem-allocated** • **mem-util-next-hop-edmem-utilization** • **mem-util-next-hop-bulk-dmem-size** • **mem-util-next-hop-bulk-dmem-allocated** • **mem-util-next-hop-bulk-dmem-utilization** • **mem-util-next-hop-idmem-size** • **mem-util-next-hop-idmem-allocated** • **mem-util-next-hop-inline-services-free-count** • **mem-util-next-hop-mobile:-timing-profile-bytes-allocated** • **mem-util-next-hop-mobile:-timing-profile-allocation-count** • **mem-util-next-hop-mobile:-timing-profile-free-count** • **mem-util-next-hop-packet-reassembly-(rw)-bytes-allocated** • **mem-util-next-hop-packet-reassembly-(rw)-allocation-count** • **mem-util-next-hop-packet-reassembly-(rw)-free-count** • **mem-util-next-hop-packet-reassembly---persistent-(rw)-bytes-allocated** • **mem-util-next-hop-packet-reassembly---persistent-(rw)-allocation-count**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **mem-util-next-hop-packet-reassembly---persistent-(rw)-free-count** • **mem-util-next-hop-ml-bundle-bytes-allocated** • **mem-util-next-hop-ml-bundle-allocation-count** • **mem-util-next-hop-ml-bundle-free-count** • **mem-util-next-hop-ddos-scfd-params-bytes-allocated** • **mem-util-next-hop-ddos-scfd-params-allocation-count** • **mem-util-next-hop-ddos-scfd-params-free-count** • **mem-util-next-hop-vbf-bytes-allocated** • **mem-util-next-hop-vbf-allocation-count** • **mem-util-next-hop-vbf-free-count** • **mem-util-next-hop-ptp-ieee-1588-nhs-bytes-allocated** • **mem-util-next-hop-ptp-ieee-1588-nhs-allocation-count** • **mem-util-next-hop-ptp-ieee-1588-nhs-free-count** • **mem-util-next-hop-cos-bytes-allocated** • **mem-util-next-hop-cos-allocation-count** • **mem-util-next-hop-cos-free-count** • **mem-util-next-hop-inline-hash-sessions-bytes-allocated** • **mem-util-next-hop-inline-hash-sessions-allocation-count** • **mem-util-next-hop-inline-hash-sessions-free-count** • **mem-util-next-hop-inline-mdi-bytes-allocated** • **mem-util-next-hop-inline-mdi-allocation-count** • **mem-util-next-hop-inline-mdi-free-count** • **mem-util-next-hop-cos-enhanced-priority-bytes-allocated** • **mem-util-next-hop-cos-enhanced-priority-allocation-count** • **mem-util-next-hop-cos-enhanced-priority-free-count** • **mem-util-firewall-fw-bytes-allocated** • **mem-util-firewall-fw-allocation-count** • **mem-util-firewall-fw-free-count** • **mem-util-counters-fw-counter-bytes-allocated** • **mem-util-counters-fw-counter-allocation-count** • **mem-util-counters-fw-counter-free-count** • **mem-util-counters-fw-policer-bytes-allocated** • **mem-util-counters-fw-policer-allocation-count** • **mem-util-counters-fw-policer-free-count** • **mem-util-counters-ifd-error-cntr-bytes-allocated**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **mem-util-counters-ifd-error-cntr-allocation-count** • **mem-util-counters-ifd-error-cntr-free-count** • **mem-util-counters-nh-cntr-bytes-allocated** • **mem-util-counters-nh-cntr-allocation-count** • **mem-util-counters-nh-cntr-free-count** • **mem-util-counters-ifl-cntr-bytes-allocated** • **mem-util-counters-ifl-cntr-allocation-count** • **mem-util-counters-ifl-cntr-free-count** • **mem-util-counters-bridge-domain-counter0-bytes-allocated** • **mem-util-counters-bridge-domain-counter0-allocation-count** • **mem-util-counters-bridge-domain-counter0-free-count** • **mem-util-counters-bridge-domain-counter0-free-count** • **mem-util-counters-bridge-domain-cntr-bytes-allocated** • **mem-util-counters-bridge-domain-cntr-allocation-count** • **mem-util-counters-bridge-domain-cntr-free-count** • **mem-util-counters-sample-inline-params-bytes-allocated** • **mem-util-counters-sample-inline-params-allocation-count** • **mem-util-counters-sample-inline-params-free-count** • **mem-util-counters-services-counters-bytes-allocated** • **mem-util-counters-services-counters-allocation-count** • **mem-util-counters-services-counters-free-count** • **mem-util-counters-exception-counter-bytes-allocated** • **mem-util-counters-exception-counter-allocation-count** • **mem-util-counters-exception-counter-free-count** • **mem-util-counters-issu-policer-bytes-allocated** • **mem-util-counters-issu-policer-allocation-count** • **mem-util-counters-issu-policer-free-count** • **mem-util-counters-ddos-scfd-counters-bytes-allocated** • **mem-util-counters-ddos-scfd-counters-allocation-count** • **mem-util-counters-ddos-scfd-counters-free-count** • **mem-util-counters-ip-reassembly-counter-bytes-allocated** • **mem-util-counters-ip-reassembly-counter-allocation-count** • **mem-util-counters-ip-reassembly-counter-free-count** • **mem-util-hash-hash-edmem-overhead-bytes-allocated** • **mem-util-hash-hash-edmem-overhead-bytes-allocated**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **mem-util-hash-hash-edmem-overhead-bytes-allocated** • **mem-util-hash-hash-edmem-overhead-bytes-allocated** • **mem-util-hash-hash-edmem-overhead-bytes-allocated** • **mem-util-hash-hash-edmem-overhead-allocation-count** • **mem-util-hash-hash-edmem-overhead-free-count** • **mem-util-hash-hash-edmem-bkt-bytes-allocated** • **mem-util-hash-hash-edmem-bkt-allocation-count** • **mem-util-hash-hash-edmem-bkt-free-count** • **mem-util-hash-hash-edmem-rec-bytes-allocated** • **mem-util-hash-hash-edmem-rec-allocation-count** • **mem-util-hash-hash-edmem-rec-free-count** • **mem-util-hash-hash-edmem-sideband-bytes-allocated** • **mem-util-hash-hash-edmem-sideband-allocation-count** • **mem-util-hash-hash-edmem-sideband-free-count** • **mem-util-hash-hash-dmem-bkt-bytes-allocated** • **mem-util-hash-hash-dmem-bkt-allocation-count** • **mem-util-hash-hash-dmem-bkt-free-count** • **mem-util-hash-hash-dmem-rec-bytes-allocated** • **mem-util-hash-hash-dmem-rec-allocation-count** • **mem-util-hash-hash-dmem-rec-free-count** • **mem-util-hash-hash-dmem-sideband-bytes-allocated** • **mem-util-hash-hash-dmem-sideband-allocation-count** • **mem-util-hash-hash-dmem-sideband-free-count** • **mem-util-encaps-ueid-bytes-allocated** • **mem-util-encaps-ueid-allocation-count** • **mem-util-encaps-ueid-free-count** • **mem-util-encaps-ueid-shared-bytes-allocated** • **mem-util-encaps-ueid-shared-bytes-allocated** • **mem-util-encaps-ueid-shared-allocation-count** • **mem-util-encaps-ueid-shared-free-count** • **mem-util-encaps-fabric-bytes-allocated** • **mem-util-encaps-fabric-allocation-count** • **mem-util-encaps-fabric-free-count** • **mem-util-services-nh-inline-jflow-sample-rr-(svcs)-bytes-allocated** • **mem-util-services-nh-inline-jflow-sample-rr-(svcs)-allocation-count**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **mem-util-services-nh-inline-jflow-sample-rr-(svcs)-free-count** • **mem-util-services-nh-inline-jflow-sample-nh-(svcs)-bytes-allocated** • **mem-util-services-nh-inline-jflow-sample-nh-(svcs)-allocation-count** • **mem-util-services-nh-inline-jflow-sample-nh-(svcs)-free-count**

Table 6: gRPC Sensors *(continued)*

resource path	Description
junos/system/linecard/npu/memory/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for network processing unit (NPU) memory, NPU memory utilization, and total memory available for each memory type. Supported on QFX10000 switches and PTX1000 routers starting with Junos OS Release 17.2R1. Supported on EX9200 switches starting with Junos OS Release 17.3R1. **NOTE:** Starting with Junos Release 17.4R1, FPC1 and FCP2 on PTX Series routers export data for NPU memory and NPU memory utilization. Previously, this sensor was supported only on FPC 3. Starting with Junos OS Release 18.3R1, EX4650 switches are supported. Starting with Junos OS Release 19.1R1, periodic streaming on PTX10002 routers is supported. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers and PTX1000 and PTX10000 routers are supported on gRPC and gNMI services. The OpenConfig path is **/components/component[name="FPC<*fpc-id*>:NPU<*npu-id*>"] /properties/property/** You can also add the following to the end of the path to stream specific statistics for NPU memory: • **[name="mem-util-<*memory-name*>-size"]/value** • **[name="mem-util-<*memory-name*>-bytes-allocated"]/value** • **[name="mem-util-<*memory-name*>-utilization"]/value** • **[name="mem-util-<*partition-name*>-< *app-name*>-allocation-count"]/value** • **[name="mem-util-<*partition-name*>-< *app-name*>-bytes-allocated"]/value** • **[name="mem-util-<*partition-name*>-< *app-name*>-free-count"]/value** You can also add the following to the end of the path to stream specific statistics for NPU: • **[name="util-<*memory-name*>-average-util">/value** • **[name="util-<*memory-name*>-highest-util">/value** • **[name="util-<*memory-name*>-lowest-util">/value**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **[name="util-<*memory-name*>-average-cache-hit-rate">/value** • **[name="util-<*memory-name*>-lowest-cache-hit-rate">/value** • **[name="util-<*packet-identifier*>-rate">/value** You can also export the following statistics for NPU memory for PTX routers only • **pfe_name** • **combined_pool_name** • **combined_size** • **combined_usage_cnt** • **combined_utilization** • **global_pool_name** • **global_usage_cnt** • **global_alloc_cnt** • **global_free_cnt** • **local_pool_name** • **local_usage_cnt** • **local_alloc_cnt** • **local_free_cnt**
/junos/system/linecard/node-slicing/af-fab-stats/	Sensor to export abstracted fabric (AF) interface-specific load-balancing and fabric queue statistics. This sensor is only supported for in node virtualization configurations on MX routers with an AF Interface as the connecting link between guest network functions (GNFs).The sensor also reports aggregated statistics across all AF interfaces hosted on a source packet forwarding engine of local guest GNFs along with the fabric statistics for all traffic ingressing from and egressing to the fabric from that the packet forwarding engine. Supported on MX480, MX960, MX2010, MX2020, MX2008 and MX-ELM routers with Junos OS Release 18.4R1.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/cpu/memory/	Sensor for CPU memory. This sensor exports the CPU and memory utilization per process and CPU usage for threads per process. The current implementation is Linux-based; therefore, the export information and gathered output format differs significantly from this sensor's performance on previous platforms. Supported on MX Series routers with MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards starting with Junos OS Release 19.3R1 for exporting telemetry information using gRPC services. This feature provides a different level of exported statistics in comparison to previous releases because it use the OpenConfig AFT model. The statistics exported from this sensor are found in the following operational mode commands: **show system info**, **show system processes**, and **show system cpu**.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/cpu/memory/	Sensor for CPU memory. **NOTE:** On PTX Series routers, FPC1 and FPC2 are not supported. Supported on QFX10000 switches and PTX1000 routers starting with Junos OS Release 17.2R1. Supported on EX9200 switches starting with Junos OS Release 17.3R1. Supported on QFX5100, QFX5110, and QFX5200 switches starting with Junos OS Release 18.2R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. Periodic streaming is supported on on QFX10002 switches and PTX10002 routers starting with Junos OS Release 19.1R1. Starting with Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services. Supported on QFX5200 switches starting with Junos OS Release 19.2R1 for streaming telemetry information using gNMI services. Periodic streaming using gRPC services is Supported on EX4300-MP switches starting with Junos OS Release 19.4R1, You can also include the following to end of the resource path for CPU memory: • **[name="mem-util-<*memory-name*>-size"]/value** • **[name="mem-util-<*memory-name*>-bytes-allocated"]/value** • **[name="mem-util-<*memory-name*>-utilization"]/value** • **[name="mem-util-<*memory-name*>-< *app-name*>-allocations"]/value** • **[name="mem-util-<*memory-name*>-< *app-name*>-frees"]/value** • **[name="mem-util-<*memory-name*>-< *app-name*>-allocations-failed"]/value**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/npu/memory/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for NPU Memory utilization statistics. Shown below, statistics are exported for the default FPC (**FPC0**). Multiples FPCs are supported. The component values and property values are names (like interface names). Starting in Junos OS Evolved Release 19.4R1, streaming statistics using gRPC and gNMI services on PTX10008 routers is supported. The following statistics are exported: • **/components-memory/component[name='FPC0:NPU17']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-kht-epp-mapid-size']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-kht-epp-mapid-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-kht-epp-mapid-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-kht-l2domain-size']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-kht-l2domain-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-kht-l2domain-utilizationn']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/ property[name='mem-util-kht-tunnell2domainhash00-size']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/ property[name='mem-util-kht-tunnell2domainhash00-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/ property[name='mem-util-kht-tunnell2domainhash00-utilization']/** • **:/components-memory/component[name='FPC0:NPU17']/ properties/ property[name='mem-util-kht-tunnell2domainhash10-size']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/ property[name='mem-util-kht-tunnell2domainhash10-allocatedd']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	property[name='mem-util-kht-tunnell2domainhash10-utilization']/ • **:/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-kht-slu-my-mac-size']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-kht-slu-my-mac-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-kht-slu-my-mac-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-kht-dlu-idb-size']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-kht-dlu-idb-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-kht-dlu-idb-utilization']/ }** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-jnh-final-size']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-jnh-final-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-jnh-final-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-jnh-remap-size']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-jnh-remap-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-jnh-remap-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-jnh-refbits-size']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-jnh-refbits-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-jnh-refbits-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-jnh-nh-size']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-jnh-nh-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/ properties/property[name='mem-util-jnh-nh-utilization']/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-mpls-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-mpls-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name=' mem-util-jnh-mpls-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-loadbal-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-loadbal-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-loadbal-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-egress-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-egress-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-egress-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jtree-memory-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jtree-memory-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jtree-memory-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-vfilter-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-vfilter-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-vfilter-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-phyfilter-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-phyfilter-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-phyfilter-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-action-size']/

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-action-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-action-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-tcam-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name=' mem-util-flt-tcam-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-tcam-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-0-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-0-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-0-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-1-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-1-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-1-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-2-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-2-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-2-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-3-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-3-allocated']/

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-3-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-4-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-4-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-fcv-blk-4-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-scv-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-scv-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-scv-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-0-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-0-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-0-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-1-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-1-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-1-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-2-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-2-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-2-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-3-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-3-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-3-utilization']/

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-4-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-4-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-4-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-5-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-5-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-5-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-6-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-6-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-6-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-7-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-7-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-0-bank-7-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name=' mem-util-flt-beta-1-bank-0-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-0-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-0-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-1-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-1-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-1-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-2-size']/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-2-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-2-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-3-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-3-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-3-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-4-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-4-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-4-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-5-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-5-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-5-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-6-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-6-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-6-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-7-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-7-allocated']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-beta-1-bank-7-utilization']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-0-kht-size']/ • /components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-0-kht-allocated']/

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-0-kht-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-0-bft-0-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-0-bft-0-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-0-bft-0-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-0-plt-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-0-plt-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-0-plt-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-1-kht-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-1-kht-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-1-kht-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-1-bft-0-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-1-bft-0-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-1-bft-0-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-1-plt-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-1-plt-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-flt-alpha-1-plt-utilization']/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/npu/utilization	Sensor for NPU utilization on the Packet Forwarding Engine. Packet Forwarding Engine utilization is exported exported as a percentage using input notifications. The following packet statistics are also exported as part of this field: • Loopback (pps) • Recirculation (pps) • WAN and host inject (pps) • ASIC to host (pps) Shown below, statistics are exported for the default FPC (**FPC0**). Multiples FPCs are supported. The component values and property values are names (like interface names). Starting in Junos OS Evolved Release 19.4R1, streaming statistics using gRPC and gNMI services on PTX10008 routers is supported. The following statistics are exported: • **/components-utilization/component[name='FPC0:NPU17'** • **/components-utilization/component[name='FPC0:NPU17']/properties/property[name='util-metric']** • **/components-utilization/component[name='FPC0:NPU17']/properties/property[name='util-Loopback-packet-rate']** • **components-utilization/component[name='FPC0:NPU17']/properties/property[name='util-Recirculation-packet-rate']** • **/components-utilization/component[name='FPC0:NPU17']/properties/property[name='util-Wan and Host inject-packet-rate']** • **/components-utilization/component[name='FPC0:NPU17']/properties/property[name='util-ASIC to host-packet-rate']**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/npu/utilization/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Packet Forwarding Engine sensor for NPU processor utilization. Supported on MX Series routers with MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards starting with Junos OS Release 19.3R1 for exporting telemetry information using gRPC services. This feature provides a different level of exported statistics in comparison to previous releases because it uses the OpenConfig AFT model. You can also include the following to the end of the resource path for NPU utilization: • **util-metric** • **util-Disp 0 Pkts-packet-rate** • **util-Disp 0 Pkts-average-instructions-per-packet** • **util-Disp 0 Pkts-average-wait-cycles-per-packet** • **util-Disp 0 Pkts-average-cycles-per-packet** • **util-Disp 1 Pkts-packet-rate** • **util-Disp 1 Pkts-average-instructions-per-packet** • **util-Disp 1 Pkts-average-wait-cycles-per-packet** • **util-Disp 1 Pkts-average-cycles-per-packet** • • **util-Disp 2 Pkts-packet-rate** • **util-Disp 2 Pkts-average-instructions-per-packet** • **util-Disp 2 Pkts-average-wait-cycles-per-packet** • **util-Disp 2 Pkts-average-cycles-per-packet** • **util-Disp 3 Pkts-packet-rate** • • **util-Disp 3 Pkts-average-instructions-per-packet** • **util-Disp 3 Pkts-average-wait-cycles-per-packet** • **util-Disp 3 Pkts-average-cycles-per-packet** • **mem-util-EDMEM-average-util** • **mem-util-EDMEM-highest-util** • **mem-util-EDMEM-lowest-util** • **mem-util-EDMEM-average-cache-hit-rate** • **mem-util-EDMEM-highest-cache-hit-rate** • **mem-util-EDMEM-lowest-cache-hit-rate** • **mem-util-IDMEM-average-util**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **mem-util-IDMEM-highest-util** • **mem-util-IDMEM-lowest-util** • **mem-util-IDMEM-average-cache-hit-rate** • **mem-util-IDMEM-highest-cache-hit-rate** • **mem-util-IDMEM-lowest-cache-hit-rate** • **mem-util-Bulk DMEM-average-util** • **mem-util-Bulk DMEM-highest-util** • **mem-util-Bulk DMEM-lowest-util** • **mem-util-Bulk DMEM-average-cache-hit-rate** • **mem-util-Bulk DMEM-highest-cache-hit-rate** • **mem-util-Bulk DMEM-lowest-cache-hit-rate**
/junos/system/linecard/npu/utilization/	Packet Forwarding Engine sensor for NPU processor utilization. Periodic streaming is supported on PTX10002 routers starting with Junos OS Release 19.1R1. Starting with Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers and PTX1000 and PTX10000 routers are supported on gRPC and gNMI services.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/interface/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Packet Forwarding Engine sensor for physical interface traffic. **NOTE:** For PTX Series routers, for a specific interface, queue statistics are exported for each line card. For MX series routers, interface queue statistics are exported only from the slot on which an interface is configured. For Aggregated Ethernet interfaces, statistics are exported for the member physical interfaces. You must aggregate the counters at the destination server, or collector. If a physical interface is administratively down or operationally down, interface counters are not exported. Issuing an operational **clear** command, such as **clear interfaces statistics all**, does not reset statistics exported by the line card. Supported on PTX Series routers starting with Junos OS Release 15.1F3. Supported on MX Series routers starting with Junos OS Release 15.1F5. Supported on QFX10000 switches and PTX1000 routers starting with Junos OS Release 17.2R1. Supported on EX9200 switches and MX150 routers starting with Junos OS Release 17.3R1. Supported on QFX5100, QFX5110, and QFX5200 switches starting with Junos OS Release 18.2R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches Starting with Junos OS Release 18.4R1. Periodic streaming is supported on QFX10002 switches and PTX10002 routers starting with Junos OS Release 19.1R1. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches with Junos OS Release 19.2R1 on gRPC and gNMI services. Supported on MX240, MX480, and MX960 routers starting with Junos OS Release 19.3R1 for exporting telemetry information using gNMI services. This feature includes support to export telemetry data for integration with AFTTelemetry and LibTelemetry libraries with the OpenConfig model openconfig-aft.

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Periodic streaming using gNMI services on MX2K-MPC11E line cards on MX2010 and MX2020 routers is supported starting with Junos OS Release 20.1R1.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/interface/logical/usage	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Packet Forwarding Engine sensor for logical interface statistics. **NOTE:** If a logical interface is operationally down, interface statistics continue to be exported. Issuing an operational **clear** command, such as **clear interfaces statistics all**, does not reset statistics exported by the line card. **NOTE:** If a logical interface is operationally down, interface statistics continue to be exported. Issuing an operational **clear** command, such as **clear interfaces statistics all**, does not reset statistics exported by the line card. **NOTE:** Locally injected packets from the Routing Engine are not exported. **NOTE:** Locally injected packets from the Routing Engine are not exported. Supported in Junos OS Release 15.1F5. Supported QFX10000 switches starting with on Junos OS Release 17.2R1. Supported on EX9200 switches and MX150 routers starting with Junos OS Release 17.3R1. Supported on QFX5100, QFX5110, and QFX5200 switches starting with Junos OS Release 18.2R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. Starting with Junos OS Release 19.1R1, periodic streaming is supported on QFX10002 switches and PTX10002 routers. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches with Junos OS Release 19.2R1 on gRPC and gNMI services. Supported on QFX5200 switches starting with Junos OS Release 19.2R1 for streaming telemetry information using gNMI services. Supported on MX240, MX480, and MX960 routers starting with Junos OS Release 19.3R1 for exporting telemetry information using gNMI

Table 6: gRPC Sensors *(continued)*

resource path	Description
	services. This feature includes support to export telemetry data for integration with AFTTelemetry and LibTelemetry libraries with the OpenConfig model openconfig-aft. Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Periodic streaming using gNMI services on MX2K-MPC11E line cards on MX2010 and MX2020 routers is supported starting with Junos OS Release 20.1R1.
/junos/system/linecard/interface/queue/	Sensor for interface queue statistics. Starting with Junos OS Release 18.3R1, when a subscription is made to **/interfaces** on MX, EX, QFX, PTX, and ACX platforms, traffic and queue statistics are delivered in two separate sensors: • **/junos/system/linecard/interface/traffic/** • **/junos/system/linecard/interface/queue/** This can reduce the reap time for non-queue data for platforms supporting Virtual Output Queues (VOQ), such as PTX Series routers. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services. Supported on MX240, MX480, and MX960 routers starting with Junos OS Release 19.3R1 for exporting telemetry information using gNMI services. This feature includes support to export telemetry data for integration with AFTTelemetry and LibTelemetry libraries with the OpenConfig model openconfig-aft. Periodic streaming using gNMI services on MX2K-MPC11E line cards on MX2010 and MX2020 routers is supported starting with Junos OS Release 20.1R1.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/interface/traffic/	Sensor for interface traffic, exporting all fields except queue statistics. Starting with Junos OS Release 18.3R1, when a subscription is made to **/interfaces** on MX, EX, QFX, PTX, and ACX platforms, traffic and queue statistics are delivered in two separate sensors: • **/junos/system/linecard/interface/traffic/** • **/junos/system/linecard/interface/queue/** This can reduce the reap time for non-queue data for platforms supporting Virtual Output Queues (VOQ), such as PTX Series routers. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services. Supported on MX240, MX480, and MX960 routers starting with Junos OS Release 19.3R1 for exporting telemetry information using gNMI services. This feature includes support to export telemetry data for integration with AFTTelemetry and LibTelemetry libraries with the OpenConfig model openconfig-aft. Periodic streaming using gNMI services on MX2K-MPC11E line cards on MX2010 and MX2020 routers is supported starting with Junos OS Release 20.1R1.
/junos/system/linecard/intf-exp/	Sensor for physical interface express statistics. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services.
/junos/system/linecard/optical	Sensor for optical alarms. Configure this sensor for **et-*type-fpc/pic/port*** (100-Gigabit Ethernet) interfaces. Supported on ACX6360 Universal Metro, MX Series, and PTX Series routers with a CFP2-DCO optics module starting with Junos OS Release 18.3R1. This module provides a high-density, long-haul OTN transport solution with MACSec capability. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 19.2R1 on gRPC and gNMI services.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/otn	Sensor for G.709 optical transport network (OTN) alarms. Configure this sensor on **ot-*type-fpc/pic/port*** interfaces. Supported on ACX6360 Universal Metro, MX Series, and PTX Series routers with a CFP2-DCO optics module starting with Junos OS Release 18.3R1. This module provides a high-density, long-haul OTN transport solution with MACSec capability. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 19.2R1 on gRPC and gNMI services.
/junos/system/linecard/qmon-sw/	Sensor for congestion and latency monitoring statistics. Supported on QFX5100, QFX5110, and QFX5200 switches starting with Junos OS Release 18.2R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 19.2R1 on gRPC and gNMI services. Supported on QFX5200 switches starting with Junos OS Release 19.2R1 for streaming telemetry information using gNMI services. Periodic streaming using gRPC services with EX4300-MP switches is supported starting with Junos OS Release 19.4R1.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/services/inline-jflow	Sensor for inline active flow monitoring services statistics. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 19.2R1 on gRPC and gNMI services. When configuring inline active flow monitoring in Junos, you can apply version 9 or IPFIX flow templates to define a flow record template suitable for IPv4 or IPv6 MPLS and bridging traffic. For more information, see *Configuring Flow Aggregation on MX, M, vMX and T Series Routers and NFX250 to Use Version 9 Flow Templates*. Supported on MX Series operating with MPC10E-15C-MRATE line-rate cards starting with Junos OS Release 19.2R1. Supported on MX240, MX480, and MX960 routers starting with Junos OS Release 19.3R1 for exporting telemetry information using gNMI services. This feature includes support to export telemetry data for integration with AFTTelemetry and LibTelemetry libraries with the OpenConfig model openconfig-aft. Periodic streaming using gNMI services on MX2K-MPC11E line cards on MX2010 and MX2020 routers is supported starting with Junos OS Release 20.1R1.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/network-instances/network-instance/protocols/protocol/bgp/	Sensor for BGP peer information. Starting in Junos OS Evolved Release 19.2R1, PTX10003 routers support streaming statistics. You can also add the following end paths: • **neighbors/neighbor/afi-safis/afi-safi/state/active** • **neighbors/neighbor/afi-safis/afi-safi/state/prefixes/installed** • **neighbors/neighbor/afi-safis/afi-safi/state/prefixes/received** • **neighbors/neighbor/afi-safis/afi-safi/state/prefixes/sent** • **neighbors/neighbor/afi-safis/afi-safi/state/prefixes/rejected** • **neighbors/neighbor/state/admin-state** • **neighbors/neighbor/state/established-transitions** • **neighbors/neighbor/state/last-established** • **neighbors/neighbor/state/messages/received/notification** • **neighbors/neighbor/state/messages/received/update** • **neighbors/neighbor/state/messages/sent/notification** • **neighbors/neighbor/state/messages/sent/update** • **neighbors/neighbor/state/session-state** • **neighbors/neighbor/state/supported-capabilities** • **transport/state/local-address** • **transport/state/remote-address** • **transport/state/remote-port**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/network-instances/network-instance/protocols/protocol/bgp/	Sensor for BGP peer information. Supported on QFX5200 switches for streaming and ON_CHANGE statistics export through gNMI services starting with Junos OS Release 19.2R1. You can also add the following end paths: • **global/afi-safis/afi-safi/state/total-prefixes** • **neighbors/neighbor/state/session-state** • **neighbors/neighbor/state/messages/sent/UPDATE** • **neighbors/neighbor/state/messages/received/UPDATE** • **neighbors/neighbor/transport/state/local-address** • **neighbors/neighbor/state/peer-as** • **neighbors/neighbor/afi-safis/afi-safi/ipv4-unicast/prefix-limit/state/max-prefixes** • **neighbors/neighbor/** • **neighbors/neighbor/** • **neighbors/neighbor/state/session-admin-status** • **neighbors/neighbor/state/session-status** • **neighbors/neighbor/state/established-transitions** • **neighbors/neighbor/state/interface-error** • **neighbors/neighbor/afi-safis/afi-safi/state/prefix-limit-exceeded**

Table 6: gRPC Sensors *(continued)*

resource path	Description

Table 6: gRPC Sensors *(continued)*

resource path	Description
/network-instances/network-instance/protocols/protocol/bgp/ **NOTE:** Starting with Junos OS Release 17.4R1 on MX Series and PTX Series routers, you can provision Junos Telemetry Interface sensors to export data for BGP routing tables (RIBs) for IPv4 and IPv6 routes. For BGP routing table paths, the **/network-instances/network-instance/** path is not supported. Each address family supports exporting data for five different tables, a main routing table, and four per-neighbor tables: • local-rib— main BGP routing table for the main routing instance. • adj-rib-in-pre— NLRI updates received from the neighbor before any local input policy filters have been applied. • adj-rib-in-post— routes received from the neighbor eligible for best-path selection after local input policy filters have been applied. • adj-rib-out-pre— routes eligible for advertising to the neighbor before output policy filters have been applied. • adj-rib-out-post— routes eligible for advertising to the neighbor after output policy filters have been applied. Use the following paths to export data for each BGP routing table. You can specify to export data either for IPv4 or IPv6 for each table: • **/bgp-rib/afi-safis/afi-safi/ipv4-unicast/loc-rib/** • **/bgp-rib/afi-safis/afi-safi/ipv6-unicast/loc-rib/** • **/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/neighbor/adj-rib-in-pre/** • **/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/neighbor/adj-rib-in-pre/** • **/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/neighbor/adj-rib-in-post/**	Sensor for BGP peer information. Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers, EX4600 and EX9200 switches, and QFX5110 switches starting with Junos OS Release 17.3R1. Starting with Junos OS Release 18.1R1, QFX5100 switches are also supported. Starting with Junos OS Release 18.3R1, QFX5120-48Y and EX4650 switches are also supported. Starting with Junos OS Release 19.1R1, periodic streaming on QFX10002 switches and PTX10002 routers is supported. Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX are also supported. **NOTE:** Starting with Junos OS Release 17.3R1, telemetry data streamed through gRPC for BGP peers is reported separately for each configured routing instance. If your Juniper Network device is running Junos OS Release 17.3R1 or later, you must prepend the following to the beginning of any path you specify to stream statistics for BGP, with the exception of paths for routing tables: **/network-instances/network-instance[name_'instance-name']/protocols/protocol/** Starting with Junos OS Release 17.3R1, the following paths are also supported: • **/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safis/afi-safi/state/prefixes/accepted** • **/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safis/afi-safi/state/prefixes/rejected** **/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safis/afi-safi/state/active** • **/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safis/afi-safi/state/queues/output** • **/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safis/afi-safi/state/queues/input**

Table 6: gRPC Sensors *(continued)*

resource path	Description
• **/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/neighbor/adj-rib-in-post/** • **/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/neighbor/adj-rib-out-pre/** • **/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/neighbor/adj-rib-out-pre/** • **/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/neighbor/adj-rib-out-post/** • **/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/neighbor/adj-rib-out-post/**	• **/network-instances/network-instance/protocols/protocol/bgp/neighbors/snmp-peer-index** • **/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/state/ImportEval** • **/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/state/ImportEvalPending** • **/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/state/messages/received/notification** **/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/state/messages/sent/notification** **/network-instances/network-instance/protocols/protocol/bgp/transport/state/remote-port** **/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/state/supported-capabilities** **NOTE:** For all the following paths, with the exception of paths for routing tables, if your Juniper Networks device is running Junos OS Release 17.3R1 or later, you must prepend the following in front of the path: **/network-instances/network-instance[name_'instance-name']/protocols/protocol/** You can also include the following at the end path to **/network-instances/network-instance[name_'instance-name']/protocols/protocol/bgp/neighbors/neighbor/**:

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **state/session-state** • **state/messages/sent/update** • **state/messages/received/update** • **transport/state/local-address** • **transport/state/remote-address** • **state/peer-as** • **afi-safis/afi-safi/state/prefix-limit/state/max-prefixes** • **afi-safis/afi-safi/state/active** • **state/session-status** • **state/session-admin-status** • **state/session-established-transitions** • **state/interface-error** • **state/prefix-limited-exceeded** • **state/last-established** • **established-transitions** You can also include the following at the end path to **/network-instances/network-instance[name_'instance-name']/protocols/protocol/ /bgp/global/**: • **afi-safis/afi-safi/state/total-prefixes** You can also include the following at the end path to **/network-instances/network-instance[name_'instance-name']/protocols/protocol/ /bgp/peer-groups/peer-group[name_'peer-group-name]/**: • **afi-safis/afi-safi/add-paths/eligible-prefix-policy** • **state/peer-count/** **NOTE:** For paths that export data for BGP routing tables, which are supported starting with Junos OS Release 17.4R1, you can apend the following to each of the paths:

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• /num-routes • /routes/route/prefix • /routes/route/attributes • /routes/route/attributes/origin • /routes/route/attributes/as-path • /routes/route/attributes/next-hop • /routes/route/attributes/med • /routes/route/attributes/local-pref • /routes/route/attributes/atomic-aggr • /routes/route/attributes/aggregator/as • /routes/route/attributes/aggregator/as4 • /routes/route/attributes/aggregator/address • /routes/route/ext-attributes/ • /routes/route/ext-attributes/community • /routes/route/ext-attributes/originator-id • /routes/route/ext-attributes/cluster-list • /routes/route/ext-attributes/extended-community • /routes/route/ext-attributes/aigp • /routes/route/ext-attributes/path-id • /routes/route/ext-attributes/unknown-attribute • /routes/route/ext-attributes/unknown-attribute/attr-type • /routes/route/ext-attributes/unknown-attribute/attr-len • /routes/route/ext-attributes/unknown-attribute/attr-value • /routes/route/last-modified-date • /routes/route/last-update-received • /routes/route/valid-route • /routes/route/invalid-reason • /routes/route/best-path

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/task-memory-information/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for memory utilization for routing protocol task. Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers, EX4600 and EX9200 switches and QFX5110 switches starting with Junos OS Release 17.3R1. Starting with Junos OS Release 18.1R1, QFX5100 switches are also supported. Starting with Junos OS Release 18.3R1, QFX5120-48Y and EX4650 switches are also supported. Starting with Junos OS Release 19.1R1, periodic streaming is supported on QFX10002 switches and PTX10002 routers. Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX are also supported. Supported on QFX5200 switches for streaming and ON_CHANGE statistics export through gNMI services starting with Junos OS Release 19.2R1. You can also include the following at the end path to **/junos/task-memory-information/**: • **task-memory-overall-report/task-size-block-list/task-size-block/tsb-size** • **task-memory-overall-report/task-size-block-list/task-size-block/tsb-alloc-bytes** • **task-memory-overall-report/task-size-block-list/task-size-block/tsb-allocs** • **task-memory-overall-report/task-size-block-list/task-size-block/tsb-max-allocs** • **task-memory-overall-report/task-size-block-list/task-size-block/tsb-max-bytes** • **task-memory-overall-report/task-size-block-list/task-size-block/tsb-free-bytes** • **task-memory-overall-report/task-memory-total-bytes** • **task-memory-overall-report/task-memory-total-max-bytes** • **task-memory-information/task-memory-overall-report/task-memory-total-free-bytes** • **task-memory-allocator-report/task-block-list/task-block/tb-name** • **task-memory-allocator-report/task-block-list/task-block/tb-size** • **task-memory-allocator-report/task-block-list/task-block/tb-alloc-size** • **task-memory-allocator-report/task-block-list/task-block/tb-alloc-blocks** • **task-memory-allocator-report/task-block-list/task-block/tb-alloc-bytes** • **task-memory-allocator-report/task-block-list/task-block/tb-max-alloc-blocks**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• task-memory-allocator-report/task-lite-page-list/task-lite-page/tlp-name • task-memory-allocator-report/task-lite-page-list/task-lite-page/tlp-alloc-bytes • task-memory-allocator-report/task-memory-total-bytes • task-memory-information/task-memory-allocator-report/task-memory-total-max-bytes • task-memory-malloc-usage-report/task-malloc-list/task-malloc/tm-name • task-memory-malloc-usage-report/task-malloc-list/task-malloc/tm-allocs • task-memory-malloc-usage-report/task-malloc-list/task-malloc/tm-alloc-bytes • task-memory-malloc-usage-report/task-malloc-list/task-malloc/tm-max-allocs • task-memory-malloc-usage-report/task-malloc-list/task-malloc/tm-max-alloc-bytes • task-memory-malloc-usage-report/task-malloc-list/task-malloc/tm-function-calls • task-memory-malloc-usage-report/task-memory-total-bytes • task-memory-malloc-usage-report/task-memory-total-max-bytes • task-memory-max-dynamic-allocs • task-memory-bss-bytes • task-memory-max-bss-bytes • task-memory-page-data-bytes • task-memory-max-page-data-bytes • task-memory-dir-bytes • task-memory-max-dir-bytes • task-memory-total-bytes-in-use • task-memory-total-bytes-percent

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/firewall/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for firewall filter counters and policer counters. Each line card reports counters separately. Supported on QFX10000 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers and EX9200 switches starting with Junos OS Release 17.3R1. Supported on QFX5100, QFX5110, and QFX5200 switches starting with Junos OS Release 18.2R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. Starting with Junos OS Release 19.1R1, periodic streaming is supported on QFX10002 switches and PTX10002 routers. Starting in Junos OS Evolved Release 19.1R1, PTX10003 routers are supported. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services. Supported on QFX5200 switches starting with Junos OS Release 19.2R1 for streaming telemetry information using gNMI services. Supported on MX240, MX480, and MX960 routers starting with Junos OS Release 19.3R1 for exporting telemetry information using gNMI services. This feature includes support to export telemetry data for integration with AFTTelemetry and LibTelemetry libraries with the OpenConfig model openconfig-aft. Periodic streaming using gRPC services with EX4300-MP switches is supported starting with Junos OS Release 19.4R1. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. Periodic streaming using gNMI services on MX2K-MPC11E line cards on MX2010 and MX2020 routers is supported starting with Junos OS Release 20.1R1. The minimum **NOTE:** Hierarchical policer statistics are collected for MX Series routers

Table 6: gRPC Sensors *(continued)*

resource path	Description
	only. Traffic-class counter statistics are collected for PTX Series routers and QFX10000 switches only. Firewall counters are exported even if the interface to which the firewall filter is attached is operationally down. The following OpenConfig paths are supported: • **junos/firewall/firewall-stats/[name='*filter-name*']/timestamp** • **/junos/firewall/firewall-stats/[name='*filter-name*']/memory-usage/[name='*memory-type*']/allocated** • **/junos/firewall/firewall-stats/[name='*filter-name*']/counter-stats/[name='*counter-name*']/packets** • **/junos/firewall/firewall-stats/[name='*filter-name*']/counter-stats/[name='*couner-name*']/bytes** • **/junos/firewall/firewall-stats/[name='*filter-name*']/policer-stats/[name='*policer-name*']/out-of-spec-packets** • **/junos/firewall/firewall-stats/[name='*filter-name*']/policer-stats/[name='*policer-name*']/out-of-spec-bytes** • **/junos/firewall/firewall-stats/[name='*filter-name*']/policer-stats/[name='*policer-name*']/offered-packets** • **/junos/firewall/firewall-stats/[name='*filter-name*']/policer-stats/[name='*policer-name*']/offered-bytes** • **/junos/firewall/firewall-stats/[name='*filter-name*']/policer-stats/[name='*policer-name*']/transmitted-packets** • **/junos/firewall/firewall-stats/[name='*filter-name*']/policer-stats/[name='*policer-name*']/transmitted-bytes** • **/junos/firewall/firewall-stats/[name='*filter-name*']/hierarchical-policer-stats/[name='*hierarchical-policer-name*']/premium-packets** (MX Series only) • **/junos/firewall/firewall-stats/[name='*filter-name*']/hierarchical-policer-stats/[name='*hierarchical-policer-name*']/premium-bytes** (MX Series only) • **/junos/firewall/firewall-stats/[name='*filter-name*']/hierarchical-policer-stats/[name='*hierarchical-policer-name*']/aggregate-packets** (MX Series only) • **/junos/firewall/firewall-stats/[name='*filter-name*']/hierarchical-policer-stats/[name='*hierarchical-policer-name*']/aggregate-bytes** (MX Series only)

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/intf-exp/	Interface express sensor. This sensor leverages statistics out of the physical interface sensor, providing faster and more frequent operational status statistics. Only the physical interfaces' operational status from the Flexible PIC Concentrator (FPC) is collected and reported. Statistics from the Routing Engine interface are not reported. Supported on PTX1000, PTX3000, PTX5000, and PTX10000 starting with Junos OS Release 18.1R1. Supported on MX960, MX2010, and MX2020 routers starting with Junos OS Release 19.3R1.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/interfaces/interface/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for physical interface traffic. **NOTE:** For PTX Series routers, for a specific interface, queue statistics are exported for each line card. For MX series routers, interface queue statistics are exported only from slot on which an interface is configured. For Aggregated Ethernet interfaces, statistics are exported for the member physical interfaces. You must aggregate the counters at the destination server, or collector. If a physical interface is administratively down or operationally down, interface counters are not exported. Only fields with a non-zero value are exported. Supported on QFX10000 switches and PTX1000 routers starting with Junos OS Release 17.2R1. Supported on EX9200 switches and MX150 routers starting with Junos OS Release 17.3R1. Starting with Junos OS Release 18.1R1, QFX5100 switches are also supported. Starting with Junos OS Release 18.3R1, QFX5120-48Y and EX4650 switches are also supported. Starting with Junos OS Release 18.4R1, EX4600 switches are also supported. Starting with Junos OS Release 19.1R1, periodic streaming is supported on QFX10002 switches and PTX10002 routers. Starting in Junos OS Evolved Release 19.1R1, PTX10003 routers are supported. Starting with Junos OS Release 19.2R1, QFX5200 supports streaming telemetry information using gNMI services. Support on PTX10003 routers starting in Junos OS Evolved Release 19.1R1. Starting with Junos OS Release 19.2R1, periodic streaming using gNMI services is supported on QFX5100, QFX5110, QFX5120, QFX5200 and QFX5210 switches.

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gRPC services with PTX10008 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. Starting with Junos OS Release 18.3R1, when a subscription is made to **/interfaces** on MX, EX, QFX, PTX, and ACX platforms, traffic and queue statistics are delivered in two separate sensors. This can reduce the reap time for non-queue data for platforms supporting Virtual Output Queues (VOQ), such as PTX Series routers. The two sensors are: • **/junos/system/linecard/interface/traffic/** exports all fields except queue statistics. • **/junos/system/linecard/interface/queue/** exports queue statistics. **NOTE:** End paths supporting ON_CHANGE streaming are indicated. The following paths are also supported:

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **/interfaces/interface[name='*interface-name*']/state/parent_ae_name** • **/interfaces/interface[name='*interface-name*']/state/admin-status** ON_CHANGE streaming supported for Junos OS and for Junos OS Evolved Release 19.1R1 and higher ON_CHANGE streaming supported • **/interfaces/interface[name='*interface-name*']/state/counters/carrier-transitions** • **/interfaces/interface[name='*interface-name*']/state/last-change** • **/interfaces/interface[name='*interface-name*']/state/high-speed** • **/interfaces/interface[name='*interface-name*']/state/counters/out-octets** • **/interfaces/interface[name='*interface-name*']/state/counters/out-unicast-pkts** • **/interfaces/interface[name='*interface-name*']/state/counters/out-multicast-pkts** • **/interfaces/interface[name='*interface-name*']/state/counters/out-broadcast-pkts** • **/interfaces/interface[name='*interface-name*']/state/counters/out-errors** • **/interfaces/interface[name='*interface-name*']/state/counters/in-octets** • **/interfaces/interface[name='*interface-name*']/state/counters/in-unicast-pkts** • **/interfaces/interface[name='*interface-name*']/state/counters/in-multicast-pkts** • **/interfaces/interface[name='*interface-name*']/state/** • **/interfaces/interface[name='*interface-name*']/state/counters/in-broadcast-pkts** • **/interfaces/interface[name='*interface-name*']/state/counters/in-errors** • **/interfaces/interface[name='*interface-name*']/state/in-pause-pkts** • **/interfaces/interface[name='*interface-name*']/state/out-pause-pkts** • **/interfaces/interface[name='*interface-name*']/state/counters/in-queue [queue-number=*queue_number*]/** • **/interfaces/interface[name='*interface-name*']/state/counters/in-queue [queue-number=*queue_number*]/ pkts** • **/interfaces/interface[name='*interface-name*']/state/counters/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	in-queue [queue-number=*queue_number*]/bytes • /interfaces/interface[name='*interface-name*']/state/counters/ in-queue [queue-number=*queue_number*]/tail-drop-pkts • /interfaces/interface[name='*interface-name*']/state/counters/ in-queue [queue-number=*queue_number*]/ rl-drop-pkts • /interfaces/interface[name='*interface-name*']/state/counters/ in-queue [queue-number=*queue_number*]/ rl-drop-bytes • /interfaces/interface[name='*interface-name*']/state/counters/ in-queue [queue-number=*queue_number*]/avg-buffer-occupancy • /interfaces/interface[name='*interface-name*']/state/counters/ in-queue [queue-number=*queue_number*]/cur-buffer-occupancy • /interfaces/interface[name='*interface-name*']/state/counters/ in-queue [queue-number=*queue_number*]/peak-buffer-occupancy • /interfaces/interface[name='*interface-name*']/state/counters/ in-queue [queue-number=*queue_number*]/allocated-buffer-size • /interfaces/interface[name='*interface-name*']/state/counters/ out-queue [queue-number=*queue_number*]/pkts • /interfaces/interface[name='*interface-name*']/state/counters/ out-queue [queue-number=*queue_number*]/bytes • /interfaces/interface[name='*interface-name*']/state/counters/ out-queue [queue-number=*queue_number*]/tail-drop-pkts • /interfaces/interface[name='*interface-name*']/state/counters/ out-queue [queue-number=*queue_number*]/rl-drop-pkts • /interfaces/interface[name='*interface-name*']/state/counters/ out-queue [queue-number=*queue_number*]/ rl-drop-bytes • /interfaces/interface[name='*interface-name*']/state/counters/ out-queue [queue-number=*queue_number*]/red-drop-pkts • /interfaces/interface[name='*interface-name*']/state/counters/ out-queue [queue-number=*queue_number*]/red-drop-bytes • /interfaces/interface[name='*interface-name*']/state/counters/ out-queue [queue-number=*queue_number*]/avg-buffer-occupancy • /interfaces/interface[name='*interface-name*']/state/counters/ out-queue [queue-number=*queue_number*]/cur-buffer-occupancy • /interfaces/interface[name='*interface-name*']/state/counters/ out-queue [queue-number=*queue_number*]/ peak-buffer-occupancy • /interfaces/interface[name='*interface-name*']/state/counters/ out-queue [queue-number=*queue_number*]/allocated-buffer-size

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **/interfaces/interface[name='*interface-name*']/state/description** ON_CHANGE streaming supported for Junos OS and for Junos OS Evolved Release 19.1R1 and higher • **/interfaces/interface[name='*interface-name*']/state/enabled** • **/interfaces/interface[name='*interface-name*']/state/ifindex** ON_CHANGE streaming supported for Junos OS Evolved Release 19.1R1 and higher • **/interfaces/interface[name='*interface-name*']/state/last-change** • **/interfaces/interface[name='*interface-name*']/state/mtu** • **/interfaces/interface[name='*interface-name*']/state/name** • **/interfaces/interface[name='*interface-name*']/state/oper-status** ON_CHANGE streaming supported for Junos OS and for Junos OS Evolved Release 19.1R1 and higher • **/interfaces/interface[name='*interface-name*']/state/type**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/interfaces/interface/ethernet/state/	Sensor for physical Ethernet interface statistics. This sensor supports OpenConfig model **openconfig-if-ethernet.yang** (physical interface level) version 2.6.2 (no configuration). Both streaming and ON-CHANGE statistics are supported for gRPC and gNMI services. Supported on MX960, MX2020, PTX1000, and PTX5000 routers starting with Junos OS Release 19.4R1. **NOTE:** End paths supporting ON_CHANGE statistics are indicated below. • **mac-address** (ON_CHANGE) • **auto-negotiate** (ON_CHANGE) • **duplex-mode** (ON_CHANGE) • **port-speed** (ON_CHANGE) • **enable-flow-control** (ON_CHANGE) • **hw-mac-address** (ON_CHANGE) • **negotiated-duplex-mode** (ON_CHANGE) • **negotiated-port-speed** (ON_CHANGE) • **counters/in-mac-control-frames** • **counters/in-mac-pause-frames** • **counters/in-oversize-frames** • **counters/in-jabber-frames** • **counters/in-fragment-frames** • **counters/in-8021q-frames** • **counters/in-crc-errors** • **counters/in-block-errors** • **counters/out-mac-control-frames** • **counters/out-mac-pause-frames**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/interfaces/interface/subinterfaces/ **/interfaces/** **interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']/**	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for logical interface traffic. **NOTE:** If a logical interface is operationally down, interface statistics continue to be exported. **NOTE:** Locally injected packets from the Routing Engine are not exported. Supported on QFX10000 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers and EX9200 switches starting with Junos OS Release 17.3R1. Starting with Junos OS Release 18.1R1, QFX5100 switches are also supported. Starting with Junos OS Release 18.3R1, QFX5120-48Y and EX4650 switches are also supported. Starting with Junos OS Release 18.4R1, EX4600 switches are also supported. Starting with Junos OS Release 19.1R1, periodic streaming is supported on QFX10002 switches and PTX10002 routers. Starting in Junos OS Evolved Release 19.1R1, PTX10003 routers are supported. Starting with Junos OS Release 19.2R1, periodic streaming using gNMI services is supported on QFX5100, QFX5110, QFX5120, QFX5200 and QFX5210 switches. Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gRPC services with PTX10008 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. **NOTE:** End paths supporting ON_CHANGE streaming are indicated. The following paths are also supported: • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/name**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	ON_CHANGE streaming supported. This value does not change with an event, but will be streamed on event creation and deletion. • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/ifindex** ON_CHANGE streaming supported. This value does not change with an event, but will be streamed on event creation and deletion. • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/index** ON_CHANGE streaming supported. This value does not change with an event, but will be streamed on event creation and deletion. • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/snmp_index** ON_CHANGE streaming supported starting with Junos OS Evolved Release 19.1R1 • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/admin_status** ON_CHANGE streaming supported for Junos OS and Junos OS Evolved Release 19.1R1 and higher • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/oper_status** ON_CHANGE streaming supported for Junos OS and Junos OS Evolved Release 19.1R1 and higher • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/last_change** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/description** ON_CHANGE streaming supported for Junos OS and Junos OS Evolved Release 19.1R1 and higher • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/enabled** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_octets** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_unicast_pkts** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_broadcast_pkts** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_multicast_pkts**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_discards** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_errors** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_unknown_protos** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/out_octets** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/out_unicast_pkts** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/out_broadcast_pkts** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/out_multicast_pkts** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/out_discards** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/out_errors** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/last_clear**
/interfaces/interface/	Sensor for Routing Engine logical interface statistics (re0:mgmt-0). Starting with Junos OS Evolved Release 19.4R1, gNMI streaming for PTX10003 routers is supported.
/junos/system/linecard/optics/	Sensor for various optical interface performance metrics, such as transmit and receive power levels. Supported on QFX10000 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers and EX9200 switches starting with Junos OS Release 17.3R1. Supported on EX4650 switches starting with Junos OS Release 18.3R1. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 19.2R1 on gRPC and gNMI services.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/rsvp-interface-information/	Sensor for events and properties for RSVP interfaces. Supported on QFX5200 switches for streaming and ON_CHANGE statistics export through gNMI services starting with Junos OS Release 19.2R1. Periodic streaming using gRPC services is supported on EX4300-MP switches starting with Junos OS Release 19.4R1. You can also add the following end paths: • **rsvp-interface[interface-name='ae0.100']/index** • **rsvp-interface[interface-name='ae0.100']/rsvp-status** • **rsvp-interface[interface-name='ae0.100']/authentication-flag** • **rsvp-interface[interface-name='ae0.100']/aggregate-flag** • **rsvp-interface[interface-name='ae0.100']/ack-flag** • **rsvp-interface[interface-name='ae0.100']/protect-flag** • **rsvp-interface[interface-name='ae0.100']/hello-interval** • **rsvp-interface[interface-name='ae0.100']/interface-address** • **rsvp-interface[interface-name='ae0.100']/rsvp-telink/preemption-count** • **rsvp-interface[interface-name='ae0.100']/rsvp-telink/update-threshold** • **rsvp-interface[interface-name='ae0.100']/rsvp-telink/subscription** • **rsvp-interface[interface-name='ae0.100']/rsvp-telink/active-reservation** • **rsvp-interface[interface-name='ae0.100']/rsvp-telink/static-bandwidth** • **rsvp-interface[interface-name='ae0.101']/rsvp-telink/available-bandwidth**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/rsvp-interface-information/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for events and properties for RSVP interfaces. **NOTE:** For 100 RSVP logical interfaces, configure a sampling interval equal to 60 seconds. For 200 RSVP logical interfaces, configure a sampling interval equal to 180 seconds. Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers, QFX5110 switches, and EX4600 and EX9200 switches starting with Junos OS Release 17.3R1. Supported on QFX5100 switches starting with Junos OS Release 18.1R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. Periodic streaming is supported on QFX10002 switches and PTX10002 routers starting with Junos OS Release 19.1R1. You can also add the following to the end path for **/junos/rsvp-interace-information/**: • **active-count** • **rsvp-interface/interface-name** • **rsvp-interface/index** • **rsvp-interface/rsvp-status** • **rsvp-interface/authentication-flag** • **rsvp-interface/aggregate-flag** • **rsvp-interface/ack-flag** • **rsvp-interface/protect-flag** • **rsvp-interface/hello-interval** • **rsvp-interface/interface-address** • **message-statistics/rsvp-message** • **rsvp-interface/message-statistics/messages-sent** • **rsvp-interface/message-statistics/messages-received** • **rsvp-interrface/message-statistics/messages-sent-5seconds** • **rsvp-interface/message-statistics/messages-received-5seconds** • **rsvp-interface/rsvp-telink/active-reservation**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **rsvp-interface/rsvp-telink/preemption-count** • **rsvp-interface/rsvp-telink/update-threshold** • **rsvp-interface/rsvp-telink/subscription** • **rsvp-interface/rsvp-telink/static-bandwidth** • **rsvp-interface/rsvp-telink/available-bandwidth** • **rsvp-interface/rsvp-telink/reserved-bandwidth/bandwidth-priority** • **rsvp-interface/rsvp-telink/reserved-bandwidth/total-reserved-bandwidth**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/components/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for operational state of Routing Engines, power supply modules, Switch Fabric Boards, Control Boards, Switch Interface Boards, Modular Interface Cards, and Physical Interface Cards. **NOTE:** Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1. Supported on EX9200 switches and MX150 routers starting with Junos OS Release 17.3R1. Supported on QFX5100 switches starting with Junos OS Release 18.1R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX are also supported. You can also add the following to each of the paths: • **name** • **cidx** • **version** • **part_number** • **serial_number** • **description** • **clei_code** • **model** • **vendor_name** • **properties/property/state** • **properties/property/state_offline_reason** (MX Series only) • **properties/property/power_usage** • **properties/property/power_maximum** • **properties/property/temperature_intake** • **properties/property/temperature_exhaust_a** (not supported on PTX1000 and PTX3000 routers) • **properties/property/temperature_exhaust_b** (not supported on

Table 6: gRPC Sensors *(continued)*

resource path	Description
	PTX1000 and PTX3000 routers) • **properties/property/temperature_exhaust** (not supported on PTX1000 and PTX5000 routers) • **properties/property/cpu_utilization_total** • **properties/property/ memory_dram_used** • **properties/property/memory_utilization_heap** • **properties/property/memory_utilization_buffer** • **properties/property/uptime** The following paths are also supported only for Routing Engine statistics: • **properties/property/mastership-state** • **properties/property/mastership-priority** • **properties/property/temperature-cpu** • **properties/property/memory-dram-installed** • **properties/property/cpu-utilization-user** • **properties/property/cpu-utilization-background** • **properties/property/cpu-utilization-kernel** • **properties/property/cpu-utilization-idle** • **properties/property/reboot-reason** The following paths are also supported for power modules:

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **properties/property/power-zone-upper-capacity** • **properties/property/power-zone-upper-maximum** • **properties/property/power-zone-upper-allocated** • **properties/property/power-zone-upper-remaining** • **properties/property/power-zone-upper-usage** • **properties/property/power-zone-lower-capacity** • **properties/property/power-zone-lower-maximum** • **properties/property/power-zone-lower-allocated** • **properties/property/power-zone-lower-remaining** • **properties/property/power-zone-lower-usage** • **properties/property/power-zone-0-capacity** • **properties/property/power-zone-0-maximum** • **properties/property/power-zone-0-allocated** • **properties/property/power-zone-0-remaining** • **properties/property/power-zone-0-usage** • **properties/property/power-zone-1-capacity** • **properties/property/power-zone-1-maximum** • **properties/property/power-zone-1-allocated** • **properties/property/power-zone-1-remaining** • **properties/property/power-zone-1-usage** • **properties/property/power-system-capacity** • **properties/property/power-system-allocated** • **properties/property/power-system-remaining** • **properties/property/power-system-usage** • **properties/property/temperature-ambient** The following paths are supported for either Switch Fabric Board or Control Boards or both:

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **properties/property/temperature-zone-0-intake** (SFB only) • **properties/property/temperature-zone-0-intake-a** (both SFB and CB) • **properties/property/temperature-zone-1-intake-b** (both SFB and CB) • **properties/property/temperature-zone-0-exhaust** (SFB only) • **properties/property/temperature-zone-1-exhaust** (SFB only) • **properties/property/temperature-zone-0-intake-c** (CB only) • **properties/property/temperature-zone-0-exhaust-a** (CB only) • **properties/property/temperature-zone-1-exhaust-b** (CB only)

Table 6: gRPC Sensors *(continued)*

resource path	Description
/lacp/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for operational state of aggregated Ethernet interfaces configured with the Link Aggregation Control Protocol. Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers and EX9200 switches starting with Junos OS Release 17.3R1. Supported on QFX5100 switches starting with Junos OS Release 18.1R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with unos OS Release 18.4R1, Supported on PTX10003 routers starting with Junos OS Evolved Release 19.1R1. Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gRPC services with PTX10008 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. You can also add the following to the end of the path for **/lacp/**: • **interfaces/interface/state** • **interfaces/interface/members/member/state/activity** • **interfaces/interface/members/member/state/timeout** • **interfaces/interface/members/member/state/system-id** • **interfaces/interface/members/member/state/partner-id** • **interfaces/interface/members/member/state/interface** • **interfaces/interface/members/member/state/synchronization** • **interfaces/interface/members/member/state/aggregatable** • **interfaces/interface/members/member/state/collecting** • **interfaces/interface/members/member/state/distributing** • **interfaces/interface/members/member/state/oper-key** • **interfaces/interface/members/member/state/partner-key**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• interfaces/interface/members/member/state/counters/lacp-in-packets • interfaces/interface/members/member/state/counters/lacp-out-packets • interfaces/interface/members/member/state/counters/lacp-rx-errors • interfaces/interface/members/member/state/counters/lacp-unknown-errors • interfaces/interface/members/member/state/counters/lacp-errors • state/system-priority • interfaces/interface[name='aggregate-interface-name']/state/ • interfaces/interface[name='aggregate-interface-name']/members/member[interface='interface-name']/state/ • interfaces/interface[name='aggregate-interface-name']/members/member[interface='interface-name']/state/counters/ • interfaces/interface[name='aggregate-interface-name']/members/member[interface='interface-name']/state/port-num • interfaces/interface[name='aggregate-interface-name']/members/member[interface='interface-name']/state/partner-port-num • interfaces/interface[name='aggregate-interface-name']/members/member[interface='interface-name']/state/mux-state

Table 6: gRPC Sensors *(continued)*

resource path	Description
/lldp/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for operational state of Ethernet interfaces enabled with the Link Layer Discovery Protocol. Subscriptions using gNMI services that include the resource path **/lldp/interfaces/interface/neighbors/neighbor/state/** ds not expot TTL value statistics to the collector. These statistics can be observed through the Junos CLI using the operational mode command **show lldp neighbors interface *interface-name***. Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers and EX9200, EX4600, and QFX5110 switches starting with Junos OS Release 17.3R1. Supported on QFX5100 switches starting with Junos OS Release 18.1R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. ON_CHANGE streaming is supported on MX Series and PTX Series routers, starting with Junos OS Release 18.3R1. Starting with Junos OS Release 19.1R1, periodic streaming on QFX10002 switches and PTX10002 routers is supported. Supported on SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX starting with Junos OS Release 19.2R1. Supported on PTX10003 routers starting with Junos OS Evolved Release 19.1R1. The resource path **/lldp/interfaces/interface[name='xe-0/0/9']/** is supported on QFX5200 switches for streaming and ON_CHANGE statistics export through gNMI services starting with Junos OS Release 19.2R1. QFX5200 switches support the LLDP statistics export and OpenConfig LLDP Model (v0.1.0). Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gRPC services with PTX10008 routers is supported.

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. You can also add the following to the end of the path for **/lldp/**: **NOTE:** End paths supporting ON_CHANGE streaming are indicated.

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **state/** • **state/enabled/** ON_CHANGE streaming supported • **state/hello-timer/** ON_CHANGE streaming supported • **state/chassis-id/** ON_CHANGE streaming supported • **state/chassis-id-type/** ON_CHANGE streaming supported • **state/system-name/** ON_CHANGE streaming supported • **state/system-description/** ON_CHANGE streaming supported • **state/loc-port-id-type/** • **state/counters/frame-in/** • **state/counters/frame-out/** • **state/counters/frame-error-in/** • **state/counters/frame-discard/** • **state/counters/tlv-unknown/** • **state/counters/tlv-discard/** • **state/counters/tlv-accepted/** • **state/counters/entries-aged-out/** • **state/counters/last-clear/** • **interfaces/interface[name='interface-name']/** • **interfaces/interface[name='interface-name']/state/** • **interfaces/interface[name='interface-name']/state/name/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/state/enabled/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/state/loc-port-id/** • **interfaces/interface[name='interface-name']/state/loc-port-description/** • **interfaces/interface[name='interface-name']/state/counters/frame-in/** • **interfaces/interface[name='interface-name']/state/counters/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	frame-error-in/ • **interfaces/interface[name='interface-name']/state/counters/frame-discard/** • **interfaces/interface[name='interface-name']/state/counters/tlv-discard/** • **interfaces/interface[name='interface-name']/state/counters/tlv-unknown/** • **interfaces/interface[name='interface-name']/state/counters/frame-out/** • **interfaces/interface[name='interface-name']/state/counters/frame-error-out/** • **interfaces/interface[name='interface-name']/state/counters/last-clear/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/capabilities/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/capabilities/cabapility/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/capabilities/cabapility/name/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/capabilities/cabapility/state/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/capabilities/cabapility/state/name/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/capabilities/cabapility/state/enabled/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/type/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/oui/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/oui-subtype/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/state/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/state/type/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/state/oui/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/state/oui-subtype/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/state/value/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/system-name/** ON_CHANGE streaming supported. This resource path does not change with an event, but will be streamed on creation and deletion. • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/system-description/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/chassis-id/** ON_CHANGE streaming supported. This resource path does not change with an event, but will be streamed on creation and deletion. • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/chassis-id-type/** ON_CHANGE streaming supported. This resource path does not change with an event, but will be streamed on creation and deletion. • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/id/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/age/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/last-update/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **interfaces/interface[name='interface-name']/neighbors/neighbor/state/port-id/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/port-id-type/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/port-description/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/management-address/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/management-address-type/** ON_CHANGE streaming supported

Table 6: gRPC Sensors *(continued)*

resource path	Description

/mpls/lsps/constrained-path/tunnels/tunnel[name='*foo-name*',source='*foo-source*']/p2p-tunnel-attributes/p2p-primary-paths[name='*foo-path*']/lsp-instances[index='*local-index*']/state/notify-status	Sensor to export events for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs.
	
	ON_CHANGE support for LSP events is only activated when the reporting interval is set to 0 in the subscription request.
	
	This sensor is supported on indicated platforms up to and including Junos OS Release 17.3R1. See the following resource paths for LSP support in Junos OS Release 17.4R1 and higher:
	
	• **/network-instances/network-instance[name='*instance-name*']/mpls/lsps/constrained-path/tunnels/tunnel/p2p-tunnel-attributes/p2p-primary-paths/*p2p-primary-path***
	• **/network-instances/network-instance[name='*instance-name*']/mpls/signaling-protocols/rsvp-te/sessions/session/state/notify-status**
	
	Supported on PTX Series routers, MX Series routers , and QFX10002, QFX10008, and QFX10016 switches starting with Junos OS Release 17.2R1.
	
	The following events are exported under this resource path:
	
	• **INITIATED**
	• **CONCLUDED_UP**
	• **CONCLUDED_TORN_DOWN**
	• **PROTECTION_AVAILABLE**
	• **PROTECTION_UNAVAILABLE**
	• **AUTOBW_SUCCESS**
	• **AUTOBW_FAIL**
	• **TUNNEL_LOCAL_REPAIRED**
	• **PATHERR_RECEIVED**
	  ◦ **ADMISSION_CONTROL_FAILURE**
	  ◦ **SESSION_PREEMPTED**
	  ◦ **BAD_LOOSE_ROUTE**
	  ◦ **BAD_STRICT_ROUTE**
	  ◦ **LABEL_ALLOCATION_FAILURE**
	  ◦ **ROUTING_LOOP_DETECTED**
	  ◦ **REQUESTED_BANDWIDTH_UNAVAILABLE**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/mpls/lsps/constrained-path/tunnels/tunnel[name='*foo-name*',source='*foo-source*']/p2p-tunnel-attributes/p2p-primary-paths[name='*foo-path*']/state/notify-status	Sensor to export events for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs. ON_CHANGE support for LSP events is only activated when the reporting interval is set to 0 in the subscription request. This sensor is supported on indicated platforms up to and including Junos OS Release 17.3R1. See the following resource paths for LSP support in Junos OS Release 17.4R1 and higher: • **/network-instances/network-instance[name='*instance-name*']/mpls/lsps-constrained-path/tunnels/tunnel/p2p-tunnel-attributes/p2p-primary-paths/*p2p-primary-path*** • **/network-instances/network-instance[name='*instance-name*']/mpls/signaling-protocols/rsvp-te/sessions/session/state/notify-status** Supported on PTX Series routers, MX Series routers , and QFX10002, QFX10008, and QFX10016 switches starting with Junos OS Release 17.2R1. The following events are exported under this resource path: • **DESELECT_ACTIVE_PATH** • **CHANGE_ACTIVE_PATH** • **SELECT_ACTIVE_PATH** • **ORIGINATE_MBB** • **CSPF_NO_ROUTE** • **CSPF_SUCCESS** • **RESTART_RECOVERY_FAIL**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/mpls/lsps-constrained-path/tunnels/tunnel[name='*foo-name*',source='*foo-source*']/p2p-tunnel-attributes/p2p-primary-paths[name='*foo-path*']/state/name	Sensor to export the path name for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs. This sensor is supported on indicated platforms up to and including Junos OS Release 17.3R1. See the following resource paths for LSP support in Junos OS Release 17.4R1 and higher: • **/network-instances/network-instance[name='*instance-name*']/mpls/lsps-constrained-path/tunnels/tunnel/p2p-tunnel-attributes/p2p-primary-paths/** • **/network-instances/network-instance[name='*instance-name*']/mpls/signaling-protocols/rsvp-te/sessions/session/state/notify-status** Supported on PTX Series routers, MX Series routers , and QFX10002, QFX10008, and QFX10016 switches starting with Junos OS Release 17.2R1.
/mpls/lsps-constrained-path/tunnels/tunnel[name='*foo-name*',source='*foo-source*']/p2p-tunnel-attributes/p2p-primary-paths[name='*foo-path*']/lsp-instances[index='*local-index*']/state/	Sensor to export LSP properties for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs Supported on PTX Series routers, MX Series routers, and QFX10002, QFX10008, and QFX10016 switches starting with Junos OS Release 17.2R1. The following end paths are also supported for the resource path: • **bandwidth** • **metric** • **max-average-bandwidth** • **explicit-route-objects** • **record-route-objects**

Table 6: gRPC Sensors *(continued)*

resource path	Description

/mpls/lsps/signaling-protocols/rsvp-te/sessions/session[local-index='*foo-index*']/state/notify-status	Sensor to export statistics for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs.
	
	ON_CHANGE support for LSP events is only activated when the reporting interval is set to 0 in the subscription request.
	
	Supported on PTX Series routers, MX Series routers, and QFX10002, QFX10008, and QFX10016 switches starting with Junos OS Release 17.2R1.
	
	The following events are exported under this resource path:
	
	• **PATHERR_RECEIVED**
	  • **TTL_EXPIRED**
	  • **NON_RSVP_CAPABLE_ROUTER**
	  • **RESVTEAR_RECEIVED**
	  • **PATH_MTU_CHANGE**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/network-instances/network-instance/mpls/signaling-protocols/rsvp-te/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor to export events for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs. Starting in Junos OS Evolved Release 19.2R1, PTX10003 routers support streaming statistics. The following end paths are also supported: • **interface-attributes/interface/bandwidth-reservations/state/active-reservations-count** • **interface-attributes/interface/bandwidth-reservations/state/available-bandwidth** • **interface-attributes/interface/bandwidth-reservations/state/highwater-mark** • **interface-attributes/interface/bandwidth-reservations/state/reserved-bandwidth** • **interface-attributes/interface/counters/in-ack-messages** • **interface-attributes/interface/counters/in-hello-messages** • **interface-attributes/interface/counters/in-path-messages** • **interface-attributes/interface/counters/in-path-tear-messages** • **interface-attributes/interface/counters/in-reservation-error-messages** • **interface-attributes/interface/counters/in-reservation-messages** • **interface-attributes/interface/counters/in-reservation-tear-messages** • **interface-attributes/interface/counters/in-srefresh-messages** • **interface-attributes/interface/counters/out-path-tear-messages** • **interface-attributes/interface/counters/out-ack-messages** • **interface-attributes/interface/counters/out-hello-messages** • **interface-attributes/interface/counters/out-path-messages** • **interface-attributes/interface/counters/out-reservation-error-messages** • **interface-attributes/interface/counters/out-reservation-messages** • **interface-attributes/interface/counters/out-reservation-tear-messages** • **interface-attributes/interface/counters/out-srefresh-messages** • **neighbors/neighbor/state/neighbor-status** • **sessions/session/record-route-objects/record-route-object**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **sessions/session/state/destination-address** • **sessions/session/state/label-in** • **sessions/session/state/label-out** • **sessions/session/state/lsp-id**
/network-instances/network-instance/mpls/signaling-protocols/rsvp-te/sessions/session/state/notify-status	Supported on Junos OS Release through 17.4R1 and higher. Sensor to export events for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs. ON_CHANGE support for LSP events is only activated when the reporting interval is set to 0 in the subscription request. Supported on PTX Series routers, MX Series routers, and QFX10002, QFX10008, and QFX10016 switches starting with Junos OS Release 17.2R1. The following events are exported under this resource path: • **DETOUR-UP** • **DETOUR-DOWN** • **PATHERR-RECV** • **PATHERR-RECV/ADMISSION_CONTROL_FAILURE** • **PATHERR-RECV/SESSION_PREEMPTED** • **PATHERR-RECV/BAD_LOOSE_ROUTE** • **PATHERR-RECV/BAD_STRICT_ROUTE** • **PATHERR-RECV/LABEL_ALLOCATION_FAILURE** • **PATHERR-RECV/NON_RSVP_CAPABLE_ROUTER** • **PATHERR-RECV/TTL_EXPIRED** • **PATHERR-RECV/ROUTING_LOOP_DETECTED** • **PATHERR-RECV/REQUESTED_BANDWIDTH_UNAVAILABLE** • **PATHMTU-CHANGE**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/mpls/signaling-protocols/segment-routing/	Sensor for traffic statistics for both ingress IP traffic and transit MPLS traffic.. Supported on MX Series and PTX Series routers starting with Junos OS Release 18.3R1. The following end points are also supported and specify BGP Segment Routing traffic Engineering (SR-TE) transit statistics: • **/sr-te-bsid-policies/sr-te-bsid-policy[binding-sid='80001', to-address='*foo-to*' color='*foo-color*']/state/counters[name='oc-*xxx*']/packets** • **/sr-te-bsid-policies/sr-te-bsid-policy[binding-sid='80001', to-address='*foo-to*' color='*foo-color*']/state/counters[name='oc-*xxx*']/bytes** The following end points are also supported and specify BGP Segment Routing traffic Engineering (SR-TE) ingress statistics: • **/sr-te-ip-policies/sr-te-ip-policy[to-address='*foo-to*' color='*foo-color*']/state/counters[name='oc-*xxx*']/packets** • **/sr-te-ip-policies/sr-te-ip-policy[to-address='*foo-to*' color='*foo-color*']/state/counters[name='oc-*xxx*']/bytes** In addition to configuring the sensor, you must enable statistics collection using the statistics statement at the [[**edit protocols source-packet-routing telemetry statistics**] hierarchy level.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/arp-information/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for Address Resolution Protocol (ARP) statistics for IPv4 routes. Supported on QFX10000 and QFX5200 switches switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers, EX9200 switches, and MX150 routers starting with Junos OS Release 17.3R1. Supported on QFX5100 switches starting with Junos OS Release 18.1R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. Periodic streaming is supported on QFX10002 switches and PTX10002 routers starting with Junos OS Release 19.1R1, Supported on SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX starting with Junos OS Release 19.2R1. Supported on PTX10003 routers starting with Junos OS Evolved Release 19.1R1. Starting with Junos OS Release 19.2R1, gNMI streaming and ON_CHANGE for QFX5200 switches is supported. Starting with Junos OS Release 19.3R1, gNMI streaming and ON_CHANGE for MX960, MX2010, MX2020, PTX5000, PTX1000, and PTX10000 routers is supported. Starting with Junos OS Evolved Release 19.4R1, gNMI streaming for PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gRPC services with PTX10008 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. You can also add the following to the end path for **/arp-information/** • **ipv4** • **ipv4/neighbors** • **ipv4/neighbors/neighbor** • **ipv4/neighbors/neighbor/state/host-name**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **ipv4/neighbors/neighbor/state/table-id** • **ipv4/neighbors/neighbor/state/neighbor-state** • **ipv4/neighbors/neighbor/state/expiry** • **ipv4/neighbors/neighbor/state/ispublish** • **ipv4/neighbors/neighbor/state/interface-name** • **ipv4/neighbors/neighbor/state/logical-router-id**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/interfaces/interface[name='*interface-name*']/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for Routing Engine internal interfaces. **NOTE:** On MX Series routers, you can specify the following interfaces: fxp0, em0, and em1 On PTX Series routers, you can specify the following interfaces: em0, ixlv0, ixlv1 On PTX Series routers with dual Routing Engines, you can specify the following interfaces: em0, ixgbe0, ixgbe1 On PTX10003 routers with Junos OS Evolved Release 19.1R1, you can specify the following interfaces: re0:mgmt-0. No internal interfaces are supported. Support on PTX1000 routers starting with Junos OS Release 17.3R1. Support on PTX10003 routers starting in Junos OS Evolved Release 19.1R1. The following end paths are also supported: • **interfaces/interface/state/type** • **/interfaces/interface/state/mtu** • **/interfaces/interface/state/name** • **/interfaces/interface/state/description** • **/interfaces/interface/state/enabled** • **/interfaces/interface/state/ifindex** • **/interfaces/interface/state/admin-status** • **/interfaces/interface/state/oper-status** • **/interfaces/interface/state/last-change** • **/interfaces/interface/state/speed** • **/interfaces/interface/state/counters/in-octets** • **/interfaces/interface/state/counters/in-unicast-pkts** • **/interfaces/interface/state/counters/in-broadcast-pkts** • **/interfaces/interface/state/counters/in-multicast-pkts** • **/interfaces/interface/state/counters/in-discards** • **/interfaces/interface/state/counters/in-errors** • **/interfaces/interface/state/counters/in-unknown-protos** • **/interfaces/interface/state/counters/out-octets** • **/interfaces/interface/state/counters/out-unicast-pkts**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **/interfaces/interface/state/counters/out-broadcast-pkts** • **/interfaces/interface/state/counters/out-multicast-pkts** • **/interfaces/interface/state/counters/out-discards** • **/interfaces/interface/state/counters/out-errors** • **/interfaces/interface/state/counters/last-clear** • **/interfaces/interface/state/counters/in-pkts** • **/interfaces/interface/state/counters/in-sec-pkts** • **/interfaces/interface/state/counters/in-sec-octets** • **/interfaces/interface/state/counters/in-pause-pkts** • **/interfaces/interface/state/counters/out-pkts** • **/interfaces/interface/state/counters/out-sec-pkts** • **/interfaces/interface/state/counters/out-sec-octets** • **/interfaces/interface/state/counters/out-pause-pkts** • **/interfaces/interface/state/counters/in-drops** • **/interfaces/interface/state/counters/in-frame-errors** • **/interfaces/interface/state/counters/in-runts** • **/interfaces/interface/state/counters/in-lchan-errors** • **/interfaces/interface/state/counters/in-l-mismatch-errors** • **/interfaces/interface/state/counters/in-fifo-errors** • **/interfaces/interface/state/counters/in-giants** • **/interfaces/interface/state/counters/in-resource-errors** • **/interfaces/interface/state/counters/out-drops** • **/interfaces/interface/state/counters/carrier-transitions** • **/interfaces/interface/state/counters/mtu-errors** • **/interfaces/interface/state/counters/out-resource-errors** • **/interfaces/interface/subinterfaces/subinterface/index** • **/interfaces/interface/subinterfaces/subinterface/state/index** • **/interfaces/interface/subinterfaces/subinterface/state/name** • **/interfaces/interface/subinterfaces/subinterface/state/description** • **/interfaces/interface/subinterfaces/subinterface/state/enabled** • **/interfaces/interface/subinterfaces/subinterface/state/ifindex** • **/interfaces/interface/subinterfaces/subinterface/state/admin-status** • **/interfaces/interface/subinterfaces/subinterface/state/oper-status** • **/interfaces/interface/subinterfaces/subinterface/state/last-change** • **/interfaces/interface/subinterfaces/subinterface/state/counters/in-pkts**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• /interfaces/interface/subinterfaces/subinterface/state/counters/in-octets • /interfaces/interface/subinterfaces/subinterface/state/counters/in-unicast-pkts • /interfaces/interface/subinterfaces/subinterface/state/counters/in-broadcast-pkts • /interfaces/interface/subinterfaces/subinterface/state/counters/in-multicast-pkts • /interfaces/interface/subinterfaces/subinterface/state/counters/in-discards • /interfaces/interface/subinterfaces/subinterface/state/counters/in-errors • /interfaces/interface/subinterfaces/subinterface/state/counters/in-unknown-protos • /interfaces/interface/subinterfaces/subinterface/state/counters/out-octets • /interfaces/interface/subinterfaces/subinterface/state/counters/out-unicast-pkts • /interfaces/interface/subinterfaces/subinterface/state/counters/out-broadcast-pkts • /interfaces/interface/subinterfaces/subinterface/state/counters/out-multicast-pkts • /interfaces/interface/subinterfaces/subinterface/state/counters/out-discards • /interfaces/interface/subinterfaces/subinterface/state/counters/out-errors • /interfaces/interface/subinterfaces/subinterface/state/counters/last-clear • /interfaces/interface/subinterfaces/subinterface/state/counters/out-pkts

Table 6: gRPC Sensors *(continued)*

resource path	Description
/nd6-information/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for Network Discovery Protocol (NDP) table state information for IPv6 routes. Supported on QFX10000 and QFX5200 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers, EX9200 switches, and MX150 routers starting with Junos OS Release 17.3R1. Supported on QFX5100 switches starting with Junos OS Release 18.1R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. Supported on PTX10003 routers starting with Junos OS Evolved Release 19.1R1. Supported on SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX starting with Junos OS Release 19.2R1, gNMI streaming and ON_CHANGE for QFX5200 switches is supported on Junos OS Release starting with 19.2R1. gNMI streaming and ON_CHANGE for MX960, MX2010, MX2020, PTX5000, PTX1000, and PTX10000 routers is supported starting with with Junos OS Release 19.3R1. Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Starting with Junos OS Evolved Release 19.4R1, gNMI streaming for PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gRPC services with PTX10008 routers is supported. You can also add the following to the end path for **nd6-information/** • **ipv6/neighbors/neighbor/state/ip** ON_CHANGE streaming supported starting with Junos OS Evolved Release 19.1R1 • **ipv6/neighbors/neighbor/state/link-layer-address** ON_CHANGE streaming supported starting with Junos OS Evolved

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Release 19.1R1 • **ipv6/neighbors/neighbor/state/origin** • **ipv6/neighbors/neighbor/sttae/is-router** ON_CHANGE streaming supported starting with Junos OS Evolved Release 19.1R1 • **ipv6/neighbors/neighbor/state/neighbor-state** • **ipv6/neighbors/neighbor/state/table-id** • **ipv6/neighbors/neighbor/state/is-secure** • **ipv6/neighbors/neighbor/state/is-publish** • **ipv6/neighbors/neighbor/state/expiry** • **ipv6/neighbors/neighbor/state/interface-name** • **ipv6/neighbors/neighbor/state/logical-router-id**
/ipv6-ra/	Sensor for NDP router-advertisement statistics. Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX are supported. Starting with Junos OS Release 19.2R1, gNMI streaming and ON_CHANGE for QFX5200 switches is supported. Starting with Junos OS Release 19.3R1, gNMI streaming and ON_CHANGE for MX960, MX2010, MX2020, PTX5000, PTX1000, and PTX10000 routers is supported.
/junos/system/linecard/packet/usage/	Sensor for Packet Forwarding Engine Statistics. This sensor exports statistics for counters and provides visibility into Packet Forwarding Engine error and drop statistics. This sensor is supported starting on MX Series and PTX Series routers starting with Junos OS Release 17.4R1. Starting in Junos OS Evolved Release 19.1R1, PTX10003 routers are supported. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/system/linecard/packet/usage/	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for Packet Forwarding Engine Statistics. This sensor exports statistics and provides visibility into Packet Forwarding Engine error and drop statistics. Statistics include counters (CC, CPU, and NPU) for traffic data. Note that NPU statistics are different than those streamed from the sensors **/junos/system/linecard/npu/memory/** and **/junos/system/linecard/npu/utilization/** . Sensor output is comparable to the output using the operational mode command **show pfe statistics traffic**. Shown below, statistics are exported for the default FPC (**FPC0**). Multiples FPCs are supported. The component values and property values are names (like interface names). Starting in Junos OS Evolved Release 19.4R1, streaming statistics using gRPC and gNMI services on PTX10008 routers is supported. The following paths are also supported: • **:/components/component[name='FPC0:CC0']/properties/property[name='ts-input-packets']/** • **/components/component[name='FPC0:CC0']/properties/property[name='ts-output-packets']/** • **//components/component[name='FPC0:CC0']/properties/property[name='ts-input-packets-pps']/** • **/components/component[name='FPC0:CC0']/properties/property[name='ts-output-packets-pps']/** • **/components/component[name='FPC0:CC0']/properties/property[name='ts-fabric-input-packets']/** • **/components/component[name='FPC0:CC0']/properties/property[name='ts-fabric-input-packets-pps']/** • **/components/component[name='FPC0:CC0']/properties/property[name='ts-fabric-output-packets']/** • **/components/component[name='FPC0:CC0']/properties/property[name='ts-fabric-output-packets-pps']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-input-packets']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-output-packets']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-sw-input-control-drops']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-sw-input-high-drops']/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• **/components/component[name='FPC0:CPU0']/properties/property[name='lts-sw-input-medium-drops']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-sw-input-low-drops']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-sw-output-low-drops']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-hw-input-drops']/** • **/components/component[name='FPC0:NPU0']/properties/property[name='hwdsNormal']/** • **/components/component[name='FPC0:NPU0']/properties/property[name='hwds-data-error']/** • **/components/component[name='FPC0:NPU0']/properties/property[name='hwds-tcp-error']/** • **/components/component[name='FPC0:NPU0']/properties/property[name='hwds-illegal-nh']/** • **/components/component[name='FPC0:NPU0']/properties/property[name='hwds-invalid-iif']/** **//components/component[name='FPC0:NPU0']/properties/property[name='hwds-fabric']/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/network-instances/network-instance/protocols/protocol/isis/levels/level/ **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/**	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensor for IS-IS routing protocol statistics. Statistics are exported separately for each routing instance. To specify a routing-instance name: /**network-instances/network-instance[name_'*instance-name*']/ protocols/protocol/isis/levels/level/** **/network-instances/network-instance[name_'*instance-name*']/ protocols/protocol/isis/interfaces/interface/levels/level/** **NOTE:** This sensor is supported on MX Series and PTX Series routers starting with Junos OS Release 17.4R1. Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX are also supported. The following paths are also supported: • **/network-instances/network-instance/protocols/protocol/isis/ interfaces/interface/levels/level/packet-counters/lsp/received** • **/network-instances/network-instance/protocols/protocol/isis/ interfaces/interface/levels/level/packet-counters/lsp/processed** • **/network-instances/network-instance/protocols/protocol/isis/ interfaces/interface/levels/level/packet-counters/lsp/dropped** • **/network-instances/network-instance/protocols/protocol/isis/ interfaces/interface/levels/level/packet-counters/lsp/sent** • **/network-instances/network-instance/protocols/protocol/isis/ interfaces/interface/levels/level/packet-counters/lsp/retransmit** • **/network-instances/network-instance/protocols/protocol/isis/ interfaces/interface/levels/level/packet-counters/iih/received** • **/network-instances/network-instance/protocols/protocol/isis/ interfaces/interface/levels/level/packet-counters/iih/processed** • **/network-instances/network-instance/protocols/protocol/isis/ interfaces/interface/levels/level/packet-counters/iih/dropped** you are here • • • • •

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• • /network-instances/network-instance/protocols/protocol /isis/interfaces/interface/levels/level/packet-counters/iih/sent • /network-instances/network-instance/protocols/protocol/ isis/interfaces/interface/levels/level/packet-counters/iih/retransmit • /network-instances/network-instance/protocols/protocol/ isis/interfaces/interface/levels/level/packet-counters/psnp/received • /network-instances/network-instance/protocols/protocol/ isis/interfaces/interface/levels/level/packet-counters/psnp/processed • /network-instances/network-instance/protocols/protocol/ isis/interfaces/interface/levels/level/packet-counters/psnp/dropped • /network-instances/network-instance/protocols/protocol/ isis/interfaces/interface/levels/level/packet-counters/psnp/sent • /network-instances/network-instance/protocols/protocol/ isis/interfaces/interface/levels/level/packet-counters/psnp/retransmit • /network-instances/network-instance/protocols/protocol/ isis/interfaces/interface/levels/level/packet-counters/cnsp/received • /network-instances/network-instance/protocols/protocol/ isis/interfaces/interface/levels/level/packet-counters/cnsp/processed • /network-instances/network-instance/protocols/protocol/ isis/interfaces/interface/levels/level/packet-counters/cnsp/dropped • /network-instances/network-instance/protocols/protocol/ isis/interfaces/interface/levels/level/packet-counters/cnsp/sent • /network-instances/network-instance/protocols/protocol/ isis/levels/level/system-level-counters/state/corrupted-lsps • /network-instances/network-instance/protocols/protocol/ isis/levels/level/system-level-counters/state/database-overloads • /network-instances/network-instance/protocols/protocol/ isis/levels/level/system-level-counters/state/manual-address-drop-from-area • /network-instances/network-instance/protocols/protocol/ isis/levels/level/system-level-counters/state/exceeded-max-seq-nums • /network-instances/network-instance/protocols/protocol/ isis/levels/level/system-level-counters/state/seq-num-skips • /network-instances/network-instance/protocols/protocol/ isis/levels/level/system-level-counters/state/own-lsp-purges • /network-instances/network-instance/protocols/protocol/ isis/levels/level/system-level-counters/state/id-len-mismatch

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• /network-instances/network-instance/protocols/protocol/isis/levels/level/system-level-counters/state/part-changes • /network-instances/network-instance/protocols/protocol/isis/levels/level/system-level-counters/state/max-area-address-mismatches • /network-instances/network-instance/protocols/protocol/isis/levels/level/system-level-counters/state/auth-fails • /network-instances/network-instance/protocols/protocol/isis/levels/level/system-level-counters/state/spf-runs • /network-instances/network-instance/protocols/protocol/isis/levels/level/system-level-counters/state/auth-type-fails • /network-instances/network-instance/protocols/protocol/isis/levels/level/system-level-counters/state/lsp-errors • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/circuit-counters/state/adj-changes • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/circuit-counters/state/adj-number • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/circuit-counters/state/auth-fails • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/circuit-counters/state/auth-type-fails • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/circuit-counters/state/id-field-len-mismatches • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/circuit-counters/state/lan-dis-changes • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/circuit-counters/state/max-area-address-mismatch • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/circuit-counters/state/rejected-adj • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/system-id • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/dis-system-id • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/local-extended-system-id • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-extended-system-id • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/adjacency-state

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-circuit-type • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-ipv4-address • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-ipv6-address • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-snpa • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/levels/level/adjacencies/adjacency/state/priority • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/remaining-hold-time • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/restart-status • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/restart-support • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/restart-suppress • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/up-time • /network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/nlpid • /network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/area-address • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/topologies • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/multi-topology • /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/adjacency-type • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/state/ipv4-prefix • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/state/up-down

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/state/s-bit • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/state/metric • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/flags/state/flags • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/flags/state/ipv4-source-router-id • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/ipv6-source-router-id/state/ipv6-source-router-id • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/flags/state/tag64 • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/flags/state/tag32 • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/type • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/length • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/value • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sid/sid/state/value • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/flags/state/flags

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/flags/state/algorithm • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/ipv6-prefix • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/up-down • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/s-bit • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/x-bit • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/metric • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/ipv6-prefix • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/ipv4-source-router-id/state/ipv4-source-router-id • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/ipv6-source-router-id/state/ipv6-source-router-id • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/tag64/state/tag64 • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/tag64/state/tag32 • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/type • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/length

Table 6: gRPC Sensors *(continued)*

resource path	Description
	• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/value • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sid/sid/state/value • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sid/sid/state/flags • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sid/sid/state/algorithm • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/router-capability/state/flags • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/router-capability/state/rtr-id • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/undefined-tlvs/undefined-tlv/state/type • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/undefined-tlvs/undefined-tlv/state/length • /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/undefined-tlvs/undefined-tlv/state/value

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/services/segment-routing/interface/ingress/usage/ **/junos/services/segment-routing/interface/egress/usage/** **/junos/services/segment-routing/sid/usage/**	

Table 6: gRPC Sensors *(continued)*

resource path	Description
	Sensors for aggregate segment routing traffic with IS-IS. This sensor is supported on MX Series and PTX5000 routers starting with Junos OS Release 17.4R1. Starting with Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services. Statistics are exported separately for each routing instance. The first path exports inbound traffic. The second path exports outbound traffic. The third path exports inbound segment routing traffic for each segment identifier. **NOTE:** When you enable a sensor for segment routing statistics, you must also configure the **sensor-based-stats** statement at the **[edit protocols isis source-packet-routing]** hierarchy level. All MX and PTX5000 routers with FPC3 onwards support enhanced mode. If enhanced mode is not enabled, configure either the **enhanced-ip** statement or the **enhanced-ethernet** statement at the **[edit chassis network-services]** hierarchy level. On PTX Series routers, configure the **enhanced-mode** statement at the **[edit chassis network-services]** hierarchy level. **NOTE:** Currently, MPLS labels correspond only to only one instance, instance 0. Since each SID corresponds to a single **instance_identifier**, no aggregation is required to be done by the collector. The **instance_identifier** is stamped as 0. The following OpenConfig paths are supported: • **/network-instances/network-instance/mpls/signaling-protocols/segment-routing/interfaces/interface/state/in-pkts** • **/network-instances/network-instance/mpls/signaling-protocols/segment-routing/interfaces/interface/state/in-octets** • **/network-instances/network-instance/mpls/signaling-protocols/segment-routing/interfaces/interface/state/out-octets** • **/network-instances/network-instance/mpls/signaling-protocols/segment-routing/interfaces/interface/state/out-pkts** • **/network-instances/network-instance/mpls/aggregate-sid-counters/aggregate-sid-counter/state/in-octets** • **/network-instances/network-instance/mpls/**

Table 6: gRPC Sensors *(continued)*

resource path	Description
	aggregate-sid-counters/aggregate-sid-counter/state/in-pkts • **/network-instances/network-instance/mpls/aggregate-sid-counters/aggregate-sid-counter/state/out-octets** • **/network-instances/network-instance/mpls/aggregate-sid-counters/aggregate-sid-counter/state/out-pkts** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/state/in-octets** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/state/in-pkts** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/state/out-octets** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/state/out-pkts** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/forwarding-classes/forwarding-class/state/in-octets** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/forwarding-classes/forwarding-class/state/in-pkts** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/forwarding-classes/forwarding-class/state/out-octets** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/forwarding-classes/forwarding-class/state/out-pkts**
/junos/services/segment-routing/sid/usage/	Sensors for aggregate segment routing traffic with IS-IS. This sensor is supported on PTX3000 routers and PTX5000 routers with FPC2 starting with Junos OS Release 19.1R1. Statistics are exported separately for each routing instance. The first path exports inbound traffic. The second path exports outbound traffic. The third path exports inbound segment routing traffic for each segment identifier. **NOTE:** When you enable a sensor for segment routing statistics, you must also configure the **sensor-based-stats** statement at the **[edit protocols isis source-packet-routing]** hierarchy level.

Table 6: gRPC Sensors *(continued)*

resource path	Description
/junos/services/segment-routing/traffic-engineering/ingress/usage	Packet Forwarding Engine sensor for ingress segment routing traffic engineering statistics. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services.
/junos/services/segment-routing/traffic-engineering/transit/usage	Packet Forwarding Engine sensor for ingress segment routing traffic engineering statistics. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services.
/junos/services/segment-routing/ traffic-engineering/tunnel/lsp/ingress/usage/ **/junos/services/segment-routing/ traffic-engineering/tunnel/lsp/transit/usage/**	Sensor for Segment Routing Traffic Engineering (SR-TE) per Label Switched Path (LSP) route statistics. You can stream SR-TE telemetry statistics for uncolored SR-TE policies to an outside collector. Ingress statistics include statistics for all traffic steered by means of an SR-TE LSP. Transit statistics include statistics for traffic to the Binding-SID (BSID) of the SR-TE policy. To enable these statistics, include the **per-source per-segment-list** option at the [**edit protocols source-packet-routing telemetry statistics**] hierarchy level. Starting in Junos OS Release 20.1R1, MX Series and PTX Series routers support streaming statistics using gRPC services. When a subscription is made to these resource paths, the following output format is displayed: • **/mpls/signaling-protocols/segment-routing/ sr-te-per-lsp-ingress-policies/sr-te-ingress-lsp-policy\ [tunnel-name='srtelsp1' and source='st' and origin='0' and distinguisher='f' and lsp-name='sr1'\]/state/counters\[name='.*'\]/ packets** • **/mpls/signaling-protocols/segment-routing/ sr-te-per-lsp-transit-policies/sr-te-transit-lsp-policy\ [tunnel-name='srtelsp1' and source='st' and origin='0' and distinguisher='f' and lsp-name='sr1'\]/state/counters\[name='.*'\]/ packets**

Table 6: gRPC Sensors *(continued)*

resource path	Description
/vlans/	Sensor for VLAN management states. This feature supports OpenConfig model openconfig-vlan.yang configuration version 1.0.2. Starting in Junos OS Release 19.4R1, streaming VLAN statistics using JTI and gRPC services on EX4650 and QFX5120 switches is supported. • **/vlans/vlan/state/name** • **/vlans/vlan/state/vlan-id** • **/vlans/vlan/members/** • **/vlans/vlan/members/member/interface-ref/state/interface/** • **/vlans/vlan/members/member/interface-ref/state/interface/switched-vlan/state/interface-mode** • **/vlans/vlan/members/member/interface-ref/state/interface/switched-vlan/state/native-vlan** • **/vlans/vlan/members/member/interface-ref/state/interface/switched-vlan/state/access-vlan** • **/vlans/vlan/members/member/interface-ref/state/interface/switched-vlan/state/trunk-vlan** • **/vlans/vlan/members/member/interface-ref/state/interface/vlan/state/vlan-id**

Table 7: Broadband Edge gRPC Sensors

resource path	Description
/junos/system/subscriber-management/aaa/accounting-statistics/	Sensor that tracks accounting statistics by means of a protocol exchange with accounting servers. You can also add the following to the end path for **/junos/system/subscriber-management/aaa/accounting-statistics/**: • **acct-req-received** • **acct-req-timeout** • **acct-resp-failure** • **acct-resp-success** • **acct-req-start** • **acct-req-interim** • **acct-req-stop** • **acct-resp-total** • **acct-resp-start** • **acct-resp-interim** • **acct-resp-stop** • **acct-resp-total**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/aaa/address-assignment-statistics/logical-system-routing-instances/logical-system-routing-instance/pools/pool	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	For Authentication, Authorization, and Accounting, this sensor tracks address pool utilization. The resource path can be refined to select a logical system routing instance by using a logical system routing instance filter: **/aaa/address-assignment-statistics/logical-system-routing-instances/logical-system-routing-instance [lsri-name=' *lsName:riName*']/pools/pool[pool-name=' *poolName*']** The resource path can be refined to select a specific pool by using a pool filter: **/junos/system/subscriber-management/aaa/address-assignment-statistics/logical-system-routing-instances/logical-system-routing-instance/pools/pool[pool-name=' *poolName*']** The resource path can be refined to select both a logical routing instance and a pool by using a logical system routing instance filter and a pool filter: **/junos/system/subscriber-management/aaa/address-assignment-statistics/logical-system-routing-instances/logical-system-routing-instance/[lsri-name=' *lsName:riName*']/pools/pool[pool-name=' *poolName*']** The following end paths are also supported for the resource path: • **pool-name** • **out-of-memory** • **out-of-address** • **address-total** • **address-in-use** • **address-usage-percent** • **linked-pool-name**-The next address pool in the chain of linked pools. If there is no next address pool, the value is empty. This leaf is supported in Junos OS Release 18.3R1 and higher. • **linked-pool-head**-The first address pool in a chain of linked pools. If this pool is not part of a linked address pool, the value is empty. This leaf is supported in Junos OS Release 18.3R1 and higher. For single pools, the value of linked-pool-head should be the same as the pool-name. For example: **key:__prefix__, str_value:/junos/system/subscriber-management/**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description

	aaa/address-assignment-statistics/logical-system-routing-instances/logical-system-routing-instance[name='default:marberry']/pools/pool[pool-name='john']/}
	
	`.`
	`.`
	`kv {`
	`  key:linked-pool-name,`
	`  str_value:jayne`
	`}`
	`kv {`
	`  key:linked-pool-head,`
	`  str_value:john`

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/aaa/diameter/clients/gx	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	Sensor for policy and charging rules function (PCRF) statistics for subscribers. Supported on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers for streaming statistics export through gRPC services and gNMI services starting with Junos OS Release 19.3R1. You can also add the following end paths: • **ccr-initial** • **ccr-initial-retry** • **cca-initial** • **cca-initial-grant** • **cca-initial-deny** • **cca-initial-failure** • **ccr-update** • **ccr-update-retry** • **cca-update** • **cca-update-timeout** • **ccr-terminate** • **ccr-terminate-retry** • **cca-terminate** • **cca-terminate-timeout** • **cca-parse-error** • **cca-dropped-no-session-id** • **cca-dropped-bad-e2e-id** • **cca-dropped-bad-origin-realm** • **cca-dropped-bad-origin-host** • **cca-dropped-no-result-code** • **cca-dropped-other** • **cca-initial-bad-result-code** • **cca-initial-bad-data** • **rar-update** • **rar-update-retry** • **rar-update-drop** • **raa-update-ack**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **raa-update-nak-no-session** • **raa-update-nak-unable-to-comply** • **raa-update-nak-other** • **rar-disconnect** • **rar-disconnect-retry** • **rar-disconnect-drop** • **raa-disconnect-ack** • **raa-disconnect-nak-no-session** • **raa-update-nak-unable-to-comply** • **raa-disconnect-nak-other** • **rar-audit** • **rar-audit-retry** • **rar-audit-drop** • **raa-audit-ack** • **raa-audit-nak-no-session** • **raa-audit-nak-unable-to-comply** • **raa-audit-nak-other**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/aaa/diameter/clients/gy	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	Sensor for Online Charging System (OCS) statistics for subscribers. Supported on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers for streaming statistics export through gRPC services and gNMI services starting with Junos OS Release 19.3R1. You can also add the following end paths: • **ccr-initial** • **ccr-initial-retry** • **ccr-initial-alternate-retry** • **cca-initial** • **cca-initial-alternate** • **ccr-update** • **ccr-update-retry** • **ccr-update-alternate-retry** • **cca-update** • **cca-update-alternate** • **ccr-terminate** • **ccr-terminate-retry** • **ccr-terminate-alternate-retry** • **cca-terminate** • **cca-terminate-alternate** • **cca-terminate-timeout** • **cca-se-error** • **cca-no-session-id** • **cca-bad-e2e-id** • **cca-bad-origin-realm** • **cca-bad-origin-host** • **cca-no-result-code** • **cca-drop** • **cca-initial-bad-result-code** • **cca-initial-bad-data** • **asr** • **asr-retry** • **asr-parse-error**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **asr-update-drop** • **asa-ack** • **asa-nak**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/aaa/diameter/clients/nasreq	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	Sensor for Network Access Server Application (NASREQ) statistics for subscribers. Supported on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers for streaming statistics export through gRPC services and gNMI services starting with Junos OS Release 19.3R1. You can also add the following end paths: • **authentication-request-messages-sent**-Authentication requests successfully sent • **authentication-request-message-failures**-Authentication requests processing errors • **authentication-denies-failures**-Authentication requests rejected • **authentication-grants-received**-Authentication grants received • **authorization-request-messages-sent**-Authorization requests successfully sent • **authorization-request-message-failures**-Authorization requests processing errors • **authorization-request-messages-timeouts**-Authorization requests timed out • **authorization-denies-failures**-Authorization requests rejected • **authorization-grants-received**-Authorization grants received • **session-terminate-request-messages-sent**-Termination requests successfully sent • **session-terminate-request-message-failures**-Termination requests processing errors • **session-terminate-request-messages-timeouts**-Termination requests timed out • **session-terminate-response-messages-failures**-Termination response processing errors • **session-terminate-response-messages-received**-Termination responses received • **abort-session-requests-received**-Abort session requests received • **abort-session-response-ack-messages-sent**-Abort session requests responded with ack • **abort-session-response-nack-messages-sent**-Abort session requests responded with nack

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **abort-session-response-message-failures**- • **transmit-queue-time-outs**-Total count of messages dropped from the transmit queue due to timeout • **response-parse-errors**-Response messages dropped due to parsing errors • **responses-dropped**-Total count of responses dropped • **outstanding-requests**-Outstanding request messages
/junos/system/subscriber-management/aaa/diameter/peers/peer[peer_address='*peer-address*']/gx/response-time	Diameter peer sensor that provides response time measurements for messages exchanged between an MX router and the peer for PCRF statistics. This sensor includes response-time and delay measurements in milliseconds. **NOTE:** The delay measurements are made over a 60-second measurement interval. As the reporting interval may be as much as 59 seconds out of phase with the measurement interval, the response time values may not be aligned with the reporting interval. Supported on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers for streaming statistics export through gRPC services and gNMI services starting with Junos OS Release 19.3R1. You can also add the following end paths: • **1minute_min_resp_time** • **1minute_avg_resp_time** • **1minute_max_resp_time** • **1minute_msgs_sent** • **1minute_msgs_recvd** • **1minute_msgs_no_resp**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/aaa/diameter/peers/peer[peer_address='*peer-address*']/gy/response-time	Diameter peer sensor that provides response time measurements for messages exchanged between an MX router and the peer for OCS statistics. This sensor includes response-time and delay measurements in milliseconds. **NOTE:** The delay measurements are made over a 60-second measurement interval. As the reporting interval may be as much as 59 seconds out of phase with the measurement interval, the response time values may not be aligned with the reporting interval. Supported on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers for streaming statistics export through gRPC services and gNMI services starting with Junos OS Release 19.3R1. You can also add the following end paths: • **1minute_min_resp_time** • **1minute_avg_resp_time** • **1minute_max_resp_time** • **1minute_msgs_sent** • **1minute_msgs_recvd** • **1minute_msgs_no_resp**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/aaa/diameter/peers/peer[peer_address='*peer-address*']/nasreq/response-time	Diameter peer sensor that provides response time measurements for messages exchanged between an MX router and the peer for NASREQ statistics. This sensor includes response-time and delay measurements in milliseconds. **NOTE:** The delay measurements are made over a 60-second measurement interval. As the reporting interval may be as much as 59 seconds out of phase with the measurement interval, the response time values may not be aligned with the reporting interval. Supported on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers for streaming statistics export through gRPC services and gNMI services starting with Junos OS Release 19.3R1. You can also add the following end paths: • **1minute_min_resp_time** • **1minute_avg_resp_time** • **1minute_max_resp_time** • **1minute_msgs_sent** • **1minute_msgs_recvd** • **1minute_msgs_no_resp**
/junos/system/subscriber-management/access-network/ancp/adapter	Sensors that track statistics associated with Access Node Control Protocol (ANCP) adapter. **mapped-dynamic-subscriber-count**—Number of ANCP subscribers mapped to dynamic interfaces by ANCP adapter.

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/access-network/ancp/protocol	Sensors that track statistics associated with ANCP protocol. **establishing-neighbor-count**—Number of neighbors in the process of establishing adjacency. **established-neighbor-count**—Number of neighbors in the process of establishing adjacency **total-neighbor-count**—Total number of neighbors in all states. **mapped-static-subscriber-count**—Number of ANCP subscribers mapped to static interfaces by ANCP protocol. **port-up-count**—Total number of port ups received. **port-down-count** —Total number of port downs received.
/junos/system/subscriber-management/aaa/authentication-statistics/	Sensors that track authentication, authorization, and accounting (AAA) authentication, pre-authentication, and re-authentication statistics. The following end paths are also supported for the resource path: • **req-received** • **req-accepted** • **req-rejected** • **req-challenge** • **req-timeout** • **pre-authen-req-received** • **pre-authen-req-accepted** • **pre-authen-req-rejected** • **pre-authen-req-challenge** • **pre-authen-req-timeout** • **re-authen-req-received** • **re-authen-req-accepted** • **re-authen-req-rejected** • **re-authen-req-internal-errors** • **re-authen-req-challenge** • **re-authen-req_timeout**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/aaa/dynamic-request-statistics/	Sensor tracks dynamic request statistics from AAA server-initiated requests, including Change of Authorization (CoA) and RADIUS-initiated Disconnect (RID). The following end paths are also supported for the resource path: • **dynamic-req-received** • **dynamic-req-success** • **dynamic-req-error** • **dynamic-req-silently-drop**
/junos/system/subscriber-management/aaa/radius-servers/radius-server/response-time/	Sensor for RADIUS server response time statistics for a specific server. A request sent to the RADIUS server is counted as a message sent. Similarly, a response to the request is counted as a message received. A timeout during the measurement interval does not impact the minimum, average, or maximum response time statistics, but the event is counted as a **no response**. The delay measurements are made over a 60-second measurement interval. The reporting interval can be as much as 59 seconds out of phase with the measurement interval. At reporting time, the values from the last update interval are reported. The response time values are not aligned with the reporting interval. The resource path can be refined to select a specific RADIUS server by adding a server address filter to the resource path: **/junos/system/subscriber-management//aaa/radius-servers/radius-server[server-address='*radiusIpv4Address*']/response-time/** The following end paths are also supported for the resource path: • **one-minute-minimum-response-time** • **one-minute-average-response-time** • **one-minute-maximum-response-time** • **one-minute-messages-sent** • **one-minute-messages-received** • **one-minute-messages-no-response**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/aaa/radius-servers/radius-server/statistics/	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	Sensor for RADIUS server statistics for a specific server. The resource path can be refined to select a specific RADIUS server by adding a server address filter to the resource path: **/junos/system/subscriber-management//aaa/radius-servers/radius-server[server-address='*radiusIpv4Address*']/statistics/** The following end paths are also supported for the resource path: • **server-address** • **server-last-rtt** • **auth-access-requests** • **auth-rollover-requests** • **auth-retransmissions** • **auth-access-accepts** • **auth-access-rejects** • **auth-access-challenges** • **auth-malformed-responses** • **auth-bad-authenticators** • **auth-req-pending** • **auth-request-timeouts** • **auth-unknown-responses** • **auth-packets-dropped** • **preauth-access-requests** • **preauth-rollover-requests** • **preauth-retransmissions** • **preauth-access-accepts** • **preauth-access-rejects** • **preauth-access-challenges** • **preauth-malformed-responses** • **preauth-bad-authenticators** • **preauth-req-pending** • **preauth-request-timeouts** • **preauth-unknown-responses** • **preauth-packets-dropped** • **acct-start-requests** • **acct-interim-requests**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **acct-stop-requests** • **acct-rollover-requests** • **acct-retransmissions** • **acct-start-responses** • **acct-interim-responses** • **acct-stop-responses** • **acct-malformed-responses** • **acct-bad-authenticators** • **acct-req-pending** • **acct-request-timeouts** • **acct-unknown-responses** • **acct-packets-dropped**
/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance/relay/bindings/	Sensor for DHVPv4 relay binding state statistics. The resource path can be refined to select a specific routing instance by adding a routing instance name: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[name=' *routing-instance-name*]/relay/bindings/** The following end paths are also supported for the resource path: • **binding-state-v4relay-binding** • **binding-state-v4relay-init** • **binding-state-v4relay-bound** • **binding-state-v4relay-selecting** • **binding-state-v4relay-requesting** • **binding-state-v4relay-renew** • **binding-state-v4relay-release** • **binding-state-v4relay-restoring**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance/relay/servers/server/response-time	Sensor for DHVPv4 server delay. The sensor periodically measures the minimum, average, and maximum delay or response time from the upstream DHCP server(s), as seen by the relay. DHCP relay does not track the state of the server. The no-response statistics are the difference between the messages sent and received during the measurement interval. The delay measurements are made over a 60-second measurement interval. Because the reporting interval can be as much as 59 seconds out of phase with the measurement interval, there is no design to align the response time values with the reporting interval. The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[name=' *routing-instance-name*]/relay/servers/server/response-time** The resource path can be refined to select a specific DHCP server by adding a server filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance/relay/servers/server[server-ip=' *server-ip*']/response-time** The resource path can be refined to select a specific DHCP server in a specific routing instance by adding both a routing instance filter and a server filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[name=' *routing-instance-name*]/relay/servers/server[server-ip=' *server-ip*']/response-time** The following end paths are also supported for the resource path: • **one-minute-minimum-response-time** • **one-minute-average-response-time** • **one-minute-maximum-response-time** • **one-minute-messages-sent** • **one-minute-messages-received** • **one-minute-messages-no-response**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance/server/bindings/	Sensor for DHVPv4 server binding state statistics. The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[name=' *routing-instance-name*]/server/bindings/** The following end paths are also supported for the resource path: • **binding-state-v4server-binding** • **binding-state-v4server-init** • **binding-state-v4server-bound** • **binding-state-v4server-selecting** • **binding-state-v4server-requesting** • **binding-state-v4server-renew** • **binding-state-v4server-release** • **binding-state-server-restoring**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance/server/statistics/	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	Sensor for DHCPv4 telemetry for server statistics for a specific routing-instance. The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name=' *routing-instance-name*']/server/statistics/** For example, the following resource path defines server statistics for the **default:n000015k routing instance**: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name=' n000015k]/server/statistics** In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name=' *routing-instance-name*'] /server/statistics/** the only value supported for *routing-instance-name* is **default**. The following end paths are also supported for the resource path: • **dropped-v4server-total** • **dropped-v4server-bad-hware** • **dropped-v4server-bootp-pkt** • **dropped-v4server-bad-bootp-opcode** • **dropped-v4server-bad-options** • **dropped-v4server-bad-address** • **dropped-v4server-no-address** • **dropped-v4server-no-interface-cfg** • **dropped-v4server-no-local-address** • **dropped-v4server-short-pkt** • **dropped-v4server-no-bad-send** • **dropped-v4server-no-option60** • **dropped-v4server-no-option82** • **dropped-v4server-authentication** • **dropped-v4server-dynamic-profile** • **dropped-v4server-no-license** • **dropped-v4server-no-bad-dhcp-opcode**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **dropped-v4server-no-options** • **dropped-v4server-hop-limit** • **dropped-v4server-ttl-expired** • **dropped-v4server-bad_udp-checksum** • **dropped-v4server-inactive-vlan** • **dropped-v4server-era-start-ailed** • **dropped-v4server-client-lookup** • **dropped-v4server-lease-time-violation** • **offer-delayed** • **offer-delay-in-progress** • **offer-delay-total** • **msg-recv-v4server-boot-request** • **msg-recv-v4server-decline** • **msg-recv-v4server-discover** • **msg-recv-v4server-inform** • **msg-recv-v4server-release** • **msg-recv-v4server-request** • **msg-recv-v4server-renew** • **msg-recv-v4server-rebind** • **msg-recv-v4server-lease-query** • **msg-recv-v4server-bulklease-query** • **msg-sent-v4server-boot-reply** • **msg-sent-v4server-offer** • **msg-sent-v4server-boot-ack** • **msg-sent-v4server-nak** • **msg-sent-v4server-force-renew** • **msg-sent-v4server-unassigned** • **msg-sent-v4server-unknown** • **msg-sent-v4server-active** • **msg-sent-v4server-query-done**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/client-protocols/dhcp/v4/	Sensor for DHCPv4 telemetry. The following end paths are also supported for the resource path: • **dropped-total** • **dropped-bad-read** • **dropped-ip-header** • **dropped-short-packet** • **dropped-no-interface** • **dropped-no-routing-instance** • **dropped-no-memory** • **dropped-recovery-in-progress** • **era-inflight-count** • **era-reported-failures** • **era-reported-successes**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance/server/statistics/	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	Sensor for DHVPv4 server statistics The resource path can be refined to select a specific routing instance by adding a routing instance name: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name=' *routing-instance-name*']/server/statistics/** For example, the following resource path defines server statistics for the **default:n000015k routing instance**: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name=' n000015k]/server/statistics** In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor **/junos/system/subscriber-management/client-ancpinstance[ri-name=' *routing-instance-name*'] /server/statistics/** the only value supported for *routing-instance-name* is **default**. The following end paths are also supported for the resource path: • **dropped-v4server-total** • **dropped-v4server-bad-hware** • **dropped-v4server-bootp-pkt** • **dropped-v4server-bad-bootp-opcode** • **dropped-v4server-bad-options** • **dropped-v4server-bad-address** • **dropped-v4server-no-address** • **dropped-v4server-no-interface-cfg** • **dropped-v4server-no-local-address** • **dropped-v4server-short-pkt** • **dropped-v4server-no-bad-send** • **dropped-v4server-no-option60** • **dropped-v4server-no-option82** • **dropped-v4server-authentication** • **dropped-v4server-dynamic-profile** • **dropped-v4server-no-license** • **dropped-v4server-no-bad-dhcp-opcode** • **dropped-v4server-no-options** • **dropped-v4server-hop-limit** • **dropped-v4server-ttl-expired**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **dropped-v4server-bad_udp-checksum** • **dropped-v4server-inactive-vlan** • **dropped-v4server-era-start-ailed** • **dropped-v4server-client-lookup** • **dropped-v4server-lease-time-violation** • **offer-delayed** • **offer-delay-in-progress** • **offer-delay-total** • **msg-recv-v4server-boot-request** • **msg-recv-v4server-decline** • **msg-recv-v4server-discover** • **msg-recv-v4server-inform** • **msg-recv-v4server-release** • **msg-recv-v4server-request** • **msg-recv-v4server-renew** • **msg-recv-v4server-rebind** • **msg-recv-v4server-lease-query** • **msg-recv-v4server-bulklease-query** • **msg-sent-v4server-boot-reply** • **msg-sent-v4server-offer** • **msg-sent-v4server-boot-ack** • **msg-sent-v4server-nak** • **msg-sent-v4server-force-renew** • **msg-sent-v4server-unassigned** • **msg-sent-v4server-unknown** • **msg-sent-v4server-active** • **msg-sent-v4server-query-done**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance/relay/statistics/	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	Sensor for DHVPv4 relay binding state statistics. The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name=' *routing-instance-name*']/relay/statistics/** For example, the following resource path defines relay statistics for the **default:n000015k routing instance**: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name=' n000015k]/relay/statistics** In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name=' *routing-instance-name*']/relay/statistics/** the only value supported for the value *routing-instance-name* is **default**. The following end paths are also supported for the resource path: • **dropped-v4relay-total** • **dropped-v4relay-bad-hardware** • **dropped-v4relay-bootp-packet** • **dropped-v4relay-bad-bootp-opcode** • **dropped-v4relay-bad-options** • **dropped-v4relay-bad-address** • **dropped-v4relay-no-address** • **dropped-v4relay-no-interface-cfg** • **dropped-v4relay-no-local-address** • **dropped-v4relay-short-packet** • **dropped-v4relay-bad-send** • **dropped-v4relay-option-60** • **dropped-v4relay-relay-option** • **dropped-v4relay-option-82** • **dropped-v4relay-authentication** • **dropped-v4relay-dynamic-profile** • **dropped-v4relay-dynamic-profile** • **dropped-v4relay-license**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **dropped-v4relay-bad-dhcp-opcode** • **dropped-v4relay-no-options** • **dropped-v4relay-hop-limit** • **dropped-v4relay-ttl-expired** • **dropped-v4relay-bad-udp-checksum** • **dropped-v4relay-inactive-vlan** • **dropped-v4relay-era-start-failed** • **dropped-v4relay-client-lookup** • **dropped-v4relay-proxy-no-server-addr** • **dropped-v4relay-lease-time-violation** • **dropped-v4relay-leasequery-repl-no-circuitid** • **dropped-v4relay-leasequery-repl-with-error-code** • **dropped-v4relay-leasequery-repl-with-query-term** • **dropped-v4relay-older-leasequery-reply** • **dropped-v4relay-abort-leasequery-reply-proc** • **dropped-v4relay-during-leasequery-reply** • **dropped-v4relay-relay-source-no-lpbk-interface** • **v4relay-bootp-request-rcvd** • **msg-recv-v4relay-decline** • **msg-recv-v4relay-discover** • **msg-recv-v4relay-inform** • **msg-recv-v4relay-release** • **msg-recv-v4relay-request** • **msg-recv-v4relay-leaseactive** • **msg-recv-v4relay-leaseunassigned** • **msg-recv-v4relay-leaseunknown** • **msg-recv-v4relay-leasequerydone** • **v4relay-bootp-reply-rcvd** • **msg-recv-v4relay-offer** • **msg-recv-v4relay-ack** • **msg-recv-v4relay-nak** • **msg-recv-v4relay-forcerenew** • **v4relay-bootp-reply-sent** • **msg-sent-v4relay-offer** • **msg-sent-v4relay-ack**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **msg-sent-v4relay-nak** • **msg-sent-v4relay-forcerenew** • **msg-sent-v4relay-leasequery** • **msg-sent-v4relay-bulkleasequery** • **v4relay-bootp-request-sent** • **msg-sent-v4relay-decline** • **msg-sent-v4relay-discover** • **msg-sent-v4relay-inform** • **msg-sent-v4relay-release** • **msg-sent-v4relay-request** • **v4relay-bootp-forwarded-total** • **v4relay-bootp-request-fwd** • **v4relay-bootp-reply-fwd**
/junos/system/subscriber-management/client-protocols/dhcp/v6/	Sensor for DHCPv6 statistics. The following end paths are also supported for the resource path: • **era-inflight-count** • **era-reported-failures** • **era-reported-successes**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance/relay/bindings/	Sensor for DHVPv6 relay binding state statistics. The resource path can be refined to select a specific routing instance by adding a routing instance name: **/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[name=' *routing-instance-name*]/relay/bindings/** The following end paths are also supported for the resource path: • **binding-state-v6relay-binding** • **binding-state-v6relay-init** • **binding-state-v6relay-bound** • **binding-state-v6relay-selecting** • **binding-state-v6relay-requesting** • **binding-state-v6relay-renew** • **binding-state-v6relay-release** • **binding-state-relay-restoring**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
[illegible]	Sensor for DHVPv6 server delay. The sensor periodically measures the minimum, average, and maximum delay or response time from the upstream DHCP server(s), as seen by the relay. DHCP relay does not track the state of the server. The no-response statistics are the difference between the messages sent and received during the measurement interval. The delay measurements are made over a 60-second measurement interval. Because the reporting interval can be as much as 59 seconds out of phase with the measurement interval, there is no design to align the response time values with the reporting interval. The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[name=' *routing-instance-name*]/relay/servers/server/response-time** The resource path can be refined to select a specific DHCP server by adding a server address filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance/relay/servers/server[server-ip=' *server-ip*']/response-time** The resource path can be refined to select a specific DHCP server in a specific routing instance by adding both a routing instance filter and a server filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[name=' *routing-instance-name*]/relay/servers/server [server-ip=' *server-ip*']/response-time** The following end paths are also supported for the resource path: • **one-minute-minimum-response-time** • **one-minute-average-response-time** • **one-minute-maximum-response-time** • **one-minute-messages-sent** • **one-minute-messages-received** • **one-minute-messages-no-response**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance/server/bindings/	Sensor for DHVPv6 binding state statistics. The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[name=' *routing-instance-name*]/server/bindings/** The following end paths are also supported for the resource path: • **binding-state-v6server-binding** • **binding-state-v6server-init** • **binding-state-v6server-bound** • **binding-state-v6server-selecting** • **binding-state-v6server-requesting** • **binding-state-v6server-renew** • **binding-state-v6server-release** • **binding-state-server-restoring**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance/server/statistics/	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	Sensor for DHCPv6 server statistics. The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[ri-name=' *routing-instance-name*']/server/statistics/** For example, the following resource path defines server statistics for the **default:n000015k routing instance**: **/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[ri-name=' n000015k]/server/statistics** In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor **/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[ri-name=' *routing-instance-name*']/server/statistics** the only value supported for *routing-instance-name* is **default**. The following end paths are also supported for the resource path: • **dropped-v6server-total** • **dropped-v6server-no-routing-instance** • **dropped-v6server-bad-send** • **dropped-v6server-short-packet** • **dropped-v6server-bad-msgtype** • **dropped-v6server-bad-options** • **dropped-v6server-bad-srcaddress** • **dropped-v6server-relay-hop-count** • **dropped-v6server-bad-udp-checksum** • **dropped-v6server-no-client-id** • **dropped-v6server-strict-reconfigure** • **dropped-v6server-option-18** • **dropped-v6server-authentication{** • **dropped-v6server-dynamic-profile** • **dropped-v6server-license** • **dropped-v6server-inactive-vlan** • **dropped-v6server-era-start-failed** • **dropped-v6server-client-lookup**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **dropped-v6server-lease-time-violation** • **advertise-delayed** • **advertise-queued** • **advertise-total** • **msg-recv-v6server-dhcpv6-decline** • **msg-recv-v6server-dhcpv6-solicit** • **msg-recv-v6server-dhcpv6-information-request** • **msg-recv-v6server-dhcpv6-release** • **msg-recv-v6server-dhcpv6-request** • **msg-recv-v6server-dhcpv6-confirm** • **msg-recv-v6server-dhcpv6-renew** • **msg-recv-v6server-dhcpv6-rebind** • **msg-recv-v6server-dhcpv6-relay-forw** • **msg-recv-v6server-dhcpv6-leasequery** • **msg-sent-v6server-advertise** • **msg-sent-v6server-reply** • **msg-sent-v6server-logical_nak** • **msg-sent-v6server-reconfigure** • **msg-sent-v6server-relay-repl** • **msg-sent-v6server-leasequery-repl** • **msg-sent-v6server-leasequery-data** • **msg-sent-v6server-leasequery-done**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance/relay/statistics/	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	Sensor for DHVPv6 relay statistics. The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[ri-name=' *routing-instance-name*']/relay/statistics/** For example, the following resource path defines relay statistics for the **default:n000015k routing instance**: **/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[ri-name=' n000015k]/relay/statistics** In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor **/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[ri-name=' *routing-instance-name*']/relay/statistics** the only value supported for *routing-instance-name* is **default**. The following end paths are also supported for the resource path: • **dropped-v6relay-total** • **dropped-v6relay-no-safd** • **dropped-v6relay-no-routing-instance** • **dropped-v6relay-bad-send** • **dropped-v6relay-short-packet** • **dropped-v6relay-bad-msgtype** • **dropped-v6relay-bad-options** • **dropped-v6relay-bad-srcaddress** • **dropped-v6relay-relay-hop-count** • **dropped-v6relay-bad-udp-checksum** • **dropped-v6relay-no-client-id** • **dropped-v6relay-strict-reconfigure** • **dropped-v6relay-relay-option** • **dropped-v6relay-option-18** • **dropped-v6relay-option-37** • **dropped-v6relay-authentication** • **dropped-v6relay-dynamic-profile** • **dropped-v6relay-license**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **dropped-v6relay-inactive-vlan** • **dropped-v6relay-era-start-failed** • **dropped-v6relay-client-lookup** • **dropped-v6relay-lease-time-violation** • **dropped-v6relay-leasequery-repl-no-client-data** • **dropped-v6relay-leasequery-repl-no-interfaceid** • **dropped-v6relay-leasequery-repl-with-client-link** • **dropped-v6relay-leasequery-repl-no-relay-data** • **dropped-v6relay-leasequery-repl-with-hop-cnt** • **dropped-v6relay-leasequery-repl-with-error-code** • **dropped-v6relay-leasequery-repl-with-query-term** • **dropped-v6relay-older-leasequery-reply** • **dropped-v6relay-abort-leasequery-reply-proc** • **dropped-v6relay-during-leasequery-reply** • **dropped-v6relay-relay-source-no-lpbk-interface** • **msg-recv-v6relay-decline** • **msg-recv-v6relay-solicit** • **msg-recv-v6relay-information-request** • **msg-recv-v6relay-release** • **msg-recv-v6relay-request** • **msg-recv-v6relay-confirm** • **msg-recv-v6relay-renew** • **msg-recv-v6relay-rebind** • **msg-recv-v6relay-relay-forw** • **msg-recv-v6relay-leasequery-repl** • **msg-recv-v6relay-leasequery-data** • **msg-recv-v6relay-leasequery-done** • **msg-recv-v6relay-advertise** • **msg-recv-v6relay-reply** • **msg-recv-v6relay-reconfigure** • **msg-recv-v6relay-relay-repl** • **msg-recv-v6relay-leasequery** • **msg-sent-v6relay-reply** • **msg-sent-v6relay-reconfigure** • **msg-sent-v6relay-relay-repl**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **msg-sent-v6relay-leasequery** • **msg-sent-v6relay-decline** • **msg-sent-v6relay-solicit** • **msg-sent-v6relay-information-request** • **msg-sent-v6relay-release** • **msg-sent-v6relay-request** • **msg-sent-v6relay-confirm** • **msg-sent-v6relay-renew** • **msg-sent-v6relay-rebind** • **msg-sent-v6relay-relay-forw** • **msg-sent-v6relay-leasequery-repl** • **msg-sent-v6relay-leasequery-data** • **msg-sent-v6relay-leasequery-done** • **v6relay-fwd-total** • **v6relay-fwd-request** • **v6relay-fwd-reply**
/junos/system/subscriber-management/client-protocols/l2tp/summary/	Sensor for L2TP telemetry information. The following end paths are also supported for the resource path: • **l2tp-stats-total-tunnels** • **l2tp-stats-total-sessions** • **l2tp-stats-control-rx-packets** • **l2tp-stats-control-rx-bytes** • **l2tp-stats-control-tx-packets** • **l2tp-stats-control-tx-bytes** • **l2tp-era-type-icrq-inflight-count** • **l2tp-era-type-icrq-reported-successes** • **l2tp-era-type-icrq-reported-failures** • **l2tp-era-type-sccrq-inflight-count** • **l2tp-era-type-sccrq-reported-successes** • **l2tp-era-type-sccrq-reported-failures**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/client-protocols/ppp/statistics/	Sensors for PPP telemetry information. The following end paths are also supported for the resource path: • **ppp-stats-total-subscriber-sessions** • **ppp-stats-sessions-disable-phase** • **ppp-stats-sessions-establish-phase** • **ppp-stats-sessions-network-phase** • **ppp-stats-sessions-authenticate-phase**
/junos/system/subscriber-management/client-protocols/pppoe/statistics/	Sensors for PPPoE counts. The following end paths are also supported for the resource path: • **padi-packets-sent** • **padi-packets-received** • **pado-packets-sent** • **pado-packets-received** • **padr-packets-sent** • **padr-packets-received** • **pads-packets-sent** • **pads-packets-received** • **padt-packets-sent** • **padt-packets-received** • **service-error-sent** • **service-error-received** • **ac-error-sent** • **ac-error-received** • **generic-error-sent** • **generic-error-received** • **malformed-packets-received** • **unknown-packets-received** • **era-inflight-count** • **era-reported-successes** • **era-reported-failures**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber_management/dynamic-interfaces/interface-sets/meta-data/interface-set[container-id='*container-id-value*']/	Sensor for subscriber interface-set information. This sensor is supported on MX Series routers starting with Junos OS Release 18.4R1. ON-CHANGE streaming is supported. The following end paths are supported: • **cos-egress-tcp-name**-The egress traffic control profile associated with this **interface-set**. • **cos-egress-tcp-remainder-name**-The egress remainder traffic control profile associated with this **interface-set**. • **interface-set-name**-The name of the **interface-set** as supplied by AAA or as constructed by the topology relationship (ACI string or interface stacking). • **interface-set-type**-The type of interface-set (determines structure of interface-set-name). • **device-name**-The name of the underlying device or port (e.g. ge-1/0/0 or ae1). This leaf is empty if the **interface-set-type** is not a physical interface-set type. • **stag**-The outer VLAN tag. The value is 0 if **interface-set-type** is not a VLAN type. • **ctag**-The inner VLAN tag. The value is 0 if **interface-set-type** is not a VLAN type.

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber_management/dynamic-interfaces/interface-sets/meta-data/interface[sid-id='*sid-value*']/	Sensor for subscriber interface information. ON-CHANGE streaming is supported. The following end paths are supported: • **interface-index**-The system assigned interface index for the interface. • **session-type**-The type of client session (e.g VLAN, DHCP, PPPoE). • **user-name**-The login name for this interface and session. • **profile-name**-The name of the client profile used to create the interface. • **underlying-interface-name**-The name of the associated underlying interface. • **cvlan-tag**-The innermost VLAN tag value associated with the interface. • **svlan-tag**-The outermost VLAN tag value associated with the interface.
/junos/system/subscriber_management/dynamic-interfaces/interface-sets/meta-data/interface[sid-id='*sid-value*']/	Sensor for actual accounting statistics for dynamic subscriber interfaces. The following end paths are supported: • **ip-in-packets**-The number of actual transit IPv4 & IPv6 packets received by the interface. • **ip-out-packets**-The number of actual transit IPv4 & IPv6 packets sent to the interface. • **ip-in-bytes**-The number of actual transit IPv4 & IPv6 bytes received by the interface. • **ip-out-bytes**-The number of actual transit IPv4 & IPv6 bytes received by the interface. • **ipv6-in-packets**-The number of actual transit IPv6 packets received by the interface. • **ipv6-out-packets**-The number of actual transit IPv6 packets sent to the interface. • **ipv6-in-bytes**-The number of actual transit IPv6 bytes received by the interface. • **ipv6-out-bytes**-The number of actual transit IPv6 bytes sent to the interface.

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber_management/dynamic-interfaces/interfaces/queue-statistics/interface[sid-id='*sid-value*']/fpcs/fpc[slot='*slot-value*']/queues/queue/[queue-no='*queue-no-value*']/	Sensor for queue statistics for dynamic interfaces. The following end paths are supported: • **transmitted-packets**-The number of actual transit IPv4 & IPv6 packets received by the interface. • **transmitted-bytes**-Total bytes enqueued for this queue. • **dropped-packets**-Total packets dropped (because of RED, rate-limited, tail-drop, etc.) for the queue. • **dropped-bytes**-Total bytes dropped (because of RED, rate-limited, tail-drop, etc.) for the queue.
/junos/system/subscriber_management/dynamic-interfaces/interface-sets/queue-statistics/interface-set[container-id='*container-id-value*']/fpcs/fpc[slot='*slot-value*']/queues/queue/[queue-no='*queue-no-value*']/	Sensor for queue statistics for dynamic interface-sets. The following end paths are supported: • **transmitted-packets**-The number of actual transit IPv4 & IPv6 packets received by the interface. • **transmitted-bytes**-Total bytes enqueued for this queue. • **dropped-packets**-Total packets dropped (because of RED, rate-limited, tail-drop, etc.) for the queue. • **dropped-bytes**-Total bytes dropped (because of RED, rate-limited, tail-drop, etc.) for the queue.
/junos/system/subscriber-management/infra/resource-monitor/chassis	Sensor for chassis resource statistics. The crossing of chassis thresholds maintained by the resource monitor can be incremented. For each threshold, a count is maintained of rising and falling threshold crossings. As the consumed resource exceeds the threshold, the threshold exceeded count is incremented. As the consumed resource drops below the threshold, the threshold nominal count is incremented. Unless limits are configured using **configured-subscriber-limit**, configured and current limit counts will not be visible. The following end paths are supported for chassis threshold crossing statistics: • **subscriber-limit-exceeded** • **subscriber-limit-nominal** • **configured-subscriber-limit** • **current-subscriber-count**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc/statistics/	Sensor for FPC resource statistics, including statistics for throttled sessions due to exceeding the line card load threshold (as measured by the routing engine to FPC round trip delay). The resource path can be refined to select a specific slot by adding a slot number filter to the resource path: **/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc[slot=' *slot number*']/statistics/** Using the slot number filter, the crossing of FPC thresholds maintained by the resource monitor can be incremented. For each threshold, a count is maintained of rising and falling threshold crossings. As the consumed resource exceeds the threshold, the threshold exceeded count is incremented. As the consumed resource drops below the threshold, the threshold nominal count is incremented. Unless limits are configured using **configured-subscriber-limit**, configured and current limit counts will not be visible. The following end paths are supported for FPC threshold crossing statistics: • **mem-heap-exceeded** • **mem-heap-nominal** • **subscriber-limit-exceeded** • **subscriber-limit-nominal** • **configured-subscriber-limit** • **current-subscriber-count** The following end paths are also supported for the resource path: • **heap-memory-used** • **client-session-denied-count** • **service-session-denied-count** • **rtt-throttled-sub-count-client** • **rtt-throttled-sub-count-client**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc/statistics/pfes/pfe	Sensor for FPC resource statistics at the Packet Forwarding Engine level. Periodically tracks line card statistics and Packet Forwarding Engine statistics. The resource path can be refined to select a specific Packet Forwarding Engine by adding a Packet forwarding Engine filter to the resource path: **/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc/statistics/pfes/pfe[pfe-no=' *pfe number*']/** The resource path can be refined to select a specific Packet Forwarding Engine by adding a slot number filter to the resource path: **/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc [slot=' *slot number*']/statistics/pfes/pfe[pfe-no=' *pfe number*']/** Using the slot number filter, the crossing of packet forwarding engine thresholds maintained by the resource monitor can be incremented. For each threshold, a count is maintained of rising and falling threshold crossings. As the consumed resource exceeds the threshold, the threshold exceeded count is incremented. As the consumed resource drops below the threshold, the threshold nominal count is incremented. The following end paths are supported for packet forwarding threshold crossing statistics: • **mem-ifl-exceeded** • **mem-ifl-nominal** • **mem-expansion-exceeded** • **mem-expansion-nominal** The following end paths are also supported for the resource path: • **pfe-no** • **filter-memory-used** • **ifl-memory-used** • **expansion-memory-used** • **nh-memory**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/infra/resource-monitor/rsmon-infra/fpcs/fpc[slot=' *slot number*']/	Sensor for FPC resource statistics. Using the slot number filter, the crossing of FPC thresholds maintained by the resource monitor can be incremented. For each threshold, a count is maintained of rising and falling threshold crossings. As the consumed resource exceeds the threshold, the threshold exceeded count is incremented. As the consumed resource drops below the threshold, the threshold nominal count is incremented. The following end paths are supported for FPC threshold crossing statistics: • **delay-round-trip-exceeded** • **delay-round-trip-nominal**
/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc [slot=' *slot number*']/statistics/pfes/pfe[pfe-no=' *pfe number*']/sched-blocks/sched-block[sblock-no=' *schedBlockNumber*']/	Sensor for counts of CoS utilization threshold crossing events above (exceeded) and below (nominal). For each threshold, a count is maintained of rising and falling threshold crossings. As the consumed resource exceeds the threshold, the threshold exceeded count is incremented. As the consumed resource drops below the threshold, the threshold nominal count is incremented. The following end paths are supported for CoS utilization threshold crossing statistics: • **cos-utilization-exceeded** • **cos-utilization-nominal** The following end paths are supported for statistical data: • **queues-max** • **queues-allocated**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc [slot=' *slot number*']/pics/pic[pic-no=' *pic number*']/	Sensor for PIC threshold crossing. For each threshold, a count is maintained of rising and falling threshold crossings. As the consumed resource exceeds the threshold, the threshold exceeded count is incremented. As the consumed resource drops below the threshold, the threshold nominal count is incremented. Unless limits are configured using **configured-subscriber-limit**, configured and current limit counts will not be visible. The following end paths are supported for PIC threshold crossing statistics: • **subscriber-limit-exceeded** • **subscriber-limit-nominal** • **configured-subscriber-limit** • **current-subscriber-count**
/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc [slot=' *slot number*']/pics/pic[pic-no=' *pic number*']/ports/port[port-no=' *port number*']/	Sensor for port threshold crossing. For each threshold, a count is maintained of rising and falling threshold crossings. As the consumed resource exceeds the threshold, the threshold exceeded count is incremented. As the consumed resource drops below the threshold, the threshold nominal count is incremented. Unless limits are configured using **configured-subscriber-limit**, configured and current limit counts will not be visible. The following end paths are supported for port utilization threshold crossing statistics: • **subscriber-limit-exceeded** • **subscriber-limit-nominal** • **configured-subscriber-limit** • **current-subscriber-count**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/infra/network/dhcp/	Sensor for network stack DHCP. Periodically tracks packets processed by the BBE network stack to and from the DHCP application. The following end paths are also supported for the resource path: • **rx-packet-cnt** • **era-drops** • **rx-no-connection** • **rx-malformed-cnt** • **rx-no-if-cnt** • **rx-ifl-invalid** • **rx-send-failed** • **tx-packet-cnt** • **packets-transmitted** • **tx-malformed-cnt** • **tx-null-pkt** • **tx-no-if-cnt** • **tx-no-iff-cnt** • **tx-no-rtt-cnt** • **tx-arp-failed** • **tx_arp_failed** • **tx-if-invalid** • **tx-send-failed** • **rx-while-not-connected**
/junos/system/subscriber-management/infra/network/dvlan/	Sensor for network stack dynamic VLAN. Periodically maintains a count of the number of packets received that triggered dynamic VLAN interface creations. The following end paths are also supported for the resource path: • **rx-packet-cnt**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/infra/network/io/	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	Sensor for network stack IO. Periodcally provides basic network stack input and output and tracks network stack packet statistics. The following end paths are also supported for the resource path: • **l2-rx-packets-cnt** • **l2-rx-packets-failed** • **l2-rx-malformed-cnt** • **l2-rx-ifd-invalid** • **l2-rx-ifl-invalid** • **l2-rx-no-iff-cnt** • **l2-rx-if-create-failed** • **l2-bbe-io-rcv-l3-unknown-address-family** • **l2-rx-unsupported-inet-protocol** • **l2-rx-unsupported-inet6-protocol** • **l2-rx-unsupported-udp-protocol** • **l2-rx-unsupported-punt-af** • **l2-rx-v4-data-path-punt-pkt** • **l2-rx-v4-data-path-punt-pkt-drop** • **l2-rx-v6-data-path-punt-pkt** • **l2-rx-v6-data-path-punt-pkt-drop** • **l2-tx-packets-cnt** • **l2-tx-malformed-cnt** • **l2-tx-no-ifd-cnt** • **l2-tx-ifl-invalid** • **l2-bbe-io-send-tx-failed** • **l2-bbe-io-send-tx-failed-partial** • **l2-tx-v4-out-error-local-intf** • **l2-tx-v6-out-error-local-intf** • **l3-rx-packet-cnt** • **l3-rx-unsupported-protocol** • **l3-tx-packet-cnt** • **l3-tx-send-failed** • **l3-tx-v4-kernel-forward** • **l3-tx-v4-kernel-forward-drops** • **l3-tx-v6-kernel-forward**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **l3-tx-v6-kernel-forward-drops**
/junos/system/subscriber-management/infra/network/dvlan/	Sensor for network stack dynamic VLAN. Periodically maintains a count of the number of packets received that triggered dynamic VLAN interface creations. The following end paths are also supported for the resource path: • **rx-packet-cnt**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/infra/network/l2tp/	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	Sensor network stack L2TP. Periodically tracks L2TP packets processed by the BBE network stack to and from the L2TP application. The following end paths are also supported for the resource path: • **rx-cnt** • **rx-pkt-cnt** • **ppp-rx-pkt-cnt** • **tx-pkt-cnt** • **ppp-rx-lcp-conf-req-count** • **ppp-rx-lcp-conf-ack-count** • **ppp-rx-lcp-conf-nack-count** • **ppp-rx-lcp-term-req-count** • **ppp-rx-lcp-term-ack-count** • **ppp-rx-lcp-echo-req-count** • **ppp-rx-lcp-echo-resp-count** • **ppp-rx-pap-req-count** • **ppp-rx-pap-ack-count** • **ppp-rx-pap-nack-count** • **ppp-rx-chap-challenge-count** • **ppp-rx-chap-resp-count** • **ppp-rx-chap-success-count** • **ppp-rx-chap-fail-count** • **ppp-rx-ipcp-conf-req-count** • **ppp-rx-ipcp-conf-ack-count** • **ppp-rx-ipcp-conf-nack-count** • **rx-malformed-cnt** • **ppp-rx-unknown-protocol** • **rx-msg-cnt** • **rx-msg-processd-cnt** • **rx-msg-err** • **rx-invalid-msg-cnt** • **tx-cnt** • **ppp-tx-lcp-conf-req-count** • **ppp-tx-lcp-conf-ack-count** • **ppp-tx-lcp-conf-nack-count**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **ppp-tx-lcp-echo-req-count** • **ppp-tx-lcp-echo-resp-count** • **ppp-tx-lcp-term-req-count** • **ppp-tx-lcp-term-ack-count** • **ppp-tx-pap-req-count** • **ppp-tx-pap-ack-count** • **ppp-tx-pap-nack-count** • **ppp-tx-chap-challenge-count** • **ppp-tx-chap-resp-count** • **ppp-tx-chap-success-count** • **ppp-tx-chap-fail-count** • **ppp-tx-ipcp-conf-req-count** • **ppp-tx-ipcp-conf-ack-count** • **ppp-tx-ipcp-conf-nack-count** • **ppp-tx-unknown-protocol** • **tx-pkt-send-failed** • **tx-pkt-err** • **tx-msg-cnt** • **tx-msg-err**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/infra/network/ppp/	

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	Sensor network stack PPP. Periodically tracks PPP packets processed by the BBE network stack to and from the PPP application. The following end paths are also supported for the resource path: • **rx-network-pkt-cnt** • **rx-plugin-pkt-cnt** • **rx-lcp-conf-req-cnt** • **rx-lcp-conf-ack-cnt** • **rx-lcp-conf-nack-cnt** • **rx-lcp-conf-rej-cnt** • **rx-lcp-term-req-cnt** • **rx-lcp-term-ack-cnt** • **rx-lcp-code-rej-cnt** • **rx-lcp-protocol-rej-cnt** • **rx-lcp-echo-req-cnt** • **rx-lcp-echo-reply-cnt** • **rx-pap-req-cnt** • **rx-pap-ack-cnt** • **rx-pap-nack-cnt** • **rx-chap-challenge-cnt** • **rx-chap-resp-cnt** • **rx-chap-success-cnt** • **rx-chap-failure-cnt** • **rx-ipcp-req-cnt** • **rx-ipcp-ack-cnt** • **rx-ipcp-nack-cnt** • **rx-ipv6cp-req-cnt** • **rx-ipv6cp-ack-cnt** • **rx-ipv6cp-nack-cnt** • **rx-malformed-cnt** • **rx-no-if-cnt** • **rx-unsupported** • **tx-cnt** • **tx-lcp-conf-req-cnt** • **tx-lcp-conf-ack-cnt**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
	• **tx-lcp-conf-nack-cnt** • **tx-lcp-echo-req-cnt** • **tx-lcp-echo-reply-cnt** • **tx-lcp-term-req-cnt** • **tx-lcp-term-ack-cnt** • **tx-pap-req-cnt** • **tx-pap-ack-cnt** • **tx-pap-nack-cnt** • **tx-chap-challenge-cnt** • **tx-chap-resp-cnt** • **tx-chap-success-cnt** • **tx-chap-failure-cnt** • **tx-ipcp-req-cnt** • **tx-ipcp-ack-cnt** • **tx-ipcp-nack-cnt** • **tx-ipv6cp-req-cnt** • **tx-ipv6cp-ack-cnt** • **tx-ipv6cp-nack-cnt** • **tx-unknown-pkt-cnt** • **tx-send-failed** • **tx-malformed-cnt**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/infra/network/pppoe/	Sensor for network stack PPPoE statistics. PPPoE packets processed by the BBE network stack to and from the PPPoE application are tracked. The following end paths are also supported for the resource path: • **rx-cnt** • **rx-padi-cnt** • **rx-padr-cnt** • **rx-ppp-cnt** • **rx-malformed-cnt** • **rx-no-if-cnt** • **rx-unsupported** • **rx-padi-era-discards** • **tx-cnt** • **tx-send-failed**
/junos/system/subscriber-management/infra/sdb/statistics/client-type/	Sensor for session database resources session counts by client type. The following end paths are also supported for the resource path: • **dhcp-client-count** • **vlan-client-count** • **ppp-client-count** • **pppoe-client-count** • **l2tp-client-count** • **static-client-count** • **vpls-pw-client-count** • **mlppp-client-count** • **essm-client-count** • **total-client-count**

Table 7: Broadband Edge gRPC Sensors *(continued)*

resource path	Description
/junos/system/subscriber-management/infra/sdb/statistics/state/	Sensor for session database resources tracking session counts by state. The following end paths are also supported for the resource path: • **init-state-count** • **configured-state-count** • **active-state-count** • **terminating-state-count** • **terminated-state-count** • **total-state-count**

Release History Table

Release	Description
20.1R1	Starting with Junos Release 20.R1, gNMI service for streaming telemetry sensors for Packet Forwarding Engine statistics is supported on MX2K-MPC11E line cards on MX2010 and MX2020 routers.
19.4R1 Evolved	Starting with Junos Release 19.4R1, gRPC service for streaming Packet Forwarding Engine and Routing Engine statistics is supported on EX4300-MP switches.
19.3R1 EVO	Starting with Junos OS Evolved Release 19.3R1, gRPC service for exporting statistics is supported on QFX5220-128C and QFX5220-32CD switches.
19.3R1	Starting with Junos OS Release 19.3R1, gNMI services for streaming Packet Forwarding Engine statistics is supported on MX240, MX480 and MX960 routers.
19.3R1	Starting with Junos OS Release 19.3R1, gRPC service for exporting statistics is supported on MX Series routers hosting MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards. The resource paths **/junos/system/linecard/cpu/memory/**, **/junos/system/linecard/npu/memory/**, and **/junos/system/linecard/npu/utilization/** can be updated to call out individual sensors (leaves) and their respective paths for better clarity.
19.2R1	Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800, and vSRX Series Services Gateways.
19.2R1	Starting with Junos OS Release 19.2R1, gNMI services for streaming Packet Forwarding Engine statistics is supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches.
19.2R1	Starting with Junos OS Release 19.2R1, gNMI services for streaming statistics is supported on QFX5100, QFX5110, QFX5120, QFX5200 and QFX5210 switches.
19.2R1	Starting with Junos OS Release 19.3R1, gNMI services for streaming and ON_CHANGE export of Routing Engine statistics is supported on MX960, MX2010, MX2020, PTX5000, PTX1000, and PTX10000 routers.
19.1R1 EVO	Starting in Junos OS Evolved Release 19.1R1, OpenConfig (OC) and Junos Telemetry Interface (JTI) are supported. Both gRPC APIs and the customer-facing CLI remain the same as for the Junos OS. As was standard for Junos OS, Network Agent (NA) and OC packages are part of the Junos OS Evolved image.
19.1R1	Starting with Junos OS Evolved 19.1R1, Packet Forwarding Engine sensors on PTX10003 routers are also supported.

18.4R1	Starting with Junos OS Release 18.4R1, MX480, MX960, MX2010, MX2020, MX2008 and MX-ELM routers are also supported.
18.3R1	Starting with Junos OS Release 18.3R1, ON_CHANGE streaming of LLDP telemetry sensor information is supported through gRPC for MX Series and PTX Series routers.
18.3R1	Starting with Junos OS Release 18.3R1, QFX5120-AY and EX4650 switches are also supported.
18.3R1	Starting with Junos OS Release 18.4R1, EX4600 switches are also supported.
18.2R1	Starting with Junos OS Release 18.2R1, PTX10002 routers are also supported.
18.1R1	Starting with Junos OS Release 18.1R1, QFX5210-64C switches and QFX5100 switches are also supported.
18.1R1	Starting with Junos OS Release 18.1R1, ON_CHANGE streaming of ARP, ND, and IP sensor information associated with interfaces is supported through gRPC for MX Series routers and PTX Series routers.
17.4R1	Starting with Junos OS Release 17.4R1, PTX10016 routers and virtual MX Series (vMX) routers are also supported.
17.3R1	Starting with Junos OS Release 17.3R1, QFX5110 switches, EX4600, EX4600-VC, and EX9200 switches and the Routing and Control Board (RCB) on PTX3000 routers are also supported.
17.3R1	Starting with Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensors are supported.
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name=' *routing-instance-name*'] /server/statistics/** the only value supported for *routing-instance-name* is **default**.
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor **/junos/system/subscriber-management/client-ancpinstance[ri-name=' *routing-instance-name*'] /server/statistics/** the only value supported for *routing-instance-name* is **default**.
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name=' *routing-instance-name*']/relay/statistics/** the only value supported for the value *routing-instance-name* is **default**.

17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor **/junos/system/subscriber-management/client-protocols/dhcp/v6/ routing-instances/routing-instance[ri-name='*routing-instance-name*']/server/statistics** the only value supported for *routing-instance-name* is **default**.
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor **/junos/system/subscriber-management/client-protocols/dhcp/v6/ routing-instances/routing-instance[ri-name='*routing-instance-name*']/relay/statistics** the only value supported for *routing-instance-name* is **default**.
17.2R1	Starting with JunosOS Release 17.2R1, QFX10002, QFX10008, and QFX10016 switches, QFX5200 switches, and PTX1000 and PTX10008 routers are also supported.
16.1R3	Starting with Junos OS Release 16.1R3, the Junos Telemetry Interface supports gRPC remote procedure calls (gRPC) to provision sensors and to subscribe to and receive telemetry data on MX Series routers and PTX3000 and PTX5000 routers.

RELATED DOCUMENTATION

Understanding OpenConfig and gRPC on Junos Telemetry Interface | 25

3

CHAPTER

OpenConfig to Junos Mapping

Mapping OpenConfig AAA Commands to Junos Operation

> **NOTE:** See "OpenConfig Data Model Version" on page 15 topic to understand the data models supported version and its Junos OS release for Juniper Networks ACX Series, EX Series, MX Series, PTX Series, and QFX Series.

The following tables show the mapping of OpenConfig AAA commands with the relevant configuration in Junos OS.

Table 8: Global AAA Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/system/aaa**	
Config-Name	**/server-groups/server-group/config/name**	Not supported **NOTE:** There is no equivalent configuration in the Junos OS for this path. The configured server group name is used in the RADIUS/TACACS attributes configuration.
Server-Config-Address	**/server-groups/server-group/servers/server/config/address**	Not supported **NOTE:** There is no equivalent configuration in the Junos OS for this path. The configured server address is used in the RADIUS/TACACS attributes configuration.
Server-Config-Name	**/server-groups/server-group/servers/server/config/name**	Not supported **NOTE:** There is no equivalent configuration in the Junos OS for this path. You can configure a server name to identify the server.

Table 8: Global AAA Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Config-Timeout	**/server-groups/server-group/servers/server/config/timeout**	Not supported **NOTE:** There is no equivalent configuration in the Junos OS for this path. However, the timeout configured is derived from the **timeout** parameter at the Junos OS **edit radius-server** or **edit tacplus-server** hierarchy level.

Table 9: RADIUS Server Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/system/aaa**	
Auth-Port	**/server-groups/server-group/servers/server/radius/config/auth-port**	**set system radius-server *address* port *port*** **NOTE:** The ***address*** value is derived from the value configured after **server**. The ***port*** value is the same value as ***auth-port*.**
Retransmit-Attempts	**/server-groups/server-group/servers/server/radius/config/retransmit-attempts**	**set system radius-server *address* retry*retry*** **NOTE:** The ***address*** value is derived from the value configured after **server**. The ***retry*** value is the same value as that specified for **retransmit-attempts**.
Secret-Key	**/server-groups/server-group/servers/server/radius/config/secret-key**	**set system radius-server *address* secret *secret*** **NOTE:** The ***address*** value is derived from the value configured after **server**. The ***secret*** value is the same value as that specified for **secret-key**.

Table 9: RADIUS Server Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Source-Address	**/server-groups/server-group/servers/server/radius/config/source-address**	**set system radius-server *address* source-address *source-address*** **NOTE:** The ***address*** value is derived from the value configured after **server.** The ***source-address*** value is the same value as that specified for **source-address**.

Table 10: TACACS Server Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/system/aaa**	
Config-Port	**/server-groups/server-group/servers/server/tacacs/config/port**	**set system tacplus-server *address* port *port*** **NOTE:** The ***address*** value is derived from the value configured after **server.** The ***port*** value is the same value as that specified for **port**.
Secret-Key	**/server-groups/server-group/servers/server/tacacs/config/secret-key**	**set system tacplus-server *address* secret *secret*** **NOTE:** The ***address*** value is derived from the value configured after **server**. The ***secret*** value is the same value as that specified for **secret-key**.
Source-Address	**/server-groups/server-group/servers/server/tacacs/config/source-address**	**set system tacplus-server *address* source-address *source-address*** **NOTE:** The ***address*** value is derived from the value configured after **server**. The ***source-address*** value is the same value as that specified for **source-address**.

Table 11: AAA Admin and User Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/system/aaa**	
Admin-Password	**/authentication/admin-user/config/admin-password**	**set system root-authentication *plain-text-password*** **NOTE:** The ***plain-text-password-authentication*** value is derived from the value configured for **admin-password**.
Admin-Password-Hashed	**/authentication/admin-user/config/admin-password-hashed**	**set system root-authentication encrypted-password *encrypted-password*** **NOTE:** The ***encrypted-password*** value is derived from the value configured for **admin-password-hashed**.
Authentication-Method	**/authentication/config/authentication-method**	**set system authentication-order** **NOTE:** The ***authentication-order*** value is derived from the value configured for **authentication-method**.
Password	**/authentication/users/user/config/password**	**set system login user *user-name* authentication plain-text-password *plain-text-password*** **NOTE:** The ***user-name*** value is derived from the value configured for **user**. The ***plain-text-password*** value is derived from the value configured for **password**.

Table 11: AAA Admin and User Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Password-Hashed	**/authentication/users/user/config/password-hashed**	**set system login user *user-name* authentication encrypted-password *encrypted-password*** **NOTE:** The ***user-name*** value is derived from the value configured for **user**. The ***encrypted-password*** value is derived from the value configured for **password-hashed**.
Role	**/authentication/users/user/config/role**	**set system login user *user-name* class *class*** **NOTE:** The ***user-name*** value is derived from the value configured for **user**. The ***class*** value is derived from the value configured for **role**.
Username	**/authentication/users/user/config/username**	Not supported **NOTE:** There is no equivalent configuration in the Junos OS.

Mapping OpenConfig BGP Commands to Junos Configuration

> **NOTE:** See "OpenConfig Data Model Version" on page 15 topic to understand the data models supported version and its Junos OS release for Juniper Networks MX Series, PTX Series, and QFX Series.

Table 12 on page 294 to Table 26 on page 311 show the mapping of OpenConfig BGP commands with the relevant configuration in Junos.

Table 12: Global BGP Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/network-instances/network-instance/protocols/protocol/bgp/global**	
As	**/config/as**	**set routing-options autonomous-system *as_number***
Router-ID	**/config/router-id**	**set routing-options router-id *router-id***
Confederation	**/confederation/config/identifier** **/confederation/config/member-as**	**set routing-options confederation *confederation_as*** **set routing-options confederation members *value***
Always-Compare-MED	**/route-selection-options/config/always-compare-med**	**set protocols bgp path-selection always-compare-med**
Ignore-AS-Path-Length	**/route-selection-options/config/ignore-as-path-length**	**set protocols bgp path-selection as-path-ignore**
Enable-AIGP	**/route-selection-options/config/enable-aigp**	**set protocols bgp family *family* aigp**
Ignore-Nexthop-IGP-Metric	**/route-selection-options/config/ignore-next-hop-igp-metric**	Not supported
Dynamic-Neighbor-Prefixes	**/dynamic-neighbor-prefixes/dynamic-neighbor-prefix/config/prefix** **/dynamic-neighbor-prefixes/dynamic-neighbor-prefix/config/peer-group**	**set protocols bgp group *group* allow *ip address***

Table 12: Global BGP Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Graceful-Restart	**/graceful-restart/config/enabled** **/graceful-restart/config/restart-time** **/graceful-restart/config/stale-routes-time** **/graceful-restart/config/helper-only**	**set protocols bgp graceful-restart disable** **set protocols bgp graceful-restart restart-time *restart -time*** **set protocols bgp graceful-restart stale-routes-time *stale- routes -time***

Table 13: AFI-SAFI Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: • Global—**/network-instances/network-instance/protocols/protocol/bgp/global/afi-safi/afi-safi** • Peer-Group—**/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/afi-safi/afi-safi** • Neighbors—**/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safi/afi-safi** Set the values for address family: **protocol/bgp/global/afi-safi/afi-safi/<afi-safi-name>/<family-type>/config**	

Table 13: AFI-SAFI Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Where, afi-safi-name is one of the following: • IPV4_LABELED_UNICAST Labeled IPv4 unicast (AFI,SAFI = 1,4) • IPV4_MULTICAST Base identify type for IPv4 multicast address family • IPV4_UNICAST IPv4 unicast (AFI,SAFI = 1,1) • IPV6_LABELED_UNICAST Labeled IPv6 unicast (AFI,SAFI = 2,4) • IPV6_MULTICAST Base identify type for IPv6 multicast address family • IPV6_UNICAST IPv6 unicast (AFI,SAFI = 2,1) • L2VPN_EVPN BGP MPLS Based Ethernet VPN (AFI,SAFI = 25,70) • L2VPN_VPLS BGP-signalled VPLS (AFI,SAFI = 25,65) • L3VPN_IPV4_MULTICAST Multicast IPv4 MPLS L3VPN (AFI,SAFI = 1,129) • L3VPN_IPV4_UNICAST Unicast IPv4 MPLS L3VPN (AFI,SAFI = 1,128) • L3VPN_IPV6_MULTICAST Multicast IPv6 MPLS L3VPN (AFI,SAFI = 2,129) • L3VPN_IPV6_UNICAST Unicast IPv6 MPLS L3VPN (AFI,SAFI = 2,128)	
	Where, family-type is one of the following: • ipv4-labeled-unicast IPv4 Labeled Unicast configuration options • ipv4-unicast IPv4 unicast configuration options • ipv6-labeled-unicast IPv6 Labeled Unicast configuration options • ipv6-unicast IPv6 unicast configuration options • l2vpn-evpn BGP EVPN configuration options • l2vpn-vpls BGP-signalled VPLS	

Table 13: AFI-SAFI Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	configuration options • l3vpn-ipv4-multicast Multicast IPv4 L3VPN configuration options • l3vpn-ipv4-unicast Unicast IPv4 L3VPN configuration options • l3vpn-ipv6-multicast Multicast IPv6 L3VPN configuration options • l3vpn-ipv6-unicast Unicast IPv6 L3VPN configuration options	
AFI-SAFI	**/config/afi-safi-name** **/config/enabled**	**set protocols bgp family *family***
Add-Path: Send	**/add-paths/config/send**	**set protocols bgp group *group-name* family *family* add-path send path-count *number***
Add-Paths: Receive	**/add-paths/config/receive**	**set protocols bgp group *group-name* family *family* add-path receive**
Add-Paths: Send-Max	**/add-paths/config/send-max** **NOTE:** You must set send-max to non-zero value before setting send to true. If not, you will receive an error message to set the correct values.	**set protocols bgp group *group-name* family *family* add-path send path-count *path-count***
Add-Paths: Eligible Prefix Policy	**/add-paths/config/eligible-prefix-policy**	**set protocols bgp group *group-name* family *family* add-path send prefix-policy *policy***
Always-Compare-MED	**/route-selection-options/config/always-compare-med**	**set protocols bgp path-selection always-compare-med**
Ignore-AS-Path-Length	**/route-selection-options/config/ignore-as-path-length**	**set protocols bgp path-selection as-path-ignore**
Enable-AIGP	**/route-selection-options/config/enable-aigp**	**set protocols bgp family *family* aigp**
Use-Multiple-Paths: Maximum-Paths	**/use-multiple-paths/ebgp/config/maximum-paths** **/use-multiple-paths/ibgp/config/maximum-paths**	**set chassis maximum-ecmp <num-next-hops>**

Table 13: AFI-SAFI Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Use-Multiple-Paths: Allow-Multiple-AS	**/use-multiple-paths/ebgp/config/allow-multiple-as**	**set protocols bgp group *group-name* multipath multiple-as**

Table 14: AFI-SAFI IPv4-Unicast Prefix-Limit Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: • Global—**/network-instances/network-instance/protocols/protocol/bgp/global/afi-safi/afi-safi-name/<afi-safi-name>/ipv4-unicast** • Peer-Group—**/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/afi-safi/afi-safi-name/<afi-safi-name>/ipv4-unicast** • Neighbors—**/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safi/afi-safi-name/<afi-safi-name>/ipv4-unicast**	
Send-Default-Route	**/config/send-default-route**	Not supported
Max-Prefixes	**/prefix-limit/config/max-prefixes**	**set protocols bgp family inet unicast accepted-prefix-limit maximum *maximum***
Prevent-Teardown	**/prefix-limit/config/prevent-teardown**	**set protocols bgp family *family* prefix-limit teardown**
Shutdown-Threshold-PCT	**/prefix-limit/config/shutdown-threshold-pct**	**set protocols bgp family inet unicast accepted-prefix-limit teardown *limit-threshold***
Restart-Timer	**/prefix-limit/config/restart-timer**	**set protocols bgp family inet unicast accepted-prefix-limit teardown idle-timeout *timeout***

Table 15: AFI-SAFI IPv6-Unicast Prefix-Limit Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: • Global—**/network-instances/network-instance/protocols/protocol/bgp/global/afi-safi/afi-safi-name/<afi-safi-name>/ipv6-unicast** • Peer-Group—**/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/afi-safi/afi-safi-name/<afi-safi-name>/ipv6-unicast** • Neighbors—**/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safi/afi-safi-name/<afi-safi-name>/ipv6-unicast**	
Send-Default-Route	**/config/send-default-route**	Not supported
Max-Prefixes	**/prefix-limit/config/max-prefixes**	**set protocols bgp family inet6 unicast accepted-prefix-limit maximum *maximum***
Prevent-Teardown	**/prefix-limit/config/prevent-teardown**	**set protocols bgp family *family* prefix-limit teardown**
Shutdown-Threshold-PCT	**/prefix-limit/config/shutdown-threshold-pct**	**set protocols bgp family inet6 unicast accepted-prefix-limit teardown *limit-threshold***
Restart-Timer	**/prefix-limit/config/restart-timer**	**set protocols bgp family inet6 unicast accepted-prefix-limit teardown idle-timeout *timeout***

Table 16: AFI-SAFI IPv4-Lbl-Unicast Prefix-Limit Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: • Global—**/network-instances/network-instance/protocols/protocol/bgp/global/afi-safi/afi-safi-name/<afi-safi-name>/ipv4-labelled-unicast/prefix-limit** • Peer-Group—**/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/afi-safi/afi-safi-name/<afi-safi-name>/ipv4-labelled-unicast/prefix-limit** • Neighbors—**/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safi/afi-safi-name/<afi-safi-name>/ipv4-labelled-unicast/prefix-limit**	
Max-Prefixes	**/config/max-prefixes**	**set protocols bgp family inet labeled-unicast accepted-prefix-limit maximum *maximum***
Prevent-Teardown	**/config/prevent-teardown**	**set protocols bgp family *family* prefix-limit teardown**
Shutdown-Threshold-PCT	**/config/shutdown-threshold-pct**	**set protocols bgp family inet labeled-unicast accepted-prefix-limit teardown *limit-threshold***
Restart-Timer	**/config/restart-timer**	**set protocols bgp family inet labeled-unicast accepted-prefix-limit teardown idle-timeout *timeout***

Table 17: AFI-SAFI IPv6-Lbl-Unicast Prefix-Limit Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: • Global—**/network-instances/network-instance/protocols/protocol/bgp/global/afi-safi/afi-safi-name/<afi-safi-name>/ipv6-labelled-unicast/prefix-limit** • Peer-Group—**/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/afi-safi/afi-safi-name/<afi-safi-name>/ipv6-labelled-unicast/prefix-limit** • Neighbors—**/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safi/afi-safi-name/<afi-safi-name>/ipv6-labelled-unicast/prefix-limit**	
Max-Prefixes	**/config/max-prefixes**	**set protocols bgp family inet6 labeled-unicast accepted-prefix-limit maximum *maximum***
Prevent-Teardown	**/config/prevent-teardown**	**set protocols bgp family *family* prefix-limit teardown**
Shutdown-Threshold-PCT	**/config/shutdown-threshold-pct**	**set protocols bgp family inet6 labeled-unicast accepted-prefix-limit teardown *limit-threshold***
Restart-Timer	**/config/restart-timer**	**set protocols bgp family inet6 labeled-unicast accepted-prefix-limit teardown idle-timeout *timeout***

Table 18: AFI-SAFI L3VPN-IPv4-Ucast Prefix-Limit Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: • Global—**/network-instances/network-instance/protocols/protocol/bgp/global/afi-safi/afi-safi-name/<afi-safi-name>/l3vpn-ipv4-unicast/prefix-limit** • Peer-Group—**/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/afi-safi/afi-safi-name/<afi-safi-name>/l3vpn-ipv4-unicast/prefix-limit** • Neighbors—**/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safi/afi-safi-name/<afi-safi-name>/l3vpn-ipv4-unicast/prefix-limit**	
Max-Prefixes	**/config/max-prefixes**	**set protocols bgp family inet-vpn unicast accepted-prefix-limit maximum *maximum***
Prevent-Teardown	**/config/prevent-teardown**	**set protocols bgp family *family* prefix-limit teardown**
Shutdown-Threshold-PCT	**/config/shutdown-threshold-pct**	**set protocols bgp family inet-vpn unicast accepted-prefix-limit teardown *limit-threshold***
Restart-Timer	**/config/restart-timer**	**set protocols bgp family inet-vpn unicast accepted-prefix-limit teardown idle-timeout *timeout***

Table 19: AFI-SAFI L3VPN-IPv6-Ucast Prefix-Limit Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: • Global—**/network-instances/network-instance/protocols/protocol/bgp/global/afi-safi/afi-safi-name/<afi-safi-name>/l3vpn-ipv6-unicast/prefix-limit** • Peer-Group—**/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/afi-safi/afi-safi-name/<afi-safi-name>/l3vpn-ipv6-unicast/prefix-limit** • Neighbors—**/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safi/afi-safi-name/<afi-safi-name>/l3vpn-ipv6-unicast/prefix-limit**	
Max-Prefixes	**/config/max-prefixes**	**set protocols bgp family inet6-vpn unicast accepted-prefix-limit maximum *maximum***
Prevent-Teardown	**/config/prevent-teardown**	**set protocols bgp family *family* prefix-limit teardown**
Shutdown-Threshold-PCT	**/config/shutdown-threshold-pct**	**set protocols bgp family inet6-vpn unicast accepted-prefix-limit teardown *limit-threshold***
Restart-Timer	**/config/restart-timer**	**set protocols bgp family inet6-vpn unicast accepted-prefix-limit teardown idle-timeout *timeout***

Table 20: AFI-SAFI L3VPN-IPv4-Mcast Prefix-Limit Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: • Global—**/network-instances/network-instance/protocols/protocol/bgp/global/afi-safi/afi-safi-name/<afi-safi-name>/l3vpn-ipv4-multicast/prefix-limit** • Peer-Group—**/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/afi-safi/afi-safi-name/<afi-safi-name>/l3vpn-ipv4-multicast/prefix-limit** • Neighbors—**/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safi/afi-safi-name/<afi-safi-name>/l3vpn-ipv4-multicast/prefix-limit**	
Max-Prefixes	**/config/max-prefixes**	**set protocols bgp family inet-vpn multicast accepted-prefix-limit maximum *maximum***
Prevent-Teardown	**/config/prevent-teardown**	**set protocols bgp family *family* prefix-limit teardown**
Shutdown-Threshold-PCT	**/config/shutdown-threshold-pct**	**set protocols bgp family inet-vpn multicast accepted-prefix-limit maximum *maximum***
Restart-Timer	**/config/restart-timer**	**set protocols bgp family inet-vpn multicast accepted-prefix-limit teardown idle-timeout *timeout***

Table 21: AFI-SAFI L3VPN-IPv6-Mcast Prefix-Limit Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: • Global—**/network-instances/network-instance/protocols/protocol/bgp/global/afi-safi/afi-safi-name/<afi-safi-name>/l3vpn-ipv6-multicast/prefix-limit** • Peer-Group—**/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/afi-safi/afi-safi-name/<afi-safi-name>/l3vpn-ipv6-multicast/prefix-limit** • Neighbors—**/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safi/afi-safi-name/<afi-safi-name>/l3vpn-ipv6-multicast/prefix-limit**	
Max-Prefixes	**/config/max-prefixes**	**set protocols bgp family inet6-vpn multicast accepted-prefix-limit maximum *maximum***
Prevent-Teardown	**/config/prevent-teardown**	**set protocols bgp family *family* prefix-limit teardown**
Shutdown-Threshold-PCT	**/config/shutdown-threshold-pct**	**set protocols bgp family inet6-vpn multicast accepted-prefix-limit teardown *limit-threshold***
Restart-Timer	**/config/restart-timer**	**set protocols bgp family inet6-vpn multicast accepted-prefix-limit teardown idle-timeout *timeout***

Table 22: AFI-SAFI L2VPN-VPLS Prefix-Limit Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: • Global—**/network-instances/network-instance/protocols/protocol/bgp/global/afi-safi/afi-safi-name/<afi-safi-name>/l2vpn-vpls/prefix-limit** • Peer-Group—**/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/afi-safi/afi-safi-name/<afi-safi-name>/l2vpn-vpls/prefix-limit** • Neighbors—**/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safi/afi-safi-name/<afi-safi-name>/l2vpn-vpls/prefix-limit**	
Max-Prefixes	**/config/max-prefixes**	**set protocols bgp family l2vpn signaling accepted-prefix-limit maximum *maximum***
Prevent-Teardown	**/config/prevent-teardown**	**set protocols bgp family *family* prefix-limit teardown**
Shutdown-Threshold-PCT	**/config/shutdown-threshold-pct**	**set protocols bgp family l2vpn signaling accepted-prefix-limit teardown *limit-threshold***
Restart-Timer	**/config/restart-timer**	**set protocols bgp family l2vpn signaling accepted-prefix-limit teardown idle-timeout *timeout***

Table 23: AFI-SAFI L2VPN-EVPN Prefix-Limit Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: • Global—**/network-instances/network-instance/protocols/protocol/bgp/global/afi-safi/afi-safi-name/<afi-safi-name>/l2vpn-evpn/prefix-limit** • Peer-Group—**/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/afi-safi/afi-safi-name/<afi-safi-name>/l2vpn-evpn/prefix-limit** • Neighbors—**/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safi/afi-safi-name/<afi-safi-name>/l2vpn-evpn/prefix-limit**	
Max-Prefixes	**/config/max-prefixes**	**set protocols bgp family evpn signaling accepted-prefix-limit maximum *maximum***
Prevent-Teardown	**/config/prevent-teardown**	**set protocols bgp family *family* prefix-limit teardown**
Shutdown-Threshold-PCT	**/config/shutdown-threshold-pct**	**set protocols bgp family evpn signaling accepted-prefix-limit teardown *limit-threshold***
Restart-Timer	**/config/restart-timer**	**set protocols bgp family evpn signaling accepted-prefix-limit teardown idle-timeout *timeout***

Table 24: Peer-Group Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group**	
Peer-Group-Name	**/config/peer-group-name**	**set protocols bgp group *group-name***

Table 24: Peer-Group Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Peer-AS	**/config/peer-as**	**set protocols bgp group *group-name* peer-as *peer-as***
Peer-Type	**/config/peer-type**	**set protocols bgp group *group-name* type <external | internal>**
Auth-Password	**/config/auth-password**	**set protocols bgp group *group-name* authentication-key *authentication-key***
Remove-Private-AS	**/config/remote-private-as**	**set protocols bgp group *group-name* remove-private all** **set protocols bgp group *group-name* remove-private all replace**
Route-Flap-Damping	**/config/route-flap-damping**	**set protocols bgp group *group-name* damping**
Send-Community	**/config/send-community**	Not supported
Description	**/config/description**	**set protocols bgp group *group-name* description *description***
Timers: Connect-Retry	**/timers/config/connect-retry**	**set protocols bgp group *group-name* connect-retry-interval *connect-retry***
Timers: Hold-Time	**/timers/config/hold-time**	**set protocols bgp group *group-name* hold-time *hold-time***
Timers: Keepalive-Interval	**/timers/config/keepalive-interval**	Not supported
Timers: Minimum-Advertisement-Interval	**/timers/config/minimum-advertisement-interval**	**set protocols bgp group *group-name* out-delay *out-delay***
Timers: Send-Update-Delay	**/timers/config/send-update-delay**	Not supported
Transport: TCP-MSS	**/transport/config/tcp-mss**	**set protocols bgp group *group-name* tcp-mss *tcp-mss***
Transport: MTU-Discovery	**/transport/config/mtu-discovery**	**set protocols bgp group *group-name* mtu-discovery**

Table 24: Peer-Group Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Transport: Passive-Mode	**/transport/config/passive-mode**	**set protocols bgp group *group-name* passive**
Transport: Local-Address	**/transport/config/local-address**	**set protocols bgp group *group-name* local-address *local-address***
Error-Handling: Treat-AS-Withdraw	**/error-handling/config/treat-as-withdraw**	**set protocols bgp group *group-name* bgp-error-tolerance**
Logging-Options: Log-Neighbor-State-Changes	**/logging-options/config/ log-neighbor-state-changes**	**set protocols bgp group *group-name* log-updown**
EBGP-Multihop: MultiHop-TTL	**/ebgp-multihop/config/multihop-ttl**	**set protocols bgp group *group-name* multihop ttl *ttl***
Route-Reflector: Route-Reflector-Cluster-ID	**/route-reflector/config/route-reflector-cluster-id**	**set protocols bgp group *group-name* cluster *cluster***
Route-Reflector: Route-Reflector-Client	**/route-reflector/config/route-reflector-client**	**set protocols bgp group *group-name* no-client-reflect**
AS-Path-Options: Allow-Own-AS	**/as-path-options/config/allow-own-as**	**set protocols bgp group *group-name* local-as loops *loops***
AS-Path-Options: Replace-Peer-AS	**/as-path-options/config/replace-peer-as**	**set protocols bgp group *group-name* as-override**
AS-Path-Options: Disable-Peer-As-Filter	**/as-path-options/config/disable-peer-as-filter**	**set protocols bgp group *group-name* advertise-peer-as**
AFI-SAFI	**/afi-safis/afi-safi/**	Supported. See Table 13 on page 296 to Table 23 on page 308
Graceful-Restart	**/graceful-restart/config/**	Supported. See Table 12 on page 294.
Apply-Policy	**/apply-policy/**	Supported. See Table 25 on page 311.

Table 25: Peer-Group Apply-Policy Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/apply-policy**	
Import-Policies	**/import-policies**	**set protocols bgp import *value***
Default-Import-Policy	**/default-import-policy**	
Export-Policies	**/export-policies**	**set protocols bgp export *value***
Default-Export-Policy	**/default-export-policy**	

Table 26: Neighbors Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor**	
Neighbor-Address	**/config/neighbor-address**	**set protocols bgp group *group-name* neighbor *address***
Peer-AS	**/config/peer-as**	**set protocols bgp group *group-name* neighbor *address* peer-as *peer-as***
Peer-Type	**/config/peer-type**	**set protocols bgp group *group-name* type <*external*|*internal*>**
Auth-Password	**/config/auth-password**	**set protocols bgp group *group-name* neighbor *address* authentication-key *authentication-key***
Remove-Private-AS	**/config/remote-private-as**	**set protocols bgp group *group-name* neighbor *address* remove-private all** **set protocols bgp group *group-name* neighbor *address* remove-private all replace**

Table 26: Neighbors Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Route-Flap-Damping	**/config/route-flap-damping**	**set protocols bgp group *group-name* neighbor *address* damping**
Send-Community	**/config/send-community**	Not supported
Description	**/config/description**	**set protocols bgp group *group-name* neighbor *address* description**
Peer-Group	**/config/peer-group**	**set protocols bgp group *group-name* neighbor *address***
Timers – Connect-Retry	**/timers/config/connect-retry**	**set protocols bgp group *group-name* neighbor *address* connect-retry-interval**
Timers – Hold-Time	**/timers/config/hold-time**	**set protocols bgp group *group-name* neighbor *address* hold-time *hold-time***
Timers - Keepalive-Interval	**/timers/config/keepalive-interval**	Not supported
Timers – Minimum-Advertisement-Interval	**/timers/config/minimum-advertisement-interval**	**set protocols bgp group *group-name* neighbor *address* out-delay *out-delay***
Timers - Send-Update-Delay	**/timers/config/send-update-delay**	Not supported
Transport – TCP-MSS	**/transport/config/tcp-mss**	**set protocols bgp group *group-name* neighbor *address* tcp-mss *tcp-mss***
Transport – MTU-Discovery	**/transport/config/mtu-discovery**	**set protocols bgp group *group-name* neighbor *address* mtu-discovery**
Transport – Passive-Mode	**/transport/config/passive-mode**	**set protocols bgp group *group-name* neighbor *address* passive**
Transport – Local-Address	**/transport/config/local-address**	**set protocols bgp group *group-name* neighbor *address* local-address *local-address***
Error-Handling – Treat-AS-Withdraw	**/error-handling/config/treat-as-withdraw**	**set protocols bgp group *group-name* neighbor *address* bgp-error-tolerance**

Table 26: Neighbors Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Logging-Options – Log-Neighbor-State-Changes	**/logging-options/config /log-neighbor-state-changes**	**set protocols bgp group *group-name* neighbor *address* log-updown**
EBGP-Multihop – Multihop-TTL	**/ebgp-multihop/config/multihop-ttl**	**set protocols bgp group *group-name* neighbor *address* multihop ttl *ttl***
Route-Reflector – Route-Reflector-Cluster-ID	**/route-reflector/config/route-reflector-cluster-id**	**set protocols bgp group *group-name* neighbor *address* cluster *cluster***
Route-Reflector – Route-Reflector-Client	**/route-reflector/config/route-reflector-client**	**set protocols bgp group *group-name* neighbor *address* no-client-reflect**
AS-Path-Options – Allow-Own-AS	**/as-path-options/config/allow-own-as**	**set protocols bgp group *group-name* neighbor *address* local-as loops *loops***
AS-Path-Options – Replace-Peer-AS	**/as-path-options/config/replace-peer-as**	**set protocols bgp group *group-name* neighbor *address* as-override**
AS-Path-Options – Disable-Peer-As-Filter	**/as-path-options/config/disable-peer-as-filter**	**set protocol bgp group *group-name* neighbor *address* advertise-peer-as**
AFI-SAFI	**/afi-safis/afi-safi/**	Supported. See Table 13 on page 296 to Table 23 on page 308
Graceful-Restart	**/graceful-restart/config/**	Supported. See Table 12 on page 294.
Apply-Policy	**/apply-policy/**	Supported. See Table 27 on page 313.

Table 27: Neighbors Apply-Policy Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/apply-policy**	
Import-Policies	**/import-policies**	**set protocols bgp import *value***
Default-Import-Policy	**/default-import-policy**	

Table 27: Neighbors Apply-Policy Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Export-Policies	**/export-policies**	**set protocols bgp export *value***
Default-Export-Policy	**/default-export-policy**	

RELATED DOCUMENTATION

Mapping OpenConfig Routing Policy Commands to Junos Configuration | 339

Mapping OpenConfig Interface Commands to Junos Configuration | 314

Mapping OpenConfig LLDP Commands to Junos Configuration | 321

Mapping OpenConfig Local Routing Commands to Junos Configuration | 323

Mapping OpenConfig MPLS Commands to Junos Configuration | 324

Mapping OpenConfig Interface Commands to Junos Configuration

NOTE: See "OpenConfig Data Model Version" on page 15 topic to understand the data models supported version and its Junos OS release for Juniper Networks MX Series, PTX Series, and QFX Series.

Table 28 on page 315 to Table 35 on page 320 shows the mapping of OpenConfig interface commands to the relevant configuration in Junos.

Table 28: VRRP Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Virtual Router ID	**ifa/vrrp/vrrp-group/config/virtual-router-id**	**set interfaces *interface-name* unit *unit-number* family inet address *address* vrrp-group *virtual-router-id*** **set interfaces *interface-name* unit *unit-number* family inet6 address *address* vrrp-inet6-group *virtual-router-id***
Virtual Address	**ifa/vrrp/vrrp-group/config/virtual-address**	**set interfaces *interface-name* unit *unit-number* family inet address *address* vrrp-group *virtual-router-id* virtual-address *address*** **set interfaces *interface-name* unit *unit-number* family inet6 address *address* vrrp-inet6-group *virtual-router-id* virtual-inet6-address**
VRRP Priority	**ifa/vrrp/vrrp-group/config/priority**	**set interfaces *interface-name* unit *unit-number* family inet address *address* vrrp-group *virtual-router-id* priority** **set interfaces *interface-name* unit *unit-number* family inet6 address *address* vrrp-inet6-group *virtual-router-id* priority**
VRRP Preempt	**ifa/vrrp/vrrp-group/config/preempt**	**set interfaces *interface-name* unit *unit-number* family inet address *address* vrrp-group *virtual-router-id* preempt** **set interfaces *interface-name* unit *unit-number* family inet6 address *address* vrrp-inet6-group *virtual-router-id* preempt**

Table 28: VRRP Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
VRRP Preempt Hold Time	**ifa/vrrp/vrrp-group/config/preempt-delay**	**set interfaces *interface-name* unit *unit-number* family inet address *address* vrrp-group *virtual-router-id* preempt hold-time *time*** **set interfaces *interface-name* unit *unit-number* family inet6 address *address* vrrp-inet6-group *virtual-router-id* preempt hold-time *time***
Accept Data	**ifa/vrrp/vrrp-group/config/accept_mode**	**set interfaces *interface-name* unit *unit-number* family inet address *address* vrrp-group *virtual-router-id* accept-data** **set interfaces *interface-name* unit *unit-number* family inet6 address *address* vrrp-inet6-group *virtual-router-id* accept-data**
Advertise Interval	**ifa/vrrp/vrrp-group/config/advertisement_interval**	**set interfaces *interface-name* unit *unit-number* family inet address *address* vrrp-group *virtual-router-id* advertise-interval** **set interfaces *interface-name* unit *unit-number* family inet6 address *address* vrrp-inet6-group *virtual-router-id* inet6-advertise-interval**

Table 28: VRRP Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Track Interface	**ifa/vrrp/vrrp-group/interface-tracking/config/track-interface**	**set interfaces *interface-name* unit *unit-number* family inet address *address* vrrp-group *virtual-router-id* track interface *interface-name*** **set interfaces *interface-name* unit *unit-number* family inet6 address *address* vrrp-inet6-group *virtual-router-id* track interface *interface-name***
Priority Cost	**ifa/vrrp/vrrp-group/interface-tracking/config/priority-decrement**	**set interfaces *interface-name* unit *unit-number* family inet address *address* vrrp-group *virtual-router-id* track interface *interface-name* priority-cost *cost*** **set interfaces *interface-name* unit *unit-number* family inet6 address *address* vrrp-inet6-group *virtual-router-id* track interface *interface-name* priority-cost *cost***
Virtual Link Local Address	**ifa/vrrp/vrrp-group/config/virtual-link-local**	**set interfaces *interface-name* unit *unit-number* family inet6 address *address* vrrp-inet6-group *virtual-router-id* virtual-link-local-address**

Table 29: IPv4 and IPv6 Address Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Configuration Address	**ipv4/addresses/address/ip** **ipv4/addresses/address/prefix-length**	**set interfaces *interface-name* unit *unit-number* family inet address *address*** **set interfaces *interface-name* unit *unit-number* family inet6 address *address***

Table 29: IPv4 and IPv6 Address Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Neighbor Address	**ipv4/neighbors/neighbor/ip** **ipv6/neighbors/neighbor/ip**	**set interfaces *interface-name* unit *unit-number* family inet address *address* arp *address*** **set interfaces *interface-name* unit *unit-number* family inet6 address *address* ndp *address***
Link Layer Address	**ip4/neighbors/neighbor/ip/link-layer-address** **ip6/neighbors/neighbor/ip/link-layer-address**	**set interfaces *interface-name* unit *unit-number* family inet address *address* arp *address* mac *address*** **set interfaces *interface-name* unit *unit-number* family inet6 address *address* ndp *address* mac *address***

Table 30: Interface AE Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
LAG Type	**/aggregation/config/lag-type/lacp** **/aggregation/config/lag-type/static**	**set interfaces *ae-name* aggregated-ether-options lacp**
Minimum Links	**/aggregation/config/min-links**	**set interfaces *ae-name* aggregated-ether-options minimum-links**

Table 31: LACP Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
LACP Interval	**/lacp/interfaces/interface/config/interval**	**set interfaces *ae-name* aggregated-ether-options lacp periodic fast** **set interfaces *ae-name* aggregated-ether-options lacp periodic slow**
LACP Mode	**/lacp/interfaces/interface/config/lacp-mode**	**set interfaces *ae-name* aggregated-ether-options lacp active** **set interfaces *ae-name* aggregated-ether-options lacp passive**

Table 31: LACP Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
System ID	**/lacp/interfaces/interface/config/system-id-mac**	**set interfaces *ae-name* aggregated-ether-options lacp system-id *address***
System Priority	**/lacp/interfaces/interface/config/system-priority**	**set interfaces *ae-name* aggregated-ether-options lacp system-priority *system-priority***
Ethernet Options	**/lacp/interfaces/interface/members/member**	**set interface *interface* gigether-options 802.3ad** **set interface *interface* fastether-options 802.3ad** **set interface *interface* ether-options 802.3ad**

Table 32: Member Interface Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Aggregate ID	**/interface/aggregate-id**	**set interface *interface* gigether-options 802.3ad *aggregate-id*** **set interface *interface* fastether-options 802.3ad *aggregate-id*** **set interface *interface* ether-options 802.3ad *aggregate-id***

Table 33: Ethernet Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Auto-negotiate	**/ethernet/config/auto-negotiate**	**set interfaces *interface* gigether-options *auto-negotiation/no-auto-negotiation***
MAC Address	**/ethernet/config/mac-address**	**set interfaces *interface* mac**
Duplex Mode	**/ethernet/config/duplex-mode**	**set interfaces *interface* link-mode**
Port Speed	**/ethernet/config/port-speed**	**set interface *interface* speed**
Flow Control	**/ethernet/config/enable-flow-control**	**set interface *interface* gigether-options flow-control**

Table 34: IFD Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Interface Type	**/interfaces/*interface*/config/type**	Not supported. Type is derived from the interface name.
Interface MTU	**/interfaces/*interface*/config/mtu**	**set interface *interface* mtu**
Interface Name	**/interfaces/*interface*/config/name**	**set interface *interface***
Interface Description	**/interfaces/*interface*/config/description**	**set interface *interface* description**
Interface Enabled/Disabled	**/interfaces/*interface*/config/enabled**	**set interface *interface* disabled** **set interface *interface* enabled**
Hold Time Up	**/interfaces/*interface*/config/hold-time/config/up**	**set interface *interface* hold-time up**
Hold Time Down	**/interfaces/*interface*/config/hold-time/config/down**	**set interface *interface* hold-time down**

Table 35: IFL Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Unit Name	**/interfaces/*interface*/subinterfaces/subinterface/config/index**	**set interfaces *interface* unit *unit***
Unnumbered Address	**/interfaces/*interface*/config/subinterfaces/subinterface/config/unnumbered**	**set interfaces *interface* unit *unit* family *family* unnumbered-address source *ifl***
Unit Description	**/interfaces/*interface*/subinterfaces/subinterface/config/description**	**set interfaces *interface* unit *unit* description**

Table 35: IFL Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Unit Enabled/Disabled	**/interfaces/*interface*/subinterfaces/subinterface/config/enabled**	**set interfaces *interface* unit *unit* enabled** **set interfaces *interface* unit *unit* disabled**
Interface Alias	**/interfaces/*interface*/subinterfaces/subinterface/config/name**	**set interfaces *interface* alias**

RELATED DOCUMENTATION

Mapping OpenConfig Routing Policy Commands to Junos Configuration | 339

Mapping OpenConfig BGP Commands to Junos Configuration | 293

Mapping OpenConfig LLDP Commands to Junos Configuration | 321

Mapping OpenConfig Local Routing Commands to Junos Configuration | 323

Mapping OpenConfig MPLS Commands to Junos Configuration | 324

Mapping OpenConfig LLDP Commands to Junos Configuration

NOTE: See "OpenConfig Data Model Version" on page 15 topic to understand the data models supported version and its Junos OS release for Juniper Networks MX Series and PTX Series.

Table 36 on page 322 and Table 37 on page 322 show the mapping of OpenConfig LLDP commands with the relevant configuration in Junos.

Table 36: Global LLDP Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Enable	**/lldp/config/enabled**	**set protocols lldp *enable/disable***
Hello time	**/lldp/config/hello-timer**	**set protocols lldp advertisement-interval *advertisement-interval***
System Information	**/lldp/config/suppress-tlv-advertisement** **/lldp/config/system-name** **/lldp/config/system-description** **/lldp/config/chassis-id** **/lldp/config/chassis-id-type**	Not supported

Table 37: Interface Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Interface Config	**/lldp/interfaces/interface/config/name** **/lldp/interfaces/interface/config/enabled**	**set protocols lldp interface *interface-name* enable**

RELATED DOCUMENTATION

- Mapping OpenConfig Routing Policy Commands to Junos Configuration | 339
- Mapping OpenConfig Interface Commands to Junos Configuration | 314
- Mapping OpenConfig Local Routing Commands to Junos Configuration | 323
- Mapping OpenConfig BGP Commands to Junos Configuration | 293
- Mapping OpenConfig MPLS Commands to Junos Configuration | 324

Mapping OpenConfig Local Routing Commands to Junos Configuration

> **NOTE:** See "OpenConfig Data Model Version" on page 15 topic to understand the data models supported version and its Junos OS release for Juniper Networks MX Series, PTX Series, and QFX Series.

Table 38 on page 323 and Table 39 on page 323 show the mapping of OpenConfig local routing commands to the relevant configuration in Junos.

Table 38: Static Route Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/local-routes/static-routes**	
Local Static Prefix	**/static/config/prefix**	**set routing-options static route *prefix***
Local Static Next Hop	**/static/config/prefix** **/static/config/next-hop/*ip-address*** **/static/config/next-hop/*local-defined-next-hop*** **/static/config/next-hop/*string***	**set routing-options static route *prefix* next-hop (*address* | *interface*)** **set routing-options static route *prefix* discard**
Local Static Tag	**/static/config/prefix** **/static/config/set-tag**	**set routing-options static route *prefix* tag *tag***

Table 39: Local Aggregate Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/local-routes/local-aggregates**	
Local Aggregate Prefix	**/aggregate/config/prefix**	**set routing-options aggregate route *prefix***

Table 39: Local Aggregate Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Local Aggregate Discard	**/aggregate/config/prefix** **/aggregate/config/discard**	**set routing-options aggregate route *prefix* discard**
Local Aggregate Tag	**/aggregate/config/prefix** **/aggregate/config/set-tag**	**set routing-options aggregate route *prefix* tag *tag***

RELATED DOCUMENTATION

Mapping OpenConfig BGP Commands to Junos Configuration | 293

Mapping OpenConfig Interface Commands to Junos Configuration | 314

Mapping OpenConfig LLDP Commands to Junos Configuration | 321

Mapping OpenConfig MPLS Commands to Junos Configuration | 324

Mapping OpenConfig Routing Policy Commands to Junos Configuration | 339

Mapping OpenConfig MPLS Commands to Junos Configuration

NOTE: See "OpenConfig Data Model Version" on page 15 topic to understand the data models supported version and its Junos OS release for Juniper Networks MX Series, PTX Series, and QFX Series.

Table 40 on page 325 to Table 45 on page 332 show the mapping of OpenConfig MPLS commands with the relevant configuration in Junos.

Table 40: Global MPLS Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Explicit Null	**/mpls/global/config/null-label/explicit** **/mpls/global/config/null-label/implicit**	**set protocols mpls explicit-null**
Interface	**/mpls/global/interface-attributes/interface/config/interface-id** **/mpls/global/interface-attributes/interface/config/mpls-enabled** **/mpls/global/interface-attributes/interface/interface-ref/config/interface** **/mpls/global/interface-attributes/interface/interface-ref/config/subinterface**	**set protocols mpls interface *interface*** **set protocols mpls interface *interface* disable**

Table 41: TE Global Attributes

Command Name	*OpenConfig Command Path*	*Junos Configuration*
SRLGs	**/mpls/te-global-attributes/srlg/srlg/config/name**	Flooded: **set routing-options srlg *name*** Static: **set routing-options fate-sharing group *name***
SRLG Value	**/mpls/te-global-attributes/srlg/srlg/config/value**	**set routing-options fate-sharing group *name* srlg-value *value***
SRLG Cost	**/mpls/te-global-attributes/srlg/srlg/config/cost**	Flooded: **set routing-options srlg *name* srlg-cost *cost*** Static: **set routing-options fate-sharing group *name* cost *cost***
Address	**/mpls/te-global-attributes/srlg/srlg/static-srlg-members/members-list/config/from-address** **/mpls/te-global-attributes/srlg/srlg/static-srlg-members/members-list/config/to-address**	**set routing-options fate-sharing group *name* from *address* to *address***

Table 41: TE Global Attributes *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Admin Groups	**/mpls/te-global-attributes/mpls-admin-groups/admin-group/config/admin-group-name** **/mpls/te-global-attributes/mpls-admin-groups/admin-group/config/bit-position**	Bit position (group-value) 0-31: **set protocols mpls admin-groups *group-name group-value*** Bit position (group-value) 32-4294967295: **set routing-options admin-groups-extended *group-name* group-value *group-value***
Delay	**/mpls/te-global-attributes/te-lsp-timers/config/install-delay** **/mpls/te-global-attributes/te-lsp-timers/config/cleanup-delay** **/mpls/te-global-attributes/te-lsp-timers/config/reoptimize-timer**	**set protocols mpls optimize-switchover-delay *delay*** **set protocols mpls optimize-hold-dead-delay *delay*** **set protocols mpls optimize-timer *timer***

Table 42: TE Interface Attributes

Command Name	*OpenConfig Command Path*	*Junos Configurat*
TE Interface	**/mpls/te-interface-attributes/interface/config/interface-id** **/mpls/te-interface-attributes/interface/interface-ref/config/interface** **/mpls/te-interface-attributes/interface/interface-ref/config/subinterface**	**set protocols osp *id* interface *interf***
TE Metric	**/mpls/te-interface-attributes/interface/config/te-metric**	**set protocols osp *id* interface *interf* te-metric *te-metr*** **set protocols isis interface *interfac* *level* te-metric *te-***
SRLG Membership	**/mpls/te-interface-attributes/interface/config/srlg-membership**	**set protocols mpl interface *name* srl**

Table 42: TE Interface Attributes *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configurat*
Admin Groups	**/mpls/te-interface-attributes/interface/config/admin-group**	If **protocols mpls admin-groups *nar*** configured: **set protocols mpl interface *name* admin-group *nam*** If **routing-options admin-groups-ex *name*** is configure **set protocols mpl interface *name* admin-group-ext *name***
IGP Flooding Bandwidth	**/mpls/te-interface-attributes/interface/igp-flooding-bandwidth/config/threshold-type** **/mpls/te-interface-attributes/interface/igp-flooding-bandwidth/config/delta-percentage**	**set protocols rsvp interface *name* update-threshold *threshold***
	/mpls/te-interface-attributes/interface/igp-flooding-bandwidth/config/threshold-specification **/mpls/te-interface-attributes/interface/igp-flooding-bandwidth/config/up-thresholds** **/mpls/te-interface-attributes/interface/igp-flooding-bandwidth/config/down-thresholds** **/mpls/te-interface-attributes/interface/igp-flooding-bandwidth/config/up-down-thresholds**	Not supported

Table 43: RSVP Signaling Protocols

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Graceful Restart	**/mpls/signaling-protocols/rsvp-te/global/graceful-restart/config/enable** **/mpls/signaling-protocols/rsvp-te/global/graceful-restart/config/restart-time** **/mpls/signaling-protocols/rsvp-te/global/graceful-restart/config/recovery-time**	**set protocols rsvp graceful-restart enable** **set protocols rsvp graceful-restart maximum-helper-recovery-time *time*** **set protocols rsvp graceful-restart maximum-helper-restart-time *time***
Cleanup Timer	**/mpls/signaling-protocols/rsvp-te/global/soft-preemption/config/enable** **/mpls/signaling-protocols/rsvp-te/global/soft-preemption/config/soft-preemption-timeout**	**set protocols rsvp preemption soft-preemption cleanup-timer *timer***
Hello Interval (All Interfaces)	**/mpls/signaling-protocols/rsvp-te/global/hellos/config/hello-interval** **/mpls/signaling-protocols/rsvp-te/global/hellos/config/refresh-reduction**	**set protocols rsvp interface all hello-interval *interval*** **set protocols rsvp interface all no-reliable**
Hello Interval (Single Interface)	**/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/config/interface-id** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/interface-ref/config/interface** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/config/interface-name** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/hellos/config/hello-interval** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/hellos/config/refresh-reduction**	**set protocols rsvp interface *name* hello-interval *interval*** **set protocols rsvp interface *name* no-reliable**

Table 43: RSVP Signaling Protocols *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Authentication Key	**/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/config/interface-id** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/interface-ref/config/interface** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/interface-ref/config/subinterface** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/authentication/config/enable** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/authentication/config/authentication-key**	**set protocols rsvp interface *name* authentication-key *key***
Subscription	**/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/config/interface-id** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/interface-ref/config/interface** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/interface-ref/config/subinterface** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/subscription/config/subscription**	**set protocols rsvp interface *name* subscription *subscription***
Link Protection	**/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/config/interface-id** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/interface-ref/config/interface** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/interface-ref/config/subinterface** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/protection/config/link-protection-style-requested/unprotected** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/protection/config/link-protection-style-requested/link-protection-requested** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/protection/config/link-protection-style-requested/link-node-protection-requested** **/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/protection/config/bypass-optimize-interval**	**set protocols rsvp interface *name* link-protection** To disable node-protection: **set protocols rsvp interface *name* link-protection no-node-protection** **set protocols rsvp interface *name* link-protection optimize-timer *timer***

Table 44: Label Switched Paths

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Path	**/mpls/lsps/constrained-path/named-explicit-paths/config/name** **/mpls/lsps/constrained-path/named-explicit-paths/explicit-route-objects/config/address** **/mpls/lsps/constrained-path/named-explicit-paths/explicit-route-objects/config/hop-type** **/mpls/lsps/constrained-path/named-explicit-paths/explicit-route-objects/config/index**	**set protocols mpls path *name address hop-type***
Name	**/mpls/lsps/constrained-path/tunnel/config/name** **/mpls/lsps/constrained-path/tunnel/config/type/P2P** **/mpls/lsps/constrained-path/tunnel/config/signaling-protocol/path-setup-rsvp**	**set protocols mpls label-switched-path *name***
Description	**/mpls/lsps/constrained-path/tunnel/config/description**	**set protocols mpls label-switched-path *name* description *description***
Admin-Status	**/mpls/lsps/constrained-path/tunnel/config/admin-status**	**set protocols mpls label-switched-path *name* disable**
Preference	**/mpls/lsps/constrained-path/tunnel/config/preference**	**set protocols mpls label-switched-path *name* preference *preference***
Metric	**/mpls/lsps/constrained-path/tunnels/tunnel/config/metric-type** **/mpls/lsps/constrained-path/tunnels/tunnel/config/shortcut-eligible** **/mpls/lsps/constrained-path/tunnel/config/metric**	**set protocols mpls label-switched-path *name* metric *metric***
Link Protection	**/mpls/lsps/constrained-path/tunnel/config/protection-style-requested/unprotected** **/mpls/lsps/constrained-path/tunnel/config/protection-style-requested/link-protection-requested** **/mpls/lsps/constrained-path/tunnel/config/protection-style-requested/link-node-protection-requested**	**set protocols mpls label-switched-path *name* link-protection** **set protocols mpls label-switched-path *name* node-link-protection**

Table 44: Label Switched Paths *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Optimize Timer	**/mpls/lsps/constrained-path/tunnel/config/reoptimize-timer**	**set protocols mpls label-switched-path *name* optimize-timer *timer***
Source	**/mpls/lsps/constrained-path/tunnel/config/source**	**set protocols mpls label-switched-path *name* from *from***
Soft Preemption	**/mpls/lsps/constrained-path/tunnel/config/soft-preemption**	**set protocols mpls label-switched-path *name* soft-preemption**
Priority	**/mpls/lsps/constrained-path/tunnel/config/setup-priority** **/mpls/lsps/constrained-path/tunnel/config/hold-priority**	**set protocols mpls label-switched-path *name* priority *setup reservation***
Bandwidth	**/mpls/lsps/constrained-path/tunnel/bandwidth/config/specification-type/specified** **/mpls/lsps/constrained-path/tunnel/bandwidth/config/set-bandwidth**	**set protocols mpls label-switched-path *name* bandwidth *bandwidth***
Min/Max Bandwidth	**/mpls/lsps/constrained-path/tunnel/bandwidth/config/specification-type/auto** **/mpls/lsps/constrained-path/tunnel/bandwidth/auto-bandwidth/config/enabled** **/mpls/lsps/constrained-path/tunnel/bandwidth/auto-bandwidth/config/min-bw** **/mpls/lsps/constrained-path/tunnel/bandwidth/auto-bandwidth/config/max-bw** **/mpls/lsps/constrained-path/tunnel/bandwidth/auto-bandwidth/config/adjust-interval** **/mpls/lsps/constrained-path/tunnel/bandwidth/auto-bandwidth/config/adjust-threshold**	**set protocols mpls label-switched-path *name* minimum-bandwidth *minimum*** **set protocols mpls label-switched-path *name* maximum-bandwidth *maximum*** **set protocols mpls label-switched-path *name* adjust-interval *interval*** **set protocols mpls label-switched-path *name* adjust-threshold *threshold***

Table 44: Label Switched Paths *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Overflow Bandwidth	**/mpls/lsps/constrained-path/tunnel/bandwidth/config/specification-type/auto** **/mpls/lsps/constrained-path/tunnel/auto-bandwidth/overflow/config/enabled** **/mpls/lsps/constrained-path/tunnel/bandwidth/auto-bandwidth/overflow/config/overflow-threshold** **/mpls/lsps/constrained-path/tunnel/bandwidth/auto-bandwidth/overflow/config/trigger-event-count**	**set protocols mpls label-switched-path *name* auto-bandwidth adjust-threshold-overflow-limit**
Underflow Bandwidth	**/mpls/lsps/constrained-path/tunnel/bandwidth/config/specification-type/auto** **/mpls/lsps/constrained-path/tunnel/auto-bandwidth/underflow/config/enabled** **/mpls/lsps/constrained-path/tunnel/bandwidth/auto-bandwidth/underflow/config/underflow-threshold** **/mpls/lsps/constrained-path/tunnel/bandwidth/auto-bandwidth/underflowflow/config/trigger-event-count**	**set protocols mpls label-switched-path *name* auto-bandwidth adjust-threshold-underflow-limit**

Table 45: RSVP P2P Tunnel

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Destination	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/config/destination**	**set protocols mpls label-switched-path *name* to *to***
Primary Path	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/name**	**set protocols mpls label-switched-path *name***

Table 45: RSVP P2P Tunnel *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Primary Path - Locally-Computed	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/path-computation-method/locally-computed** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/use-cspf** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/cspf-tiebreaker/random** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/cspf-tiebreaker/least-fill** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/cspf-tiebreaker/most-fill**	**set protocols mpls label-switched-path *name* no-cspf** **set protocols mpls label-switched-path *name* random** **set protocols mpls label-switched-path *name* least-fill** **set protocols mpls label-switched-path *name* most-fill**
Primary Path - Externally Queried	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/path-computation-method/externally-queried**	**set protocols mpls label-switched-path *name* lsp-external-controller pccd** **set protocols pcep pce *name* destination-ipv4-address *address*** **set protocols pcep pce *name* destination-port 4189**
Primary Path - Explicitly Defined	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/path-computation-method/explicitly-defined** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/explicit-path-name**	**set protocols mpls label-switched-path *name* primary *path***
Primary Path - Preference	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/preference**	**set protocols mpls label-switched-path *name* primary *path* preference *preference***
Primary Path - Priorities	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/setup-priority** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/hold-priority**	**set protocols mpls label-switched-path *name* primary *path* priority *setup reservation***

Table 45: RSVP P2P Tunnel *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Primary Path - Retry Timer	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/config/retry-timer**	**set protocols mpls label-switched-path *name* retry-timer**
Primary Path - Candidate Secondary Paths	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/candidate-secondary-paths**	Not supported
Primary Path – Admin-Groups	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/admin-groups/config/exclude-group** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/admin-groups/config/include-all-group** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/admin-groups/config/include-any-group**	**set protocols mpls label-switched-path *name* primary *path* admin-group exclude *group*** **set protocols mpls label-switched-path *name* primary *path* admin-group exclude *group*** **set protocols mpls label-switched-path *name* primary *path* admin-group include-any *group***
Secondary Path	**/mpls/lsps/constrained-path/tunnel/config/name** **/mpls/lsps/constrained-path/tunnel/config/type/P2P** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/name**	**set protocols mpls label-switched-path *name***
Secondary Path - Locally-Computed	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/path-computation-method/locally-computed** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/use-cspf** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/cspf-tiebreaker/random** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/cspf-tiebreaker/least-fill** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/cspf-tiebreaker/most-fill**	**set protocols mpls label-switched-path *name* secondary *path name* no-cspf**

Table 45: RSVP P2P Tunnel *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Secondary Path - Externally Queried	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/path-computation-method/externally-queried**	Not supported
Secondary Path - Explicitly Defined	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/path-computation-method/explicitly-defined** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/explicit-path-name**	**set protocols mpls label-switched-path *name* secondary *path***
Secondary Path - Preference	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/preference**	**set protocols mpls label-switched-path *name* secondary *path* preference *preference***
Secondary Path - Priorities	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/setup-priority** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/hold-priority**	**set protocols mpls label-switched-path *name* secondary *path* priority *setup reservation***
Secondary Path - Retry Timer	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/retry-timer**	**set protocols mpls label-switched-path *name* secondary *path* retry-timer**
Secondary Path - Admin-Groups	**/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/admin-groups/config/exclude-group** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/admin-groups/config/include-all-group** **/mpls/lsps/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/admin-groups/config/include-any-group**	**set protocols mpls label-switched-path *name* secondary *path* admin-group exclude *group*** **set protocols mpls label-switched-path *name* secondary *path* admin-group include-all *group*** **set protocols mpls label-switched-path *name* secondary *path* admin-group include-any *group***

RELATED DOCUMENTATION

Mapping OpenConfig BGP Commands to Junos Configuration | 293
Mapping OpenConfig Interface Commands to Junos Configuration | 314
Mapping OpenConfig LLDP Commands to Junos Configuration | 321
Mapping OpenConfig Local Routing Commands to Junos Configuration | 323
Mapping OpenConfig Routing Policy Commands to Junos Configuration | 339

Mapping OpenConfig Network Instance Commands to Junos Operation

NOTE: See "OpenConfig Data Model Version" on page 15 topic to understand the data models supported version and its Junos OS release for Juniper Networks MX Series, PTX Series, and QFX Series.

Network instance models a generic virtual forwarding table on a device. This supports a Layer 3 forwarding construct such as a virtual routing and forwarding (VRF) instance, or a Layer 2 instance such as a virtual switch instance. A mixed Layer 2 and Layer 3 instances are also supported.

Starting with Junos OS Release 17.4R1, network instance based BGP configuration is supported. After the network instance is configured, you will be prompted with options for BGP configuration such as global bgp, neighbor bgp, and so on.

NOTE: There is no change in the existing BGP configuration, you can configure BGP in a specific network instance.

Table 46 on page 337 details the network instance commands.

Table 46: Network Instance

Resource Path	Description
/network-instances/network-instance/config/name	An assigned unique name for the forwarding instance. In Junos, you need to provide a name because you do not run different BGP in the same routing instance.
/network-instances/network-instance/config/name/description	Description of the network instance.
/network-instances/network-instance/config/type	Type of network instance: • default_instance • l3vrf • l2vsi • l2p2p • l2l3 **NOTE:** Only default_instance and l3vrf instances are supported.
/network-instances/network-instance/config/enabled	Whether the network instance should be configured to be active on the network element: *True* or *False*. By default, the value is *True*.
/network-instances/network-instance/config/router-id	An identifier for the local network instance.
/network-instances/network-instance/config/route-distinguisher	The route distinguisher that should be used for the local VRF instance when it is signalled through BGP.

Table 46: Network Instance *(continued)*

Resource Path	Description
/network-instances/network-instance/interfaces/config/interface	Name of interfaces belonging to this routing instance.
/network-instances/network-instance/protocols/protocol/config/identifier	Type of identifier: • BGP • ISIS • OSPF • OSPF3 • STATIC • DIRECTLY_CONNECTED • LOCAL_AGGREGATE **NOTE:** Only BGP is supported.
/network-instances/network-instance/protocols/protocol/config/name	A unique name for the protocol instance. This is not a mandatory field.
• **/network-instances/network-instance/protocols/protocol/config/name/enable** • **/network-instances/network-instance/protocols/protocol/config/name/target-table** • **/network-instances/network-instance/inter-instance-policies/apply-policy/config/** • **/network-instances/network-instance/table-connections/table-connection/config/src-table** • **/network-instances/network-instance/table-connections/table-connection/config/dst-table** • **/network-instances/network-instance/table-connections/table-connection/config/tables**	Not supported.

Release History Table

Release	Description
17.4R1	Starting with Junos OS Release 17.4R1, network instance based BGP configuration is supported.

RELATED DOCUMENTATION

Mapping OpenConfig BGP Commands to Junos Configuration | 293

Mapping OpenConfig Routing Policy Commands to Junos Configuration

NOTE: See "OpenConfig Data Model Version" on page 15 topic to understand the data models supported version and its Junos OS release for Juniper Networks MX Series, PTX Series, and QFX Series.

Table 47 on page 339 to Table 49 on page 340 show the mapping of OpenConfig routing policy commands to the relevant configuration in Junos.

Table 47: Defined Set Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Prefix Set	**/routing-policy/defined-sets/prefix-set**	**set policy-options prefix-list *name***
Neighbor Set	**/routing-policy/defined-sets/neighbor-set**	**set policy-options neighbor-list *name***
Tag Set	**/routing-policy/defined-sets/tag-set**	**set policy-options tag-list *name* tag-set *value***

Table 48: BGP Defined Set Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Community Set	**/routing-policy/defined-sets/bgp-defined-sets/community-set**	**set policy-options community *name* members *value***
AS Path Set	**/routing-policy/defined-sets/bgp-defined-sets/as-path-set**	Not supported
Ext Community Set	**/routing-policy/defined-sets/bgp-defined-sets/ext-community-set**	**set policy-options community *name* members *value***

Table 49: Policy Definition Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/routing-policy/policy-definition/statement**	
Call Policy	**/conditions/call-policy**	**set policy-options policy-statement *name* from policy *value***
Prefix Set	**/conditions/match-prefix-set/prefix-set**	**set policy-options policy-statement *name* from prefix-list *name*** **set policy-options policy-statement *name* from route-filter *address* prefix-length-range *range***
Match Set Options	**/conditions/match-prefix-set/match-set-options**	Not supported
Neighbor Set	**/conditions/match-neighbor-set/neighbor-set**	**set policy-options policy-statement *name* from neighbor *address***
Match Neighbor Set	**/conditions/match-neighbor-set/match-set-options**	Not supported
Tag Set	**/conditions/match-tag-set/tag-set**	**set policy-options policy-statement *name* from tag *tag***
Match Tag Set	**/conditions/match-tag-set/match-set-options**	Not supported

Table 49: Policy Definition Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Install Protocol EQ	**/conditions/install-protocol-eq**	**set policy-options policy-statement *name* from protocol *protocol***
IGP Conditions	**/conditions/igp-conditions**	Not supported
BGP Match Community Set	**/conditions/bgp-conditions/match-community-set/community-set**	**set policy-options policy-statement *name* from community *name***
BGP Match Ext Community Set	**/conditions/bgp-conditions/match-ext-community-set**	**set policy-options policy-statement *name* from community *name***
BGP Match Ext Community Set Options	**/conditions/bgp-conditions/match-ext-community-set/match-set-options**	Not supported
BGP Match AS Path Set	**/conditions/bgp-conditions/match-as-path-set**	Not supported
BGP MED EQ	**/conditions/bgp-conditions/med-eq**	**set policy-options policy-statement *name* from metric *metric***
BGP Origin EQ	**/conditions/bgp-conditions/origin-eq**	**set policy-options policy-statement *name* from origin (egp | igp | incomplete)**
BGP Next Hop	**/conditions/bgp-conditions/next-hop-in**	**set policy-options policy-statement *name* from next-hop *address***

Table 49: Policy Definition Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
BGP Local Preference EQ	**/conditions/bgp-conditions/local-pref-eq**	**set policy-options policy-statement *name* from local-preference *preference***
BGP Community Count	**/conditions/bgp-conditions/community-count**	**set policy-options policy-statement *name* from community-count *count* (equal | orhigher |orlower)**
BGP AS Path Length	**/conditions/bgp-conditions/as-path-length**	Not supported
Accept-Route	**/actions/config/accept-route**	**set policy-options policy-statement example-accept then accept**
Reject-Route	**/actions/config/reject-route**	**set policy-options policy-statement example-reject then reject**
IGP Actions	**/actions/igp-actions/set-tag**	**set policy-options policy-statement *name* then tag *tag***
BGP Actions Set AS Path Prepend	**/actions/bgp-actions/set-as-path-prepend**	Not supported
BGP Actions Set Community	**/actions/bgp-actions/set-community**	**set policy-options policy-statement *name* then community (set | replace | add) *name***

Table 49: Policy Definition Configuration *(continued)*

Command Name	*OpenConfig Command Path*	*Junos Configuration*
BGP Actions Set Ext Community	**/actions/bgp-actions/set-ext-community**	**set policy-options policy-statement *name* then community (set | replace | add) *name***
BGP Actions Set Route Origin	**/actions/bgp-actions/set-route-origin**	**set policy-options policy-statement *name* then origin (egp |igp | incomplete)**
BGP Actions Set Local Preferences	**/actions/bgp-actions/set-local-pref**	**set policy-options policy-statement *name* then local-preference *preference***
BGP Actions Set Next Hop	**/actions/bgp-actions/set-next-hop**	**set policy-options policy-statement *name* then next-hop *address***
BGP Actions Set Med	**/actions/bgp-actions/set-med**	**set policy-options policy-statement *name* then metric *metric***
BGP Actions As-Path-Prepend	**/actions/bgp-actions/config/set-as-path-prepend/asn**	**set policy-options policy-statement *name* then as-path-prepend *as-path***

RELATED DOCUMENTATION

Mapping OpenConfig BGP Commands to Junos Configuration | 293

Mapping OpenConfig Interface Commands to Junos Configuration | 314

Mapping OpenConfig VLAN Commands to Junos Configuration

NOTE: See "OpenConfig Data Model Version" on page 15 topic to understand the data models supported version and its Junos OS release for Juniper Networks EX Series and QFX Series.

Table 12 on page 294 to Table 53 on page 345 show the mapping of OpenConfig VLAN commands with the relevant configuration in Junos.

Table 50: Top Level Group VLAN Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
Interface VLAN ID	**vlans/vlan/vlan-id**	**set vlans *vlan-name* vlan-id *vid***
Interface VLAN Name	**vlans/vlan/name**	
VLAN Admin State	**vlans/vlan/status**	**deactivate vlans *vlan-name***

Table 51: VLAN Tagged IFL Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/ocif:interfaces/ocif:interface/ocif:subinterfaces/ocif:subinterface/vlan**	
VLAN ID	**/config/vlan-id**	**set interfaces *interface* unit *subinterface index* vlan-id *vid*** **set interfaces *interface* vlan-tagging**

Table 52: VLAN Membership Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/oc-if:interfaces/oc-if:interface/oc-eth:ethernet/switched-vlan**	
Interface Mode	**/config/interface-mode**	**set interfaces ge-0/0/0 unit 0 family ethernet-switching interface-mode trunk** (l2ng)
Native VLAN	**/config/native-vlan**	**set interfaces ge-0/0/0 native-vlan-id *vid*** (for a trunk port) **set interface ge-0/0/0 unit 0 family ethernet-switching interface-mode trunk**
Trunk VLANs	**/config/trunk-vlans**	**set interfaces ge-0/0/0 unit 0 family ethernet-switching vlan members 600** **set interfaces ge-0/0/0 unit 0 family ethernet-switching vlan members [10-200]** **Interface-mode = TRUNK**
Access VLAN	**/config/access-vlan**	**set interfaces ge-0/0/0 unit 0 family ethernet-switching vlan members 600** **Interface-mode = ACCESS**

Table 53: Routed VLAN Interfaces Configuration

Command Name	*OpenConfig Command Path*	*Junos Configuration*
	Command path prefix: **/oc-if:interfaces/oc-if:interface/routed-vlan**	
VLAN	**/config/vlan**	**Set vlans *vlan-name* l3-interface irb.*vid*** **NOTE:** To create IRB IFL, configure IPv4/IPv6 under routed VLAN hierarchy.

RELATED DOCUMENTATION

Mapping OpenConfig Interface Commands to Junos Configuration | 314

Mapping OpenConfig Local Routing Commands to Junos Configuration | 323

Mapping OpenConfig Network Instance Commands to Junos Operation | 336

Mapping OpenConfig Routing Policy Commands to Junos Configuration | 339

4

CHAPTER

Configuration Statements

netconf

Syntax

```
netconf {
    rfc-compliant;
    ssh {
        connection-limit limit;
        port port;
        rate-limit limit;
    }
    traceoptions {
        file <filename> <files number> <match regular-expression> <size size> <world-readable | no-world-readable>;
        flag flag;
        no-remote-trace;
        on-demand;
    }
    yang-compliant;
    yang-modules {
        device-specific;
        emit-extensions;
    }
}
```

Hierarchy Level

```
[edit system services]
```

Release Information

Statement introduced in Junos OS Release 7.5.

Description

Configure the NETCONF XML management protocol.

The remaining statements are explained separately. See CLI Explorer.

Default

If you do not include the **netconf** statement, NETCONF connections are not permitted.

Required Privilege Level

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

RELATED DOCUMENTATION

connection-limit

port (NETCONF)

rate-limit

ssh (NETCONF)

traceoptions (NETCONF and Junos XML Protocol)

schema

Syntax

```
schema {
    openconfig {
        unhide;
    }
}
```

Hierarchy Level

```
[edit system]
```

Release Information

Statement introduced in Junos OS Release 18.3R1.

Description

Specify whether OpenConfig statements are available and viewable in the CLI.

Options

openconfig unhide—Unhide the OpenConfig statements in the CLI. By default, the OpenConfig schema is not available through the CLI. To rehide the OpenConfig statements, use the following command:

```
delete system schema openconfig unhide
```

Required Privilege Level

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

RELATED DOCUMENTATION

Installing the OpenConfig Package | 21

track-igp-metric (LSP)

Syntax

```
track-igp-metric <install-v4-prefixes> <install-v6-prefixes>;
```

Hierarchy Level

The hierarchy level for **track-igp-metric** globally enabled for all LSPs:

```
[edit protocols mpls]
```

The hierarchy level for **track-igp-metric** at the per LSP level:

```
[edit protocols mpls label-switched-path pathname],
```

Release Information

Statement introduced in Junos OS Release 18.4R1.

Description

Track IGP metric for LSP install prefixes

Options

install-v4-prefixes—Track IGP metric for IPV4 prefixes.

install-v6-prefixes—Track IGP metric for IPV6 prefixes.

Required Privilege Level

routing

RELATED DOCUMENTATION

Install Prefix IGP Overview