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Junos<sup>®</sup> OS

## OpenConfig Feature Guide

Release  
18.2



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*Junos® OS OpenConfig Feature Guide*

18.2

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# About the Documentation

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## Documentation and Release Notes

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To obtain the most current version of all Juniper Networks<sup>®</sup> 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.

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## Supported Platforms

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

- QFX Series
- MX Series
- PTX Series
- EX Series

## Using the Examples in This Manual

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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.xml;
    }
  }
}
interfaces {
  fxp0 {
    disable;
    unit 0 {
      family inet {
        address 10.0.0.1/24;
      }
    }
  }
}
```

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

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

## Merging a Snippet

To merge a snippet, follow these steps:

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

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

```
commit {
```



```
file ex-script-snippet.xml; }
```

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

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

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

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

For more information about the **load** command, see [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 x defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
<b>Bold text like this</b>	Represents text that you type.	To enter configuration mode, type the <b>configure</b> command:  user@host> <b>configure</b>
Fixed-width text like this	Represents output that appears on the terminal screen.	user@host> <b>show chassis alarms</b>  No alarms currently active
<i>Italic text like this</i>	<ul style="list-style-type: none"> <li>Introduces or emphasizes important new terms.</li> <li>Identifies guide names.</li> <li>Identifies RFC and Internet draft titles.</li> </ul>	<ul style="list-style-type: none"> <li>A policy <i>term</i> is a named structure that defines match conditions and actions.</li> <li><i>Junos OS CLI User Guide</i></li> <li>RFC 1997, <i>BGP Communities Attribute</i></li> </ul>
<i>Italic text like this</i>	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name:  [edit] root@# <b>set system domain-name</b> <i>domain-name</i>
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none"> <li>To configure a stub area, include the <b>stub</b> statement at the [edit protocols <b>ospf area area-id</b>] hierarchy level.</li> <li>The console port is labeled <b>CONSOLE</b>.</li> </ul>
< > (angle brackets)	Encloses optional keywords or variables.	<b>stub</b> <default-metric <i>metric</i> >;
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	<b>broadcast</b>   <b>multicast</b>  ( <i>string1</i>   <i>string2</i>   <i>string3</i> )
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	<b>rsvp { # Required for dynamic MPLS only</b>
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	<b>community name members</b> [ <b>community-ids</b> ]
Indentation and braces ( { } )	Identifies a level in the configuration hierarchy.	[edit] routing-options { static { route default { nexthop <i>address</i> ; retain; } } }
;(semicolon)	Identifies a leaf statement at a configuration hierarchy level.	

## GUI Conventions

Table 2: Text and Syntax Conventions (continued)

Convention	Description	Examples
<b>Bold text like this</b>	Represents graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none"> <li>In the Logical Interfaces box, select <b>All Interfaces</b>.</li> <li>To cancel the configuration, click <b>Cancel</b>.</li> </ul>
<b>&gt;</b> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select <b>Protocols&gt;Ospf</b> .

## Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can provide feedback by using either of the following methods:

- Online feedback rating system—On any page of the Juniper Networks TechLibrary site at <https://www.juniper.net/documentation/index.html>, simply click the stars to rate the content, and use the pop-up form to provide us with information about your experience. Alternately, you can use the online feedback form at <https://www.juniper.net/documentation/feedback/>.
- E-mail—Send your comments to [techpubs-comments@juniper.net](mailto: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 J-Care or Partner Support Service 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.

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- 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/>
- Open a case online in the CSC Case Management tool: <https://www.juniper.net/cm/>

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

## Opening a Case with JTAC

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

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

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

## PART 1

# Overview

- [OpenConfig Overview on page 3](#)
- [gRPC Overview on page 11](#)
- [OpenConfig to Junos Mapping on page 111](#)



## CHAPTER 1

# OpenConfig Overview

- [OpenConfig Overview on page 3](#)
- [OpenConfig Data Model Version on page 4](#)
- [Installing the OpenConfig Package on page 8](#)

## OpenConfig Overview

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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

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

#### Related Documentation

- [OpenConfig Data Model Version on page 4](#)
- [Understanding YANG on Devices Running Junos OS](#)
- [NETCONF XML Management Protocol Developer Guide](#)

## OpenConfig Data Model Version

Table 3 on page 4 lists the OpenConfig data model versions.

Table 3: OpenConfig Data Model Versions

OpenConfig Data Model	Junos OS Release	OpenConfig Supported Version	Supported Platform
• BGP ( <a href="#">openconfig-bgp.yang</a> )	16.1	2.0.1	Juniper Networks MX Series and PTX Series
• BGP NEIGHBOR ( <a href="#">openconfig-bgp-neighbor.yang</a> )	17.1	2.1.1	
• BGP POLICY ( <a href="#">openconfig-bgp-policy.yang</a> )	17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2		Juniper Networks MX Series, PTX Series, and QFX Series
• BGP TYPES ( <a href="#">openconfig-bgp-types.yang</a> )			
• BGP COMMON ( <a href="#">openconfig-bgp-common.yang</a> )	17.1	2.1.1	Juniper Networks MX Series and PTX Series
• BGP COMMON MULTIPROTOCOL ( <a href="#">openconfig-bgp-common-multiprotocol.yang</a> )	17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2		Juniper Networks MX Series, PTX Series, and QFX Series
• BGP COMMON STRUCTURE ( <a href="#">openconfig-bgp-common-structure.yang</a> )			
• BGP GLOBAL ( <a href="#">openconfig-bgp-global.yang</a> )			
• BGP PEER GROUP ( <a href="#">openconfig-bgp-peer-group.yang</a> )			



Table 3: OpenConfig Data Model Versions (continued)

OpenConfig Data Model	Junos OS Release	OpenConfig Supported Version	Supported Platform
<ul style="list-style-type: none"> <li>IF AGGREGATE (<b>openconfig-if-aggregate.yang</b>)</li> <li>IF ETHERNET (<b>openconfig-if-ethernet.yang</b>)</li> <li>IF IP (<b>openconfig-if-ip.yang</b>)</li> <li>IF IP EXT (<b>openconfig-if-ip-ext.yang</b>)</li> <li>INTERFACES (<b>openconfig-interfaces.yang</b>)</li> </ul>	16.1, 17.1, 17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2	1.0.1	Juniper Networks MX Series and PTX Series
I3 YANG ( <b>openconfig-network-instance-i3.yang</b> )	17.2X75, 17.3, 17.4, 18.1, 18.2	0.4.0	Juniper Networks MX Series, PTX Series, and QFX Series
INET TYPES ( <b>openconfig-inet-types.yang</b> )	17.2X75, 17.3, 17.4, 18.1, 18.2	0.1.0	Juniper Networks MX Series, PTX Series, and QFX Series
<ul style="list-style-type: none"> <li>ISIS ( <b>openconfig-isis.yang</b>)</li> <li>ISIS LSDB TYPES (<b>openconfig-isis-lsdb-types.yang</b>)</li> </ul>	17.2X75, 17.4, 18.1, 18.2	0.2.1	Juniper Networks MX Series and PTX Series
<ul style="list-style-type: none"> <li>ISIS LSP (<b>openconfig-isis-lsp.yang</b>)</li> <li>ISIS POLICY (<b>openconfig-isis-policy.yang</b>)</li> <li>ISIS ROUTING (<b>openconfig-isis-routing.yang</b>)</li> <li>ISIS TYPES ( <b>openconfig-isis-types</b>)</li> </ul>	17.2X75, 17.4, 18.1, 18.2	0.2.1	Juniper Networks MX Series and PTX Series
LACP ( <b>openconfig-lacp.yang</b> )	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	1.1.0	
<ul style="list-style-type: none"> <li>LLDP (<b>openconfig-lldp.yang</b>)</li> <li>LLDP TYPES (<b>openconfig-lldp-types.yang</b>)</li> </ul>	16.1, 17.1, 17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2	0.1.0	Juniper Networks MX Series and PTX Series
LOCAL ROUTING ( <b>openconfig-local-routing.yang</b> )	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		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 ( <b>openconfig-mpls.yang</b> )	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	2.2.0	
• MPLS IDP ( <b>openconfig-mpls-ldp.yang</b> )	16.1, 17.1	1.0.0	Juniper Networks MX Series and PTX Series
• MPLS IGP ( <b>openconfig-mpls-igp.yang</b> )	17.2, 17.3		Juniper Networks MX Series, PTX Series, and QFX Series
• MPLS RSVP ( <b>openconfig-mpls-rsvp.yang</b> )	17.2X75, 17.4, 18.1, 18.2	2.2.0	
• MPLS SR ( <b>openconfig-mpls-sr.yang</b> )			
• MPLS STATIC ( <b>openconfig-mpls-static.yang</b> )			
• MPLS TE ( <b>openconfig-mpls-te.yang</b> )			
• MPLS TYPES ( <b>openconfig-mpls-types.yang</b> )			
NETWORK INSTANCE ( <b>openconfig-network-instance.yang</b> )	17.3, 17.4, 18.1, 18.2	0.4.0	Juniper Networks MX Series, PTX Series, and QFX Series
	17.2X75	0.4.1	
• NETWORK INSTANCE I2 ( <b>openconfig-network-instance-l2.yang</b> )	17.2X75, 17.3, 17.4, 18.1, 18.2	0.4.0	Juniper Networks MX Series, PTX Series, and QFX Series
• NETWORK INSTANCE TYPES ( <b>openconfig-network-instance-types.yang</b> )			
• PLATFORM ( <b>openconfig-platform.yang</b> )	16.1, 17.1, 17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2	0.3.0	Juniper Networks MX Series and PTX Series
• PLATFORM TYPES ( <b>openconfig-platform-types.yang</b> )			
POLICY TYPES ( <b>openconfig-policy-types.yang</b> )	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		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
<ul style="list-style-type: none"> <li>RIB BGP (<b>openconfig-rib-bgp.yang</b>)</li> </ul>	16.1, 17.1	0.2.0	Juniper Networks MX Series and PTX Series
<ul style="list-style-type: none"> <li>RIB BGP EXT (<b>openconfig-rib-bgp-ext.yang</b>)</li> <li>RIB BGP TYPES (<b>openconfig-rib-bgp-types.yang</b>)</li> </ul>	17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2		Juniper Networks MX Series, PTX Series, and QFX Series
ROUTING POLICY ( <b>openconfig-routing-policy.yang</b> )	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		Juniper Networks MX Series, PTX Series, and QFX Series
RPC ( <b>openconfig-rpc-api.yang</b> )	16.1, 17.1, 17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2	0.1.0	Juniper Networks MX Series and PTX Series
SEGMENT ROUTING ( <b>openconfig-segment-routing.yang</b> )	17.2X75, 17.3, 17.4, 18.1, 18.2	0.0.3	Juniper Networks MX Series and PTX Series
TELEMETRY ( <b>openconfig-telemetry.yang</b> )	16.1, 17.1, 17.2, 17.2X75, 17.3, 17.4, 18.1, 18.2	0.2.0	Juniper Networks MX Series, PTX Series, and QFX Series
<ul style="list-style-type: none"> <li>TERMINAL DEVICE (<b>openconfig-terminal-device.yang</b>)</li> <li>TRANSPORT TYPES (<b>openconfig-transport-types.yang</b>)</li> </ul>	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	0.3.1	
TYPES ( <b>openconfig-types.yang</b> )	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	0.3.2	
<ul style="list-style-type: none"> <li>VLAN CONFIGURATION SUPPORT (<b>openconfig-vlan.yang</b>)</li> <li>VLAN TYPES (<b>openconfig-vlan-types.yang</b>)</li> </ul>	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		
YANG TYPES ( <b>openconfig-yang-types.yang</b> )	17.2X75, 17.3, 17.4, 18.1, 18.2	0.1.0	Juniper Networks MX Series, PTX Series, and QFX Series

- Related Documentation**
- [OpenConfig Overview on page 3](#)
  - *Understanding YANG on Devices Running Junos OS*
  - *NETCONF XML Management Protocol Developer Guide*

---

## Installing the OpenConfig Package

OpenConfig for Junos OS corresponds to OpenConfig YANG data module releases and contain translation scripts and deviation modules for each supported Junos OS release. Each package includes the following files:

- OpenConfig set of data models written in YANG.
- Translation scripts that translate OpenConfig configuration schemas to Junos OS configuration schemas for each supported Junos OS release.
- Deviation modules that specify the unsupported nodes within the schema for each supported Junos OS release.
- Augmentation modules that specify additions to various OpenConfig specified models.
- Dynamic rendering files that map operational state data for each supported Junos OS release.

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 **request system software add** command, 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](#).



.....

**NOTE:** When you install or remove an OpenConfig package on a device that uses the ephemeral configuration database, the device deletes all ephemeral configuration data in the process of rebuilding the Junos OS schema. To restore the ephemeral configuration data, you must load and commit the data to the ephemeral database again.

.....

**Related  
Documentation**

- *Understanding YANG on Devices Running Junos OS*
- *NETCONF XML Management Protocol Developer Guide*
- *Release Information for Junos OS with Upgraded FreeBSD*



## CHAPTER 2

# gRPC Overview

- [Understanding OpenConfig and gRPC on Junos Telemetry Interface on page 11](#)
- [Installing the Network Agent Package \(Junos Telemetry Interface\) on page 20](#)
- [gRPC Services for Junos Telemetry Interface on page 23](#)
- [Guidelines for gRPC Sensors \(Junos Telemetry Interface\) on page 27](#)

## Understanding OpenConfig and gRPC on Junos Telemetry Interface

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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:** 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.

- [Network Agent Software on page 12](#)
- [Using OpenConfig for Junos OS to Enable Junos Telemetry Interface on page 12](#)
- [Using gRPC to Stream Data on page 13](#)
- [Exporting Packet Forwarding Engine Traffic Sensor Data on page 14](#)
- [Enabling “ON CHANGE” Sensor Support Through Network Management Interface \(gNMI\) on page 16](#)

- [Enabling Client Streaming and Bidirectional Streaming of Telemetry Sensor Information on page 17](#)
- [Enabling Client Streaming and Bidirectional Streaming of Telemetry Sensor Information on page 18](#)

## 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 Feature 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 20](#).

## 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 8](#) 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 13](#) for a list and descriptions of the RPCs implemented to the support the Junos Telemetry Interface.

**Table 4: Telemetry RPCs**

RPC Name	Description
<code>telemetrySubscribe</code>	Specify telemetry parameters and stream data for the specified list of OpenConfig paths.
<code>getTelemetrySubscriptions</code>	Retrieve the list of subscriptions that are created through <code>telemetrySubscribe</code> .
<code>cancelSubscription</code>	Unsubscribe a subscription created through <code>telemetrySubscribe</code> .

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='FPCid:NPUid']/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='FPCid:CCid']/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='FPCid']/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 **telemetrySubscribe** 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 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 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 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.

Release History Table

Release	Description
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 <b>junos-analytics</b> instance of the ephemeral configuration database, and the configuration can be viewed by using the <b>show ephemeral-configuration instance junos-analytics</b> operational command.
18.1R1	Starting with Junos OS Release 18.1R1, OpenConfig support through Remote Procedure Calls (gRPC) and JTl 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 18.1R1, OpenConfig support through Remote Procedure Calls (gRPC) and JTl is extended to support client streaming and bidirectional streaming of telemetry sensor information on MX Series and PTX Series 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.
17.3R1	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.

#### Related Documentation

- [Installing the Network Agent Package \(Junos Telemetry Interface\) on page 20](#)
- [Release Information for Junos OS with Upgraded FreeBSD](#)
- [Guidelines for gRPC Sensors \(Junos Telemetry Interface\) on page 27](#)

## 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.

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. Values include **32** for 32-bit architectures and **64** for 64-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.

Examples of valid Network Agent package names including the following:

- **network-agent-x86-64-16.1R3.16-C1.0.tgz**
- **network-agent-x86-32-16.1R4.12-C1.1.tgz**

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 8.

- 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-x86-64-16.1R3.16-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 23](#).

Release History Table

Release	Description
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 on page 11](#)

gRPC Services for Junos Telemetry Interface

- [Configuring gRPC for the Junos Telemetry Interface on page 24](#)
- [Configuring Bidirectional Authentication for gRPC for Junos Telemetry Interface on page 25](#)

## 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 20](#).

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 8](#).

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 step 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 this example 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**
- [Understanding OpenConfig and gRPC on Junos Telemetry Interface on page 11](#)
  - [Importing SSL Certificates for Junos XML Protocol Support](#)

## 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 8](#).
- Configure the gRPC server. For more information, see [“Configuring gRPC for the Junos Telemetry Interface” on page 24](#).

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 extension-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-verify`.

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 extension-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](#)

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## Guidelines for gRPC Sensors (Junos Telemetry Interface)

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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 Junos OS Release 17.2R1, QFX10000 switches, QFX5200 switches, and PTX1000 routers are also supported.

Starting with Junos OS Release 17.3R1, QFX5110 switches, EX4600 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 17.4R1, 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.

See [Table 5 on page 28](#) for information about which sensors are supported with gRPC and on which platforms.

See [Table 6 on page 68](#) for a description of supported broadband edge (BBE) gRPC sensors, which are supported on all platforms supporting gRPC unless otherwise noted.

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 Sensors

See [Table 5 on page 28](#) for a description of supported gRPC sensors and [Table 6 on page 68](#) for a description of supported broadband edge (BBE) gRPC sensors, including the subscription path you use to provision the sensors.

Table 5: gRPC Sensors

resource path	Description
<code>/components/component/subcomponents/ subcomponent[name='FPCid:NPUid']/properties/property/ [name='counter']/state/value</code>	<p>Sensor for packet forwarding engine statistics. The subcomponent name <i>npu-id</i> refers to the number of the packet forwarding engine. This sensor provides visibility into packet forwarding engine errors and drops.</p> <p>Supported on MX Series routers and PTX Series routers starting with Junos OS Release 17.4R1.</p> <p>The value for <i>counter</i> is one of the following;</p> <ul style="list-style-type: none"> <li>• lts-hw-input-drops</li> <li>• hwds-normal</li> <li>• hwds-fabric</li> <li>• hwds-info-cell</li> <li>• hwds-timeout</li> <li>• hwds-truncated-key</li> <li>• hwds-bits-to-test</li> <li>• hwds-stack-underflow</li> <li>• hwds-stack-overflow</li> <li>• hwds-inet6-bad-route</li> <li>• hwds-inet-bad-route</li> <li>• hwds-filter-discard</li> <li>• hwds-dlu-not-routable</li> <li>• hwds-data-error</li> <li>• hwds-extended</li> <li>• hwds-invalid-iif</li> <li>• hwds-input-checksum</li> <li>• hwds-output-mtu</li> <li>• lts-input-packets</li> <li>• lts-output-packets</li> <li>• lts-sw-input-control-drops</li> <li>• lts-sw-input-high-drops</li> <li>• lts-sw-input-medium-drops</li> <li>• lts-sw-input-low-drops</li> <li>• lts-sw-output-low-drops</li> </ul>



Table 5: gRPC Sensors (continued)

resource path	Description
<code>/components/component/subcomponents/ subcomponent[name='FPC/ID:CCid']/properties/property/ [name='counter']/state/value</code>	<p>Sensor for packet forwarding engine statistics. The subcomponent name <i>cc-id</i> refers to the center chip. This sensor provides visibility into packet forwarding engine errors and drops.</p> <p>Supported on MX Series routers and PTX Series routers starting with Junos OS Release 17.4R1.</p> <p>The value for <i>counter</i> is one of the following;</p> <ul style="list-style-type: none"> <li>• <i>ts-fabric-input-pps</i></li> <li>• <i>ts-fabric-output-pps</i></li> <li>• <i>ts-fabric-input-packets</i></li> <li>• <i>ts-fabric-output-packets</i></li> <li>• <i>lpbk-packets</i></li> <li>• <i>lpbk-pps</i></li> <li>• <i>lpbk-bytes</i></li> <li>• <i>lpbk-pps</i></li> <li>• <i>lpbk-drop-packets</i></li> <li>• <i>lpbk-drop-pps</i></li> <li>• <i>lpbk-drop-bytes</i></li> <li>• <i>lpbk-drop-bps</i></li> </ul>
<code>/components/component/subcomponents/ subcomponent[name='FPC/ID']/properties/property/ [name='counter']/state/value</code>	<p>Sensor for packet forwarding engine statistics. The subcomponent name <i>FPCid</i> 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.</p> <p>Supported on MX Series routers and PTX Series routers starting with Junos OS Release 17.4R1.</p> <p>The value for <i>counter</i> is one of the following;</p> <ul style="list-style-type: none"> <li>• <i>lts-hw-input-drops</i></li> <li>• <i>lts-input-packets</i></li> <li>• <i>lts-output-packets</i></li> <li>• <i>lts-sw-input-control-drops</i></li> <li>• <i>lts-sw-input-high-drops</i></li> <li>• <i>lts-sw-input-medium-drops</i></li> <li>• <i>lts-sw-input-low-drops</i></li> <li>• <i>lts-sw-output-low-drops</i></li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
/junos/kernel-ifstate/stats/churn-rate	<p>Sensor for Routing Engine network object churn rate statistics.</p> <p>Starting in Junos OS Release 18.2R1, MX Series and PTX Series switches are supported.</p> <ul style="list-style-type: none"> <li>consumption-route-change-rate</li> <li>overall-churn-rate</li> <li>route-add-rate</li> <li>route-change-rate</li> <li>route-delete-rate</li> <li>nexthop-add-rate</li> <li>nexthop-change-rate</li> <li>nexthop-delete-rate</li> </ul>
/junos/kernel-ifstate/stats/peer-consumption-rate	<p>Sensor for Routing Engine network object peer consumption rate statistics.</p> <p>Starting in Junos OS Release 18.2R1, MX Series and PTX Series switches are supported.</p> <ul style="list-style-type: none"> <li>peer-index</li> <li>consumption-rate-counter</li> <li>consumption-route-add-rate</li> <li>consumption-route-delete-rate</li> <li>consumption-nexthop-add-rate</li> <li>consumption-nexthop-change-rate</li> <li>consumption-nexthop-delete-rate</li> </ul>
/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.
/junos/kernel-ifstate/stats/vetos-statistics	<p>Sensor for Routing Engine state statistics.</p> <p>Starting in Junos OS Release 18.2R1, MX Series and PTX Series switches are supported.</p> <ul style="list-style-type: none"> <li>veto-vm-page-count-severe</li> <li>veto-ifstate-memory</li> <li>veto-memory-overconsumed</li> <li>veto-pfe-veto-max-routes</li> <li>veto-too-many-delayed-unrefs</li> <li>veto-nh-memory-usage</li> <li>veto-mbuf-cluster</li> <li>veto-flabel-space-exhaustion</li> <li>veto-flabel-space-consumption</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
<code>/junos/ike-security-associations/ike-security-association/ routing-instance [name='routing-instance-name']</code>	<p>Sensor for Internet Key Exchange (IKE) security statistics.</p> <p>When you configure a subscription request, use the <b>reporting-interval</b> parameter to configure the interval (in seconds) in which statistics are reported.</p> <p>Starting with Junos OS Release 18.1R1, MX Series routers are supported.</p> <ul style="list-style-type: none"> <li>• remote-ip</li> <li>• local-ip</li> <li>• number-ipsec-sa-created</li> <li>• number-ipsec-sa-deleted</li> <li>• number-ipsec-sa-rekey</li> <li>• exchange-type</li> <li>• in-bytes</li> <li>• in-packets</li> <li>• out-bytes</li> <li>• out-packets</li> <li>• delete-payload-received</li> <li>• delete-payload-transmitted</li> <li>• dpd-request-payload-received</li> <li>• dpd-request-payload-transmitted</li> <li>• dpd-response-payload-received</li> <li>• dpd-response-payload-transmitted</li> <li>• dpd-response-payload-missed</li> <li>• dpd-response-payload-maximum-delay</li> <li>• dpd-response-seq-payload-missed</li> <li>• invalid-spi-notify-received</li> <li>• invalid-spi-notify-transmitted</li> <li>• routing-instance</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
/junos/services/label-switched-path/usage/	<p>Sensor for LSP statistics. On MX Series routers only, the following are also supported: bidirectional LSPs for ultimate-hop popping (UHP).</p> <p>Starting with Junos OS Release 17.2R1, QFX10000 switches and PTX1000 routers are also supported.</p> <p>Starting with Junos OS Release 17.3R1, EX9200 switches are also supported.</p> <p>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.</p> <p>For bypass LSPs, the following are exported:</p> <ul style="list-style-type: none"> <li>• Bypass LSP originating at the ingress router of the protected LSP.</li> <li>• Bypass LSP originating at the transit router of the protected LSP.</li> <li>• Bypass LSP protecting the transit LSP as well as the locally originated LSP.</li> </ul> <p>When the bypass LSP is active, traffic is exported both on the bypass LSP and the ingress (protected) LSP.</p> <p>You can also specify an LSP name and source IP address at the end of the path: <code>[name='lsp-name',source='ip-address']</code></p> <p><b>NOTE:</b> When you enable a sensor for LSP statistics only, you must also configure the <b>sensor-based-stats</b> statement at the <code>[edit protocols mpls]</code> hierarchy level. MX Series routers should operate in enhanced mode. If not enabled by default, include either the <b>enhanced-ip</b> statement or the <b>enhanced-ethernet</b> statement at the <code>[edit chassis network-services]</code> hierarchy level.</p>

Table 5: gRPC Sensors (continued)

resource path	Description
<code>/network-instances/network-instance/mpls/</code>	<p>Sensor for LSP events and properties.</p> <p>Supported on MX Series and PTX Series routers and QFX10000 switches starting with Junos OS Release 17.2R1.</p> <p>Supported on EX4600 and EX9200 switches and QFX5110 and QFX5200 switches starting with Junos OS Release 17.3R1.</p> <p>LSP events and properties are exported for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs.</p> <p><b>NOTE:</b> 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 <code>/network-instances/network-instance[name='instance-name']/</code> in front of all supported paths. .</p> <p>The following paths are also supported:</p> <ul style="list-style-type: none"> <li><code>/network-instances/network-instance[name='instance-name']/mpls/lsp/constrained-path/tunnels/tunnel/p2p-tunnel-attributes/p2p-primary-paths/lsp-instances/state/notify-status</code></li> <li><code>/network-instances/network-instance[name='instance-name']/mpls/lsp/constrained-path/tunnels/tunnel/p2p-tunnel-attributes/p2p-primary-paths/state/notify-status</code></li> <li><code>/network-instances/network-instance[name='instance-name']/mpls/signaling-protocols/rsvp-te/sessions/session/state/notify-status</code></li> <li><code>/network-instances/network-instance[name='instance-name']/mpls/lsp/constrained-path/tunnels/tunnel/p2p-tunnel-attributes/p2p-primary-paths/lsp-instances/state/bandwidth</code></li> <li><code>/network-instances/network-instance[name='instance-name']/mpls/lsp/constrained-path/tunnels/tunnel/p2p-tunnel-attributes/p2p-primary-paths/lsp-instances/state/metric</code></li> <li><code>/network-instances/network-instance[name='instance-name']/mpls/lsp/constrained-path/tunnels/tunnel/p2p-tunnel-attributes/p2p-primary-paths/state/explicit-path-name</code></li> <li><code>/network-instances/network-instance[name='instance-name']/mpls/lsp/constrained-path/tunnels/tunnel/p2p-tunnel-attributes/p2p-primary-paths/lsp-instances/state/max-avg-bandwidth</code></li> </ul> <p><b>NOTE:</b> To specify a specific LSP name and source address, include <code>[name='lsp-name',source='address']</code> after <code>mpls/lsp/constrained-path-tunnels/tunnel/</code> in any of the supported paths. If do not include a specific LSP name, data is exported for all configured LSPs.</p>

*Table 5: gRPC Sensors (continued)*

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

Table 5: gRPC Sensors (continued)

resource path	Description
	<p>Sensor for network processing unit (NPU) memory, NPU memory utilization, and total memory available for each memory type.</p> <p>Supported on QFX10000 switches and PTX1000 routers starting with Junos OS Release 17.2R1.</p> <p>Supported on EX9200 switches starting with Junos OS Release 17.3R1.</p> <p><b>NOTE:</b> 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.</p> <p>The OpenConfig path is  <code>/components/component[name="FPC&lt;fpc-id&gt;:NPU&lt;npu-id&gt;"]  /properties/property/</code></p> <p>You can also add the following to the end of the path to stream specific statistics for NPU memory:</p> <ul style="list-style-type: none"> <li><code>[name="mem-util-&lt;memory-name&gt;-size"]/value</code></li> <li><code>[name="mem-util-&lt;memory-name&gt;-bytes-allocated"]/value</code></li> <li><code>[name="mem-util-&lt;memory-name&gt;-utilization"]/value</code></li> <li><code>[name="mem-util-&lt;partition-name&gt;-&lt;app-name&gt;-allocation-count"]/value</code></li> <li><code>[name="mem-util-&lt;partition-name&gt;-&lt;app-name&gt;-bytes-allocated"]/value</code></li> <li><code>[name="mem-util-&lt;partition-name&gt;-&lt;app-name&gt;-free-count"]/value</code></li> </ul> <p>You can add the following to the end of the path to stream specific statistics for NPU utilization:</p> <ul style="list-style-type: none"> <li><code>[name="util-&lt;memory-name&gt;-average-util"]&gt;/value</code></li> <li><code>[name="util-&lt;memory-name&gt;-highest-util"]&gt;/value</code></li> <li><code>[name="util-&lt;memory-name&gt;-lowest-util"]&gt;/value</code></li> <li><code>[name="util-&lt;memory-name&gt;-average-cache-hit-rate"]&gt;/value</code></li> <li><code>[name="util-&lt;memory-name&gt;-lowest-cache-hit-rate"]&gt;/value</code></li> <li><code>[name="util-&lt;packet-identifier&gt;-rate"]&gt;/value</code></li> </ul> <p>You can also export the following statistics for NPU memory for PTX routers only</p> <ul style="list-style-type: none"> <li><code>pfe_name</code></li> <li><code>combined_pool_name</code></li> <li><code>combined_size</code></li> <li><code>combined_usage_cnt</code></li> <li><code>combined_utilization</code></li> <li><code>global_pool_name</code></li> <li><code>global_usage_cnt</code></li> <li><code>global_alloc_cnt</code></li> <li><code>global_free_cnt</code></li> <li><code>local_pool_name</code></li> <li><code>local_usage_cnt</code></li> <li><code>local_alloc_cnt</code></li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>local_free_cnt</li> </ul>
/junos/system/linecard/cpu/memory/	<p>Sensor for CPU memory.</p> <p><b>NOTE:</b> On PTX Series routers, FPC1 and FPC2 are not supported.</p> <p>Supported on QFX10000 switches and PTX1000 routers starting with Junos OS Release 17.2R1.</p> <p>Supported on EX9200 switches starting with Junos OS Release 17.3R1.</p> <p>You can also include the following to end of the resource path for CPU memory:</p> <ul style="list-style-type: none"> <li>[name="mem-util-&lt;memory-name&gt;-size"]/value</li> <li>[name="mem-util-&lt;memory-name&gt;-bytes-allocated"]/value</li> <li>[name="mem-util-&lt;memory-name&gt;-utilization"]/value</li> <li>[name="mem-util-&lt;memory-name&gt;-&lt;app-name&gt;-allocations"]/value</li> <li>[name="mem-util-&lt;memory-name&gt;-&lt;app-name&gt;-frees"]/value</li> <li>[name="mem-util-&lt;memory-name&gt;-&lt;app-name&gt;-allocations-failed"]/value</li> </ul>



Table 5: gRPC Sensors (continued)

resource path	Description
<p><b>/network-instances/network-instance/protocols/protocol/bgp/</b></p> <p><b>NOTE:</b> 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.</p> <p>For BGP routing table paths, the <b>/network-instances/network-instance/</b> path is not supported.</p> <p>Each address family supports exporting data for five different tables, a main routing table, and four per-neighbor tables:</p> <ul style="list-style-type: none"> <li>• local-rib—main BGP routing table for the main routing instance.</li> <li>• adj-rib-in-pre—NLRI updates received from the neighbor before any local input policy filters have been applied.</li> <li>• adj-rib-in-post—routes received from the neighbor eligible for best-path selection after local input policy filters have been applied.</li> <li>• adj-rib-out-pre—routes eligible for advertising to the neighbor before output policy filters have been applied.</li> <li>• adj-rib-out-post—routes eligible for advertising to the neighbor after output policy filters have been applied.</li> </ul> <p>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:</p> <ul style="list-style-type: none"> <li>• <b>/bgp-rib/afi-safis/afi-safi/ipv4-unicast/loc-rib/</b></li> <li>• <b>/bgp-rib/afi-safis/afi-safi/ipv6-unicast/loc-rib/</b></li> <li>• <b>/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/neighbor/adj-rib-in-pre/</b></li> <li>• <b>/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/neighbor/adj-rib-in-pre/</b></li> <li>• <b>/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/neighbor/adj-rib-in-post/</b></li> <li>• <b>/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/neighbor/adj-rib-in-post/</b></li> <li>• <b>/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/neighbor/adj-rib-out-pre/</b></li> <li>• <b>/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/neighbor/adj-rib-out-pre/</b></li> <li>• <b>/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/neighbor/adj-rib-out-post/</b></li> <li>• <b>/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/neighbor/adj-rib-out-post/</b></li> </ul>	

Table 5: gRPC Sensors (continued)

resource path	Description
	<p>Sensor for BGP peer information.</p> <p>Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1.</p> <p>Supported on PTX1000 routers, EX4600 and EX9200 switches, and QFX5110 switches starting with Junos OS Release 17.3R1.</p> <p><b>NOTE:</b> Starting with Junos OS Release 17.3R1, telemetry data streamed through gRPC for BGP peers is reported separately for each configured routing instance.</p> <p>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: <code>/network-instances/network-instance[name_'instance-name']/protocols/protocol/</code></p> <p>Starting with Junos OS Release 17.3R1, the following paths are also supported:</p> <ul style="list-style-type: none"> <li><code>/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safis/afi-safi/state/prefixes/accepted</code></li> <li><code>/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safis/afi-safi/state/prefixes/rejected</code></li> <li><code>/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safis/afi-safi/state/active</code></li> <li><code>/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safis/afi-safi/state/queues/output</code></li> <li><code>/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/afi-safis/afi-safi/state/queues/input</code></li> <li><code>/network-instances/network-instance/protocols/protocol/bgp/neighbors/snmp-peer-index</code></li> <li><code>/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/state/ImportEval</code></li> <li><code>/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/state/ImportEvalPending</code></li> <li><code>/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/state/messages/received/notification</code></li> <li><code>/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/state/messages/sent/notification</code></li> <li><code>/network-instances/network-instance/protocols/protocol/bgp/transport/state/remote-port</code></li> <li><code>/network-instances/network-instance/protocols/protocol/bgp/neighbors/neighbor/state/supported-capabilities</code></li> </ul> <p><b>NOTE:</b> 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: <code>/network-instances/network-instance[name_'instance-name']/protocols/protocol/</code></p> <p>You can also include the following at the end path to <code>/network-instances/network-instance[name_'instance-name']/protocols/protocol/bgp/neighbors/neighbor/</code>:</p>

Table 5: gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>state/session-state</li> <li>state/messages/sent/update</li> <li>state/messages/received/update</li> <li>transport/state/local-address</li> <li>transport/state/remote-address</li> <li>state/peer-as</li> <li>afi-safis/afi-safi/state/prefix-limit/state/max-prefixes</li> <li>afi-safis/afi-safi/state/active</li> <li>state/session-status</li> <li>state/session-admin-status</li> <li>state/session-established-transitions</li> <li>state/interface-error</li> <li>state/prefix-limited-exceeded</li> <li>state/last-established</li> <li>established-transitions</li> </ul> <p>You can also include the following at the end path to <code>/network-instances/network-instance[name_'instance-name']/protocols/protocol/bgp/global/</code>:</p> <ul style="list-style-type: none"> <li>afi-safis/afi-safi/state/total-prefixes</li> </ul> <p>You can also include the following at the end path to <code>/network-instances/network-instance[name_'instance-name']/protocols/protocol/bgp/peer-groups/peer-group[name_'peer-group-name']/</code>:</p> <ul style="list-style-type: none"> <li>afi-safis/afi-safi/add-paths/eligible-prefix-policy</li> <li>state/peer-count/</li> </ul> <p><b>NOTE:</b> For paths that export data for BGP routing tables, which are supported starting with Junos OS Release 17.4R1, you can append the following to each of the paths:</p>

Table 5: gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>• /num-routes</li> <li>• /routes/route/prefix</li> <li>• /routes/route/attributes</li> <li>• /routes/route/attributes/origin</li> <li>• /routes/route/attributes/as-path</li> <li>• /routes/route/attributes/next-hop</li> <li>• /routes/route/attributes/med</li> <li>• /routes/route/attributes/local-pref</li> <li>• /routes/route/attributes/atomic-aggr</li> <li>• /routes/route/attributes/aggregator/as</li> <li>• /routes/route/attributes/aggregator/as4</li> <li>• /routes/route/attributes/aggregator/address</li> <li>• /routes/route/ext-attributes/</li> <li>• /routes/route/ext-attributes/community</li> <li>• /routes/route/ext-attributes/originator-id</li> <li>• /routes/route/ext-attributes/cluster-list</li> <li>• /routes/route/ext-attributes/extended-community</li> <li>• /routes/route/ext-attributes/aigp</li> <li>• /routes/route/ext-attributes/path-id</li> <li>• /routes/route/ext-attributes/unknown-attribute</li> <li>• /routes/route/ext-attributes/unknown-attribute/attr-type</li> <li>• /routes/route/ext-attributes/unknown-attribute/attr-len</li> <li>• /routes/route/ext-attributes/unknown-attribute/attr-value</li> <li>• /routes/route/last-modified-date</li> <li>• /routes/route/last-update-received</li> <li>• /routes/route/valid-route</li> <li>• /routes/route/invalid-reason</li> <li>• /routes/route/best-path</li> </ul>

Table 5: gRPC Sensors (continued)

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

Table 5: gRPC Sensors (continued)

resource path	Description
	<p>Sensor for memory utilization for routing protocol task.</p> <p>Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1.</p> <p>Supported on PTX1000 routers, EX4600 and EX9200 switches and QFX5110 switches starting with Junos OS Release 17.3R1.</p> <p>You can also include the following at the end path to <code>/junos/task-memory-information/</code>:</p> <ul style="list-style-type: none"> <li><code>task-memory-overall-report/task-size-block-list/task-size-block/tsb-size</code></li> <li><code>task-memory-overall-report/task-size-block-list/task-size-block/tsb-alloc-bytes</code></li> <li><code>task-memory-overall-report/task-size-block-list/task-size-block/tsb-allocs</code></li> <li><code>task-memory-overall-report/task-size-block-list/task-size-block/tsb-max-allocs</code></li> <li><code>task-memory-overall-report/task-size-block-list/task-size-block/tsb-max-bytes</code></li> <li><code>task-memory-overall-report/task-size-block-list/task-size-block/tsb-free-bytes</code></li> <li><code>task-memory-overall-report/task-memory-total-bytes</code></li> <li><code>task-memory-overall-report/task-memory-total-max-bytes</code></li> <li><code>task-memory-information/task-memory-overall-report/task-memory-total-free-bytes</code></li> <li><code>task-memory-allocator-report/task-block-list/task-block/tb-name</code></li> <li><code>task-memory-allocator-report/task-block-list/task-block/tb-size</code></li> <li><code>task-memory-allocator-report/task-block-list/task-block/tb-alloc-size</code></li> <li><code>task-memory-allocator-report/task-block-list/task-block/tb-alloc-blocks</code></li> <li><code>task-memory-allocator-report/task-block-list/task-block/tb-alloc-bytes</code></li> <li><code>task-memory-allocator-report/task-block-list/task-block/tb-max-alloc-blocks</code></li> <li><code>task-memory-allocator-report/task-lite-page-list/task-lite-page/tlp-name</code></li> <li><code>task-memory-allocator-report/task-lite-page-list/task-lite-page/tlp-alloc-bytes</code></li> <li><code>task-memory-allocator-report/task-memory-total-bytes</code></li> <li><code>task-memory-information/task-memory-allocator-report/task-memory-total-max-bytes</code></li> <li><code>task-memory-malloc-usage-report/task-malloc-list/task-malloc/tm-name</code></li> <li><code>task-memory-malloc-usage-report/task-malloc-list/task-malloc/tm-allocs</code></li> <li><code>task-memory-malloc-usage-report/task-malloc-list/task-malloc/tm-alloc-bytes</code></li> <li><code>task-memory-malloc-usage-report/task-malloc-list/task-malloc/tm-max-allocs</code></li> <li><code>task-memory-malloc-usage-report/task-malloc-list/task-malloc/tm-max-alloc-bytes</code></li> <li><code>task-memory-malloc-usage-report/task-malloc-list/task-malloc/tm-function-calls</code></li> <li><code>task-memory-malloc-usage-report/task-memory-total-bytes</code></li> <li><code>task-memory-malloc-usage-report/task-memory-total-max-bytes</code></li> <li><code>task-memory-max-dynamic-allocs</code></li> <li><code>task-memory-bss-bytes</code></li> <li><code>task-memory-max-bss-bytes</code></li> <li><code>task-memory-page-data-bytes</code></li> <li><code>task-memory-max-page-data-bytes</code></li> <li><code>task-memory-dir-bytes</code></li> <li><code>task-memory-max-dir-bytes</code></li> <li><code>task-memory-total-bytes-in-use</code></li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>task-memory-total-bytes-percent</li> </ul>
/junos/system/linecard/firewall/	<p>Sensor for firewall filter counters and policer counters. Each line card reports counters separately.</p> <p>Supported on QFX10000 switches starting with Junos OS Release 17.2R1.</p> <p>Supported on PTX1000 routers and EX9200 switches starting with Junos OS Release 17.3R1.</p> <p><b>NOTE:</b> Hierarchical policer statistics are collected for MX Series routers only. Traffic-class counter statistics are collected for PTX Series routers and QFX10000 switches only.</p> <p>Firewall counters are exported even if the interface to which the firewall filter is attached is operationally down.</p> <p>The following OpenConfig paths are supported:</p> <ul style="list-style-type: none"> <li>junos/firewall/firewall-stats/[name='filter-name']/timestamp</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/memory-usage/[name='memory-type']/allocated</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/counter-stats/[name='counter-name']/packets</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/counter-stats/[name='counter-name']/bytes</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/policer-stats/[name='policer-name']/out-of-spec-packets</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/policer-stats/[name='policer-name']/out-of-spec-bytes</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/policer-stats/[name='policer-name']/offered-packets</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/policer-stats/[name='policer-name']/offered-bytes</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/policer-stats/[name='policer-name']/transmitted-packets</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/policer-stats/[name='policer-name']/transmitted-bytes</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/hierarchical-policer-stats/[name='hierarchical-policer-name']/premium-packets (MX Series only)</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/hierarchical-policer-stats/[name='hierarchical-policer-name']/premium-bytes (MX Series only)</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/hierarchical-policer-stats/[name='hierarchical-policer-name']/aggregate-packets (MX Series only)</li> <li>/junos/firewall/firewall-stats/[name='filter-name']/hierarchical-policer-stats/[name='hierarchical-policer-name']/aggregate-bytes (MX Series only)</li> </ul>

*Table 5: gRPC Sensors (continued)*

resource path	Description
/interfaces/interface/	



Table 5: gRPC Sensors (continued)

resource path	Description
	<p>Sensor for physical interface traffic.</p> <p><b>NOTE:</b> 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.</p> <p>For Aggregated Ethernet interfaces, statistics are exported for the member physical interfaces. You must aggregate the counters at the destination server, or collector.</p> <p>If a physical interface is administratively down or operationally down, interface counters are not exported.</p> <p>Only fields with a non-zero value are exported.</p> <p>Supported on QFX10000 switches and PTX1000 routers starting with Junos OS Release 17.2R1.</p> <p>Supported on EX9200 switches and MX150 routers starting with Junos OS Release 17.3R1.</p> <p><b>NOTE:</b> End paths supporting ON_CHANGE streaming are indicated.</p> <p>The following paths are also supported:</p> <ul style="list-style-type: none"> <li>• /interfaces/interface[name='interface-name']/state/parent_ae_name</li> <li>• /interfaces/interface[name='interface-name']/state/admin-status ON_CHANGE streaming supported</li> <li>• /interfaces/interface[name='interface-name']/state/counters/carrier-transitions</li> <li>• /interfaces/interface[name='interface-name']/state/last-change</li> <li>• /interfaces/interface[name='interface-name']/state/high-speed</li> <li>• /interfaces/interface[name='interface-name']/state/counters/out-octets</li> <li>• /interfaces/interface[name='interface-name']/state/counters/out-unicast-pkts</li> <li>• /interfaces/interface[name='interface-name']/state/counters/out-multicast-pkts</li> <li>• /interfaces/interface[name='interface-name']/state/counters/out-broadcast-pkts</li> <li>• /interfaces/interface[name='interface-name']/state/counters/out-errors</li> <li>• /interfaces/interface[name='interface-name']/state/counters/in-octets</li> <li>• /interfaces/interface[name='interface-name']/state/counters/in-unicast-pkts</li> <li>• /interfaces/interface[name='interface-name']/state/counters/in-multicast-pkts</li> <li>• /interfaces/interface[name='interface-name']/state/</li> <li>• /interfaces/interface[name='interface-name']/state/counters/in-broadcast-pkts</li> <li>• /interfaces/interface[name='interface-name']/state/counters/in-errors</li> <li>• /interfaces/interface[name='interface-name']/state/in-pause-pkts</li> <li>• /interfaces/interface[name='interface-name']/state/out-pause-pkts</li> <li>• /interfaces/interface[name='interface-name']/state/counters/in-queue [queue-number=queue_number]/</li> <li>• /interfaces/interface[name='interface-name']/state/counters/in-queue [queue-number=queue_number]/ pkts</li> <li>• /interfaces/interface[name='interface-name']/state/counters/in-queue [queue-number=queue_number]/bytes</li> <li>• /interfaces/interface[name='interface-name']/state/counters/in-queue</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>[queue-number=<i>queue_number</i>]/tail-drop-pkts</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/in-queue [queue-number=<i>queue_number</i>]/rl-drop-pkts</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/in-queue [queue-number=<i>queue_number</i>]/rl-drop-bytes</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/in-queue [queue-number=<i>queue_number</i>]/avg-buffer-occupancy</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/in-queue [queue-number=<i>queue_number</i>]/cur-buffer-occupancy</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/in-queue [queue-number=<i>queue_number</i>]/peak-buffer-occupancy</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/in-queue [queue-number=<i>queue_number</i>]/allocated-buffer-size</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/out-queue [queue-number=<i>queue_number</i>]/pkts</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/out-queue [queue-number=<i>queue_number</i>]/bytes</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/out-queue [queue-number=<i>queue_number</i>]/tail-drop-pkts</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/out-queue [queue-number=<i>queue_number</i>]/rl-drop-pkts</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/out-queue [queue-number=<i>queue_number</i>]/rl-drop-bytes</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/out-queue [queue-number=<i>queue_number</i>]/red-drop-pkts</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/out-queue [queue-number=<i>queue_number</i>]/red-drop-bytes</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/out-queue [queue-number=<i>queue_number</i>]/avg-buffer-occupancy</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/out-queue [queue-number=<i>queue_number</i>]/cur-buffer-occupancy</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/out-queue [queue-number=<i>queue_number</i>]/peak-buffer-occupancy</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/counters/out-queue [queue-number=<i>queue_number</i>]/allocated-buffer-size</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/description ON_CHANGE streaming supported</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/enabled</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/ifindex</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/last-change</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/mtu</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/name</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/oper-status ON_CHANGE streaming supported</li> <li>• /interfaces/interface[name=<i>interface-name</i>]/state/type</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
/interfaces/interface/subinterfaces/	Sensor for logical interface traffic.
/interfaces/interface[name= <i>interface-name</i> ]/subinterfaces/subinterface[index= <i>unit</i> ]	<p><b>NOTE:</b> If a logical interface is operationally down, interface statistics continue to be exported.</p> <p><b>NOTE:</b> Locally injected packets from the Routing Engine are not exported.</p> <p>Supported on QFX10000 switches starting with Junos OS Release 17.2R1.</p> <p>Supported on PTX1000 routers and EX9200 switches starting with Junos OS Release 17.3R1.</p> <p><b>NOTE:</b> End paths supporting ON_CHANGE streaming are indicated.</p> <p>The following paths are also supported:</p> <ul style="list-style-type: none"> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/name ON_CHANGE streaming supported. This value does not change with an event, but will be streamed on event creation and deletion.</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/ifindex ON_CHANGE streaming supported. This value does not change with an event, but will be streamed on event creation and deletion.</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/index ON_CHANGE streaming supported. This value does not change with an event, but will be streamed on event creation and deletion.</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/snmp_index</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/admin_status ON_CHANGE streaming supported</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/oper_status ON_CHANGE streaming supported</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/last_change</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/description ON_CHANGE streaming supported</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/enabled</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/in_octets</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/in_unicast_pkts</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/in_broadcast_pkts</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/in_multicast_pkts</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/in_discards</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/in_gross</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/in_unknown_pkts</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/out_octets</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/out_unicast_pkts</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/out_broadcast_pkts</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/out_multicast_pkts</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/out_discards</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/out_gross</li> <li>/interfaces/interface[name=<i>interface-name</i>]/subinterfaces/subinterface[index=<i>unit</i>]/state/counters/last_clear</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
<code>/junos/system/linecard/optics/</code>	<p>Sensor for various optical interface performance metrics, such as transmit and receive power levels.</p> <p>Supported on QFX10000 switches starting with Junos OS Release 17.2R1.</p> <p>Supported on PTX1000 routers and EX9200 switches starting with Junos OS Release 17.3R1.</p>
<code>/junos/rsvp-interface-information/</code>	<p>Sensor for events and properties for RSVP interfaces.</p> <p><b>NOTE:</b> 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.</p> <p>Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1.</p> <p>Supported on PTX1000 routers, QFX5110 switches, and EX4600 and EX9200 switches starting with Junos OS Release 17.3R1.</p> <p>You can also add the following to the end path for <code>/junos/rsvp-interface-information/</code>:</p> <ul style="list-style-type: none"> <li>• <code>active-count</code></li> <li>• <code>rsvp-interface/interface-name</code></li> <li>• <code>rsvp-interface/index</code></li> <li>• <code>rsvp-interface/rsvp-status</code></li> <li>• <code>rsvp-interface/authentication-flag</code></li> <li>• <code>rsvp-interface/aggregate-flag</code></li> <li>• <code>rsvp-interface/ack-flag</code></li> <li>• <code>rsvp-interface/protect-flag</code></li> <li>• <code>rsvp-interface/hello-interval</code></li> <li>• <code>rsvp-interface/interface-address</code></li> <li>• <code>message-statistics/rsvp-message</code></li> <li>• <code>rsvp-interface/message-statistics/messages-sent</code></li> <li>• <code>rsvp-interface/message-statistics/messages-received</code></li> <li>• <code>rsvp-interface/message-statistics/messages-sent-5seconds</code></li> <li>• <code>rsvp-interface/message-statistics/messages-received-5seconds</code></li> <li>• <code>rsvp-interface/rsvp-telink/active-reservation</code></li> <li>• <code>rsvp-interface/rsvp-telink/preemption-count</code></li> <li>• <code>rsvp-interface/rsvp-telink/update-threshold</code></li> <li>• <code>rsvp-interface/rsvp-telink/subscription</code></li> <li>• <code>rsvp-interface/rsvp-telink/static-bandwidth</code></li> <li>• <code>rsvp-interface/rsvp-telink/available-bandwidth</code></li> <li>• <code>rsvp-interface/rsvp-telink/reserved-bandwidth/bandwidth-priority</code></li> <li>• <code>rsvp-interface/rsvp-telink/reserved-bandwidth/total-reserved-bandwidth</code></li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
/components/	

Table 5: gRPC Sensors (continued)

resource path	Description
	<p>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.</p> <p><b>NOTE:</b></p> <p>Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1.</p> <p>Supported on EX9200 switches and MX150 routers starting with Junos OS Release 17.3R1.</p> <p>You can also add the following to each of the paths:</p> <ul style="list-style-type: none"> <li>• <b>name</b></li> <li>• <b>cidr</b></li> <li>• <b>version</b></li> <li>• <b>part_number</b></li> <li>• <b>serial_number</b></li> <li>• <b>description</b></li> <li>• <b>clei_code</b></li> <li>• <b>model</b></li> <li>• <b>vendor_name</b></li> <li>• <b>properties/property/state</b></li> <li>• <b>properties/property/state_offline_reason</b> (MX Series only)</li> <li>• <b>properties/property/power_usage</b></li> <li>• <b>properties/property/power_maximum</b></li> <li>• <b>properties/property/temperature_intake</b></li> <li>• <b>properties/property/temperature_exhaust_a</b> (not supported on PTX1000 and PTX3000 routers)</li> <li>• <b>properties/property/temperature_exhaust_b</b> (not supported on PTX1000 and PTX3000 routers)</li> <li>• <b>properties/property/temperature_exhaust</b> (not supported on PTX1000 and PTX5000 routers)</li> <li>• <b>properties/property/cpu_utilization_total</b></li> <li>• <b>properties/property/memory_dram_used</b></li> <li>• <b>properties/property/memory_utilization_heap</b></li> <li>• <b>properties/property/memory_utilization_buffer</b></li> <li>• <b>properties/property/uptime</b></li> </ul> <p>The following paths are also supported only for Routing Engine statistics:</p> <ul style="list-style-type: none"> <li>• <b>properties/property/mastership-state</b></li> <li>• <b>properties/property/mastership-priority</b></li> <li>• <b>properties/property/temperature-cpu</b></li> <li>• <b>properties/property/memory-dram-installed</b></li> <li>• <b>properties/property/cpu-utilization-user</b></li> <li>• <b>properties/property/cpu-utilization-background</b></li> <li>• <b>properties/property/cpu-utilization-kernel</b></li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>• <code>properties/property/cpu-utilization-idle</code></li> <li>• <code>properties/property/reboot-reason</code></li> </ul> <p>The following paths are also supported for power modules:</p> <ul style="list-style-type: none"> <li>• <code>properties/property/power-zone-upper-capacity</code></li> <li>• <code>properties/property/power-zone-upper-maximum</code></li> <li>• <code>properties/property/power-zone-upper-allocated</code></li> <li>• <code>properties/property/power-zone-upper-remaining</code></li> <li>• <code>properties/property/power-zone-upper-usage</code></li> <li>• <code>properties/property/power-zone-lower-capacity</code></li> <li>• <code>properties/property/power-zone-lower-maximum</code></li> <li>• <code>properties/property/power-zone-lower-allocated</code></li> <li>• <code>properties/property/power-zone-lower-remaining</code></li> <li>• <code>properties/property/power-zone-lower-usage</code></li> <li>• <code>properties/property/power-zone-0-capacity</code></li> <li>• <code>properties/property/power-zone-0-maximum</code></li> <li>• <code>properties/property/power-zone-0-allocated</code></li> <li>• <code>properties/property/power-zone-0-remaining</code></li> <li>• <code>properties/property/power-zone-0-usage</code></li> <li>• <code>properties/property/power-zone-1-capacity</code></li> <li>• <code>properties/property/power-zone-1-maximum</code></li> <li>• <code>properties/property/power-zone-1-allocated</code></li> <li>• <code>properties/property/power-zone-1-remaining</code></li> <li>• <code>properties/property/power-zone-1-usage</code></li> <li>• <code>properties/property/power-system-capacity</code></li> <li>• <code>properties/property/power-system-allocated</code></li> <li>• <code>properties/property/power-system-remaining</code></li> <li>• <code>properties/property/power-system-usage</code></li> <li>• <code>properties/property/temperature-ambient</code></li> </ul> <p>The following paths are supported for either Switch Fabric Board or Control Boards or both:</p> <ul style="list-style-type: none"> <li>• <code>properties/property/temperature-zone-0-intake</code> (SFB only)</li> <li>• <code>properties/property/temperature-zone-0-intake-a</code> (both SFB and CB)</li> <li>• <code>properties/property/temperature-zone-1-intake-b</code> (both SFB and CB)</li> <li>• <code>properties/property/temperature-zone-0-exhaust</code> (SFB only)</li> <li>• <code>properties/property/temperature-zone-1-exhaust</code> (SFB only)</li> <li>• <code>properties/property/temperature-zone-0-intake-c</code> (CB only)</li> <li>• <code>properties/property/temperature-zone-0-exhaust-a</code> (CB only)</li> <li>• <code>properties/property/temperature-zone-1-exhaust-b</code> (CB only)</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
/lACP/	<p>Sensor for operational state of aggregated Ethernet interfaces configured with the Link Aggregation Control Protocol.</p> <p>Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1.</p> <p>Supported on PTX1000 routers and EX9200 switches starting with Junos OS Release 17.3R1.</p> <p>You can also add the following to the end of the path for /lACP/:</p> <ul style="list-style-type: none"> <li>• state/system-priority</li> <li>• interfaces/interface[name='aggregate-interface-name']/state/</li> <li>• interfaces/interface[name='aggregate-interface-name']/members/member[interface='interface-name']/state/</li> <li>• interfaces/interface[name='aggregate-interface-name']/members/member[interface='interface-name']/state/counters/</li> <li>• interfaces/interface[name='aggregate-interface-name']/members/member[interface='interface-name']/state/port-num</li> <li>• interfaces/interface[name='aggregate-interface-name']/members/member[interface='interface-name']/state/partner-port-num</li> <li>• interfaces/interface[name='aggregate-interface-name']/members/member[interface='interface-name']/state/mux-state</li> </ul>
/mpls/lsp/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	<p>Sensor to export events for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs.</p> <p>ON_CHANGE support for LSP events is only activated when the reporting interval is set to 0 in the subscription request.</p> <p>Supported on PTX Series routers, MX Series switches, and QFX10002, QFX10008, and QFX10016 switches starting with Junos OS Release 17.2R1.</p> <p>The following events are exported under this resource path:</p> <ul style="list-style-type: none"> <li>• INITIATED</li> <li>• CONCLUDED_UP</li> <li>• CONCLUDED_TORN_DOWN</li> <li>• PROTECTION_AVAILABLE</li> <li>• PROTECTION_UNAVAILABLE</li> <li>• AUTOBW_SUCCESS</li> <li>• AUTOBW_FAIL</li> <li>• TUNNEL_LOCAL_REPAIRED</li> <li>• PATHERR_RECEIVED <ul style="list-style-type: none"> <li>• ADMISSION_CONTROL_FAILURE</li> <li>• SESSION_PREEMPTED</li> <li>• BAD_LOOSE_ROUTE</li> <li>• BAD_STRICT_ROUTE</li> <li>• LABEL_ALLOCATION_FAILURE</li> <li>• ROUTING_LOOP_DETECTED</li> <li>• REQUESTED_BANDWIDTH_UNAVAILABLE</li> </ul> </li> </ul>



Table 5: gRPC Sensors (continued)

resource path	Description
<code>/mpls/lsp/constrained-path/tunnels/  tunnel[name='foo-name',source='foo-source']/  p2p-tunnel-attributes/  p2p-primary-paths[name='foo-path']/state/notify-status</code>	<p>Sensor to export events for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs.</p> <p>ON_CHANGE support for LSP events is only activated when the reporting interval is set to 0 in the subscription request.</p> <p>Supported on PTX Series routers, MX Series switches, and QFX10002, QFX10008, and QFX10016 switches starting with Junos OS Release 17.2R1.</p> <p>The following events are exported under this resource path:</p> <ul style="list-style-type: none"> <li>• DESELECT_ACTIVE_PATH</li> <li>• CHANGE_ACTIVE_PATH</li> <li>• SELECT_ACTIVE_PATH</li> <li>• ORIGINATE_MBB</li> <li>• CSPF_NO_ROUTE</li> <li>• CSPF_SUCCESS</li> <li>• RESTART_RECOVERY_FAIL</li> </ul>
<code>/mpls/lsp/constrained-path/tunnels/  tunnel[name='foo-name',source='foo-source']/  p2p-tunnel-attributes/  p2p-primary-paths[name='foo-path']/state/name</code>	<p>Sensor to export the path name for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs.</p> <p>Supported on PTX Series routers, MX Series switches, and QFX10002, QFX10008, and QFX10016 switches starting with Junos OS Release 17.2R1.</p>
<code>/mpls/lsp/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/</code>	<p>Sensor to export LSP properties for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs.</p> <p>Supported on PTX Series routers, MX Series switches, and QFX10002, QFX10008, and QFX10016 switches starting with Junos OS Release 17.2R1.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• metric</li> <li>• max-average-bandwidth</li> <li>• bandwidth</li> <li>• explicit-route-objects</li> <li>• record-route-objects</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
<code>/mpls/lsp/signaling-protocols/rsvp-te/sessions/session[local-index='foo-index']/state/notify-status</code>	<p>Sensor to export statistics for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs.</p> <p>ON_CHANGE support for LSP events is only activated when the reporting interval is set to 0 in the subscription request.</p> <p>Supported on PTX Series routers, MX Series switches, and QFX10002, QFX10008, and QFX10016 switches starting with Junos OS Release 17.2R1.</p> <p>The following events are exported under this resource path:</p> <ul style="list-style-type: none"> <li>• PATHERR_RECEIVED <ul style="list-style-type: none"> <li>• TTL_EXPIRED</li> <li>• NON_RSVP_CAPABLE_ROUTER</li> </ul> </li> <li>• RESVTEAR_RECEIVED</li> <li>• PATH_MTU_CHANGE</li> </ul>
<code>/lldp/</code>	<p>Sensor for operational state of Ethernet interfaces enabled with the Link Layer Discovery Protocol.</p> <p>Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1.</p> <p>Supported on PTX1000 routers and EX9200, EX4600, and QFX5110 switches starting with Junos OS Release 17.3R1.</p> <p>You can also add the following to the end of the path for <code>/lldp/</code>:</p> <ul style="list-style-type: none"> <li>• state/</li> <li>• state/enabled</li> <li>• state/hello-timer</li> <li>• state/system-name</li> <li>• state/system-description</li> <li>• state/chassis-id</li> <li>• state/loc-port-id-type</li> <li>• interfaces/interface[name='interface-name']/state/</li> <li>• interfaces/interface[name='interface-name']/state/counters/</li> <li>• interfaces/interface[name='interface-name']/neighbors/</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
<code>/arp-information/</code>	<p>Sensor for Address Resolution Protocol (ARP) statistics.</p> <p>Supported on QFX10000 and QFX5200 switches starting with Junos OS Release 17.2R1.</p> <p>Supported on PTX1000 routers, EX9200 switches, and MX150 routers starting with Junos OS Release 17.3R1.</p> <p>You can also add the following to the end path for <code>/arp-information/</code></p> <ul style="list-style-type: none"> <li>• <code>ipv4</code></li> <li>• <code>ipv4/neighbors</code></li> <li>• <code>ipv4/neighbors/neighbor</code></li> <li>• <code>ipv4/neighbors/neighbor/ip</code></li> <li>• <code>ipv4/neighbors/neighbor/link-layer-address</code></li> <li>• <code>pv4/neighbors/neighbor/origin</code></li> <li>• <code>ipv4/neighbors/neighbor/host-name</code></li> <li>• <code>ipv4/neighbors/neighbor/rtb-id</code></li> <li>• <code>ipv4/neighbors/neighbor/state</code></li> <li>• <code>ipv4/neighbors/neighbor/expiry</code></li> <li>• <code>ipv4/neighbors/neighbor/ispublish</code></li> <li>• <code>ipv4/neighbors/neighbor/interface-name</code></li> <li>• <code>ipv4/neighbors/neighbor/logical-router-id</code></li> </ul>

*Table 5: gRPC Sensors (continued)*

resource path	Description
<code>/interfaces/interface[name='interface-name']/</code>	

Table 5: gRPC Sensors (continued)

resource path	Description
	<p>Sensor for Routing Engine internal interfaces.</p> <p><b>NOTE:</b> On MX Series routers, you can specify the following interfaces: fxp0, em0, and em1</p> <p>On PTX Series routers, you can specify the following interfaces: em0, ixlv0, ixlv1</p> <p>On PTX Series routers with dual Routing Engines, you can specify the following interfaces: em0, ixgbe0, ixgbe1</p> <p>Support on PTX1000 routers starting with Junos OS Release 17.3R1.</p> <p>The following end paths are also supported:</p> <ul style="list-style-type: none"> <li>• interfaces/interface/state/type</li> <li>• /interfaces/interface/state/mtu</li> <li>• /interfaces/interface/state/name</li> <li>• /interfaces/interface/state/description</li> <li>• /interfaces/interface/state/enabled</li> <li>• /interfaces/interface/state/ifindex</li> <li>• /interfaces/interface/state/admin-status</li> <li>• /interfaces/interface/state/oper-status</li> <li>• /interfaces/interface/state/last-change</li> <li>• /interfaces/interface/state/speed</li> <li>• /interfaces/interface/state/counters/in-octets</li> <li>• /interfaces/interface/state/counters/in-unicast-pkts</li> <li>• /interfaces/interface/state/counters/in-broadcast-pkts</li> <li>• /interfaces/interface/state/counters/in-multicast-pkts</li> <li>• /interfaces/interface/state/counters/in-discards</li> <li>• /interfaces/interface/state/counters/in-errors</li> <li>• /interfaces/interface/state/counters/in-unknown-protos</li> <li>• /interfaces/interface/state/counters/out-octets</li> <li>• /interfaces/interface/state/counters/out-unicast-pkts</li> <li>• /interfaces/interface/state/counters/out-broadcast-pkts</li> <li>• /interfaces/interface/state/counters/out-multicast-pkts</li> <li>• /interfaces/interface/state/counters/out-discards</li> <li>• /interfaces/interface/state/counters/out-errors</li> <li>• /interfaces/interface/state/counters/last-clear</li> <li>• /interfaces/interface/state/counters/in-pkts</li> <li>• /interfaces/interface/state/counters/in-sec-pkts</li> <li>• /interfaces/interface/state/counters/in-sec-octets</li> <li>• /interfaces/interface/state/counters/in-pause-pkts</li> <li>• /interfaces/interface/state/counters/out-pkts</li> <li>• /interfaces/interface/state/counters/out-sec-pkts</li> <li>• /interfaces/interface/state/counters/out-sec-octets</li> <li>• /interfaces/interface/state/counters/out-pause-pkts</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>• /interfaces/interface/state/counters/in-drops</li> <li>• /interfaces/interface/state/counters/in-frame-errors</li> <li>• /interfaces/interface/state/counters/in-runs</li> <li>• /interfaces/interface/state/counters/in-lchan-errors</li> <li>• /interfaces/interface/state/counters/in-l-mismatch-errors</li> <li>• /interfaces/interface/state/counters/in-fifo-errors</li> <li>• /interfaces/interface/state/counters/in-giants</li> <li>• /interfaces/interface/state/counters/in-resource-errors</li> <li>• /interfaces/interface/state/counters/out-drops</li> <li>• /interfaces/interface/state/counters/carrier-transitions</li> <li>• /interfaces/interface/state/counters/mtu-errors</li> <li>• /interfaces/interface/state/counters/out-resource-errors</li> <li>• /interfaces/interface/subinterfaces/subinterface/index</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/index</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/name</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/description</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/enabled</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/ifindex</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/admin-status</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/oper-status</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/last-change</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/in-pkts</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/in-octets</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/in-unicast-pkts</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/in-broadcast-pkts</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/in-multicast-pkts</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/in-discards</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/in-errors</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/in-unknown-protos</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/out-octets</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/out-unicast-pkts</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/out-broadcast-pkts</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/out-multicast-pkts</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/out-discards</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/out-errors</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/last-clear</li> <li>• /interfaces/interface/subinterfaces/subinterface/state/counters/out-pkts</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
<code>/nd6-information/</code>	<p>Sensor for Network Discovery Protocol (NDP) table state.</p> <p>Supported on QFX10000 and QFX5200 switches starting with Junos OS Release 17.2R1.</p> <p>Supported on PTX1000 routers, EX9200 switches, and MX150 routers starting with Junos OS Release 17.3R1.</p> <p>You can also add the following to the end path for <code>nd6-information/</code></p> <ul style="list-style-type: none"> <li>• <code>ipv6</code></li> <li>• <code>ipv6/neighbors</code></li> <li>• <code>ipv6/neighbors/neighbor</code></li> <li>• <code>ipv6/neighbors/neighbor/ip</code></li> <li>• <code>ipv6/neighbors/neighbor/link-layer-address</code></li> <li>• <code>ipv6/neighbors/neighbor/origin</code></li> <li>• <code>ipv6/neighbors/neighbor/isrouter</code></li> <li>• <code>ipv6/neighbors/neighbor/state</code></li> <li>• <code>ipv6/neighbors/neighbor/rtb-id</code></li> <li>• <code>ipv6/neighbors/neighbor/issecure</code></li> <li>• <code>ipv6/neighbors/neighbor/ispublish</code></li> <li>• <code>ipv6/neighbors/neighbor/expiry</code></li> <li>• <code>ipv6/neighbors/neighbor/interface-name</code></li> <li>• <code>ipv6/neighbors/neighbor/logical-router-id</code></li> </ul>
<code>/ipv6-ra/</code>	Sensor for NDP router-advertisement statistics.
<code>/junos/system/linecard/packet/usage/</code>	<p>Sensor for Packet Forwarding Engine Statistics. This sensor exports statistics for counters and provides visibility into Packet Forwarding Engine error and drop statistics.</p> <p>This sensor is supported starting on MX Series and PTX Series routers starting with Junos OS Release 17.4R1.</p>

*Table 5: 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 5: gRPC Sensors (continued)

resource path	Description
	<p>Sensor for IS-IS routing protocol statistics. Statistics are exported separately for each routing instance.</p> <p>To specify a routing-instance name:</p> <p><code>/network-instances/network-instance[name_ 'instance-name']/protocols/protocol/isis/levels/level/</code></p> <p><code>/network-instances/network-instance[name_ 'instance-name']/protocols/protocol/isis/interfaces/interface/levels/level/</code></p> <p><b>NOTE:</b> This sensor is supported on MX Series and PTX Series routers starting with Junos OS Release 17.4R1.</p> <p>The following paths are also supported:</p> <ul style="list-style-type: none"> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/lsp/received</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/lsp/processed</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/lsp/dropped</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/lsp/sent</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/lsp/retransmit</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/iih/received</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/iih/processed</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/iih/dropped</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/iih/sent</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/iih/retransmit</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/psnp/received</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/psnp/processed</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/psnp/dropped</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/psnp/sent</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/psnp/retransmit</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/cnsp/received</code></li> <li><code>/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/cnsp/processed</code></li> <li><code>/network-instances/network-instance/protocols/protocol/</code></li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
	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
	• /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

Table 5: gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/local-extended-system-id</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-extended-system-id</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/adjacency-state</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-circuit-type</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-ipv4-address</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-ipv6-address</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-snpa</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/levels/level/adjacencies/adjacency/state/priority</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/remaining-hold-time</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/restart-status</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/restart-support</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/restart-suppress</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/up-time</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/nlpid</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/area-address</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/topologies</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/multi-topology</li> <li>• /network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/adjacency-type</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/state/ipv4-prefix</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/state/up-down</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/state/s-bit</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/state/metric</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/ipv6-prefix</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/up-down</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/s-bit</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/x-bit</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/metric</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/ipv6-prefix</li> <li>• /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</li> <li>• /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</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/tag64/state/tag64</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/tag64/state/tag32</li> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /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</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/router-capability/state/flags</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/router-capability/state/rtr-id</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/undefined-tlvs/undefined-tlv/state/type</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/undefined-tlvs/undefined-tlv/state/length</li> <li>• /network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/undefined-tlvs/undefined-tlv/state/value</li> </ul>

*Table 5: gRPC Sensors (continued)*

resource path	Description
<code>/junos/services/segment-routing/interface/ingress/usage/</code>	
<code>/junos/services/segment-routing/interface/egress/usage/</code>	
<code>/junos/services/segment-routing/sid/usage/</code>	

Table 5: gRPC Sensors (continued)

resource path	Description
	<p>Sensors for aggregate segment routing traffic with IS-IS.</p> <p>This sensor is supported on MX Series and PTX5000 routers starting with Junos OS Release 17.4R1.</p> <p>Statistics are exported separately for each routing instance.</p> <p>The first path exports inbound traffic. The second path exports outbound traffic. The third path exports inbound segment routing traffic for each segment identifier.</p> <p><b>NOTE:</b> When you enable a sensor for segment routing statistics, you must also configure the <b>sensor-based-stats</b> statement at the <b>[edit protocols isis source-packet-routing]</b> hierarchy level. MX Series and PTX Series routers must also operate in enhanced mode. On MX Series routers, if not enabled by default, configure either the <b>enhanced-ip</b> statement or the <b>enhanced-ethernet</b> statement at the <b>[edit chassis network-services]</b> hierarchy level. On PTX Series routers, configure the <b>enhanced-mode</b> statement at the <b>[edit chassis network-services]</b> hierarchy level.</p> <p><b>NOTE:</b> Currently, MPLS labels correspond only to only one instance, instance 0. Since each SID corresponds to a single <b>instance_identifier</b>, no aggregation is required to be done by the collector. The <b>instance_identifier</b> is stamped as 0.</p> <p>The following OpenConfig paths are supported:</p> <ul style="list-style-type: none"> <li>/network-instances/network-instance/mpls/signaling-protocols/segment-routing/interfaces/interface/state/in-pkts</li> <li>/network-instances/network-instance/mpls/signaling-protocols/segment-routing/interfaces/interface/state/in-octets</li> <li>/network-instances/network-instance/mpls/signaling-protocols/segment-routing/interfaces/interface/state/out-octets</li> <li>/network-instances/network-instance/mpls/signaling-protocols/segment-routing/interfaces/interface/state/out-pkts</li> <li>/network-instances/network-instance/mpls/aggregate-sid-counters/aggregate-sid-counter/state/in-octets</li> <li>/network-instances/network-instance/mpls/aggregate-sid-counters/aggregate-sid-counter/state/in-pkts</li> <li>/network-instances/network-instance/mpls/aggregate-sid-counters/aggregate-sid-counter/state/out-octets</li> <li>/network-instances/network-instance/mpls/aggregate-sid-counters/aggregate-sid-counter/state/out-pkts</li> <li>/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/state/in-octets</li> <li>/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/state/in-pkts</li> <li>/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/state/out-octets</li> <li>/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/state/out-pkts</li> <li>/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/forwarding-classes/forwarding-class/state/</li> </ul>

Table 5: gRPC Sensors (continued)

resource path	Description
	in-octets <ul style="list-style-type: none"> <li>• /network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/forwarding-classes/forwarding-class/state/in-pkts</li> <li>• /network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/forwarding-classes/forwarding-class/state/out-octets</li> <li>• /network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/forwarding-classes/forwarding-class/state/out-pkts</li> </ul>

Table 6: Broadband Edge gRPC Sensors

resource path	Description
/junos/system/subscriber-management/aaa/accounting-statistics/	<p>Sensor that tracks accounting statistics by means of a protocol exchange with accounting servers.</p> <p>You can also add the following to the end path for /junos/system/subscriber-management/aaa/accounting-statistics/:</p> <ul style="list-style-type: none"> <li>• acct-req-received</li> <li>• acct-req-timeout</li> <li>• acct-resp-failure</li> <li>• acct-resp-success</li> <li>• acct-req-start</li> <li>• acct-req-interim</li> <li>• acct-req-stop</li> <li>• acct-resp-total</li> <li>• acct-resp-start</li> <li>• acct-resp-interim</li> <li>• acct-resp-stop</li> <li>• acct-resp-total</li> </ul>



Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<code>/junos/system/subscriber-management/aaa/ address-assignment-statistics/ logical-system-routing-instances/ logical-system-routing-instance/pools/pool</code>	<p>For Authentication, Authorization, and Accounting, this sensor tracks address pool utilization.</p> <p>The resource path can be refined to select a logical system routing instance by using a logical system routing instance filter:</p> <p><code>/aaa/address-assignment-statistics/logical-system-routing-instances/ logical-system-routing-instance [lsri-name='lsName:riName']/pools/ pool[pool-name='poolName']</code></p> <p>The resource path can be refined to select a specific pool by using a pool filter:</p> <p><code>/junos/system/subscriber-management/aaa/address-assignment-statistics/ logical-system-routing-instances/logical-system-routing-instance/pools/ pool[pool-name='poolName']</code></p> <p>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:</p> <p><code>/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']</code></p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• pool-name</li> <li>• out-of-memory</li> <li>• out-of-address</li> <li>• address-total</li> <li>• address-in-use</li> <li>• address-usage-percent</li> </ul>
<code>/junos/system/subscriber-management/access-network/ ancp/adapter</code>	<p>Sensors that track statistics associated with Access Node Control Protocol (ANCP) adapter.</p> <p><b>mapped-dynamic-subscriber-count</b>—Number of ANCP subscribers mapped to dynamic interfaces by ANCP adapter.</p>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<code>/junos/system/subscriber-management/access-network/ anncp/protocol</code>	<p>Sensors that track statistics associated with ANCP protocol.</p> <p><b>establishing-neighbor-count</b>—Number of neighbors in the process of establishing adjacency.</p> <p><b>established-neighbor-count</b>—Number of neighbors in the process of establishing adjacency</p> <p><b>total-neighbor-count</b>—Total number of neighbors in all states.</p> <p><b>mapped-static-subscriber-count</b>—Number of ANCP subscribers mapped to static interfaces by ANCP protocol.</p> <p><b>port-up-count</b>—Total number of port ups received.</p> <p><b>port-down-count</b> —Total number of port downs received.</p>
<code>/junos/system/subscriber-management/aaa/ authentication-statistics/</code>	<p>Sensors that track authentication, authorization, and accounting (AAA) authentication, pre-authentication, and re-authentication statistics.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• req-received</li> <li>• req-accepted</li> <li>• req-rejected</li> <li>• req-challenge</li> <li>• req-timeout</li> <li>• pre-authen-req-received</li> <li>• pre-authen-req-accepted</li> <li>• pre-authen-req-rejected</li> <li>• pre-authen-req-challenge</li> <li>• pre-authen-req-timeout</li> <li>• re-authen-req-received</li> <li>• re-authen-req-accepted</li> <li>• re-authen-req-rejected</li> <li>• re-authen-req-internal-errors</li> <li>• re-authen-req-challenge</li> <li>• re-authen-req_timeout</li> </ul>
<code>/junos/system/subscriber-management/aaa/ dynamic-request-statistics/</code>	<p>Sensor tracks dynamic request statistics from AAA server-initiated requests, including Change of Authorization (CoA) and RADIUS-initiated Disconnect (RID).</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• dynamic-req-received</li> <li>• dynamic-req-success</li> <li>• dynamic-req-error</li> <li>• dynamic-req-silently-drop</li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<code>/junos/system/subscriber-management/aaa/radius-servers/radius-server/response-time/</code>	<p>Sensor for RADIUS server response time statistics for a specific server.</p> <p>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 <b>no response</b>.</p> <p>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.</p> <p>The resource path can be refined to select a specific RADIUS server by adding a server address filter to the resource path:</p> <p><code>/junos/system/subscriber-management/aaa/radius-servers/radius-server[server-address='radius/pv4Address']/response-time/</code></p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• <code>one-minute-minimum-response-time</code></li> <li>• <code>one-minute-average-response-time</code></li> <li>• <code>one-minute-maximum-response-time</code></li> <li>• <code>one-minute-messages-sent</code></li> <li>• <code>one-minute-messages-received</code></li> <li>• <code>one-minute-messages-no-response</code></li> </ul>

*Table 6: Broadband Edge gRPC Sensors (continued)*

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

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<p>Sensor for RADIUS server statistics for a specific server.</p> <p>The resource path can be refined to select a specific RADIUS server by adding a server address filter to the resource path:</p> <pre>/junos/system/subscriber-management//aaa/radius-servers/ radius-server[server-address='radius/pv4Address']/statistics/</pre> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• server-address</li> <li>• server-last-rtt</li> <li>• auth-access-requests</li> <li>• auth-rollover-requests</li> <li>• auth-retransmissions</li> <li>• auth-access-accepts</li> <li>• auth-access-rejects</li> <li>• auth-access-challenges</li> <li>• auth-malformed-responses</li> <li>• auth-bad-authenticators</li> <li>• auth-req-pending</li> <li>• auth-request-timeouts</li> <li>• auth-unknown-responses</li> <li>• auth-packets-dropped</li> <li>• preauth-access-requests</li> <li>• preauth-rollover-requests</li> <li>• preauth-retransmissions</li> <li>• preauth-access-accepts</li> <li>• preauth-access-rejects</li> <li>• preauth-access-challenges</li> <li>• preauth-malformed-responses</li> <li>• preauth-bad-authenticators</li> <li>• preauth-req-pending</li> <li>• preauth-request-timeouts</li> <li>• preauth-unknown-responses</li> <li>• preauth-packets-dropped</li> <li>• acct-start-requests</li> <li>• acct-interim-requests</li> <li>• acct-stop-requests</li> <li>• acct-rollover-requests</li> <li>• acct-retransmissions</li> <li>• acct-start-responses</li> <li>• acct-interim-responses</li> <li>• acct-stop-responses</li> <li>• acct-malformed-responses</li> <li>• acct-bad-authenticators</li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>• acct-req-pending</li> <li>• acct-request-timeouts</li> <li>• acct-unknown-responses</li> <li>• acct-packets-dropped</li> </ul>
/junos/system/subscriber-management/client-protocols/ dhcp/v4/routing-instances/routing-instance/relay/ bindings/	<p>Sensor for DHCPv4 relay binding state statistics.</p> <p>The resource path can be refined to select a specific routing instance by adding a routing instance name:</p> <p>/junos/system/subscriber-management/client-protocols/dhcp/v4/            routing-instances/routing-instance[name='routing-instance-name']/relay/            bindings/</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• binding-state-v4relay-binding</li> <li>• binding-state-v4relay-init</li> <li>• binding-state-v4relay-bound</li> <li>• binding-state-v4relay-selecting</li> <li>• binding-state-v4relay-requesting</li> <li>• binding-state-v4relay-renew</li> <li>• binding-state-v4relay-release</li> <li>• binding-state-v4relay-restoring</li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<code>/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance/relay/servers/server/response-time</code>	<p>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.</p> <p>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.</p> <p>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.</p> <p>The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path:</p> <p><code>/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[name='routing-instance-name']/relay/servers/server/response-time</code></p> <p>The resource path can be refined to select a specific DHCP server by adding a server filter to the resource path:</p> <p><code>/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance/relay/servers/server[server-ip='server-ip']/response-time</code></p> <p>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:</p> <p><code>/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</code></p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• <code>one-minute-minimum-response-time</code></li> <li>• <code>one-minute-average-response-time</code></li> <li>• <code>one-minute-maximum-response-time</code></li> <li>• <code>one-minute-messages-sent</code></li> <li>• <code>one-minute-messages-received</code></li> <li>• <code>one-minute-messages-no-response</code></li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<code>/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance/server/bindings/</code>	<p>Sensor for DHVPv4 server binding state statistics.</p> <p>The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path:</p> <p><code>/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[name='routing-instance-name']/server/bindings/</code></p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"><li>• <code>binding-state-v4server-binding</code></li><li>• <code>binding-state-v4server-init</code></li><li>• <code>binding-state-v4server-bound</code></li><li>• <code>binding-state-v4server-selecting</code></li><li>• <code>binding-state-v4server-requesting</code></li><li>• <code>binding-state-v4server-renew</code></li><li>• <code>binding-state-v4server-release</code></li><li>• <code>binding-state-server-restoring</code></li></ul>



*Table 6: Broadband Edge gRPC Sensors (continued)*

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

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<p>Sensor for DHCPv4 telemetry for server statistics for a specific routing-instance.</p> <p>The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path:</p> <pre>/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name='routing-instance-name']/server/statistics/</pre> <p>For example, the following resource path defines server statistics for the default:n000015k routing instance: <code>/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name='n000015k']/server/statistics</code></p> <p>In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor <code>/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name='routing-instance-name']/server/statistics/</code> the only value supported for <i>routing-instance-name</i> is <b>default</b>.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• dropped-v4server-total</li> <li>• dropped-v4server-bad-hware</li> <li>• dropped-v4server-bootp-pkt</li> <li>• dropped-v4server-bad-bootp-opcode</li> <li>• dropped-v4server-bad-options</li> <li>• dropped-v4server-bad-address</li> <li>• dropped-v4server-no-address</li> <li>• dropped-v4server-no-interface-cfg</li> <li>• dropped-v4server-no-local-address</li> <li>• dropped-v4server-short-pkt</li> <li>• dropped-v4server-no-bad-send</li> <li>• dropped-v4server-no-option60</li> <li>• dropped-v4server-no-option82</li> <li>• dropped-v4server-authentication</li> <li>• dropped-v4server-dynamic-profile</li> <li>• dropped-v4server-no-license</li> <li>• dropped-v4server-no-bad-dhcp-opcode</li> <li>• dropped-v4server-no-options</li> <li>• dropped-v4server-hop-limit</li> <li>• dropped-v4server-ttl-expired</li> <li>• dropped-v4server-bad_udp-checksum</li> <li>• dropped-v4server-inactive-vlan</li> <li>• dropped-v4server-era-start-ailed</li> <li>• dropped-v4server-client-lookup</li> <li>• dropped-v4server-lease-time-violation</li> <li>• offer-delayed</li> <li>• offer-delay-in-progress</li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>• offer-delay-total</li> <li>• msg-recv-v4server-boot-request</li> <li>• msg-recv-v4server-decline</li> <li>• msg-recv-v4server-discover</li> <li>• msg-recv-v4server-inform</li> <li>• msg-recv-v4server-release</li> <li>• msg-recv-v4server-request</li> <li>• msg-recv-v4server-renew</li> <li>• msg-recv-v4server-rebind</li> <li>• msg-recv-v4server-lease-query</li> <li>• msg-recv-v4server-bulklease-query</li> <li>• msg-sent-v4server-boot-reply</li> <li>• msg-sent-v4server-offer</li> <li>• msg-sent-v4server-boot-ack</li> <li>• msg-sent-v4server-nak</li> <li>• msg-sent-v4server-force-renew</li> <li>• msg-sent-v4server-unassigned</li> <li>• msg-sent-v4server-unknown</li> <li>• msg-sent-v4server-active</li> <li>• msg-sent-v4server-query-done</li> </ul>
/junos/system/subscriber-management/client-protocols/dhcp/v4/	<p>Sensor for DHCPv4 telemetry.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• dropped-total</li> <li>• dropped-bad-read</li> <li>• dropped-ip-header</li> <li>• dropped-short-packet</li> <li>• dropped-no-interface</li> <li>• dropped-no-routing-instance</li> <li>• dropped-no-memory</li> <li>• dropped-recovery-in-progress</li> <li>• era-inflight-count</li> <li>• era-reported-failures</li> <li>• era-reported-successes</li> </ul>

*Table 6: Broadband Edge gRPC Sensors (continued)*

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

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<p>Sensor for DHCPv4 server statistics</p> <p>The resource path can be refined to select a specific routing instance by adding a routing instance name:</p> <p><del>/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance-name/server/statistics/</del></p> <p>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</p> <p>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.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• dropped-v4server-total</li> <li>• dropped-v4server-bad-hware</li> <li>• dropped-v4server-bootp-pkt</li> <li>• dropped-v4server-bad-bootp-opcode</li> <li>• dropped-v4server-bad-options</li> <li>• dropped-v4server-bad-address</li> <li>• dropped-v4server-no-address</li> <li>• dropped-v4server-no-interface-cfg</li> <li>• dropped-v4server-no-local-address</li> <li>• dropped-v4server-short-pkt</li> <li>• dropped-v4server-no-bad-send</li> <li>• dropped-v4server-no-option60</li> <li>• dropped-v4server-no-option82</li> <li>• dropped-v4server-authentication</li> <li>• dropped-v4server-dynamic-profile</li> <li>• dropped-v4server-no-license</li> <li>• dropped-v4server-no-bad-dhcp-opcode</li> <li>• dropped-v4server-no-options</li> <li>• dropped-v4server-hop-limit</li> <li>• dropped-v4server-ttl-expired</li> <li>• dropped-v4server-bad_udp-checksum</li> <li>• dropped-v4server-inactive-vlan</li> <li>• dropped-v4server-era-start-ailed</li> <li>• dropped-v4server-client-lookup</li> <li>• dropped-v4server-lease-time-violation</li> <li>• offer-delayed</li> <li>• offer-delay-in-progress</li> <li>• offer-delay-total</li> <li>• msg-recv-v4server-boot-request</li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"><li>• msg-recv-v4server-decline</li><li>• msg-recv-v4server-discover</li><li>• msg-recv-v4server-inform</li><li>• msg-recv-v4server-release</li><li>• msg-recv-v4server-request</li><li>• msg-recv-v4server-renew</li><li>• msg-recv-v4server-rebind</li><li>• msg-recv-v4server-lease-query</li><li>• msg-recv-v4server-bulklease-query</li><li>• msg-sent-v4server-boot-reply</li><li>• msg-sent-v4server-offer</li><li>• msg-sent-v4server-boot-ack</li><li>• msg-sent-v4server-nak</li><li>• msg-sent-v4server-force-renew</li><li>• msg-sent-v4server-unassigned</li><li>• msg-sent-v4server-unknown</li><li>• msg-sent-v4server-active</li><li>• msg-sent-v4server-query-done</li></ul>

*Table 6: Broadband Edge gRPC Sensors (continued)*

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

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<p>Sensor for DHVPv4 relay binding state statistics.</p> <p>The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path:</p> <pre>/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name='routing-instance-name']/relay/statistics/</pre> <p>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</p> <p>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 <i>routing-instance-name</i> is <b>default</b>.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• dropped-v4relay-total</li> <li>• dropped-v4relay-bad-hardware</li> <li>• dropped-v4relay-bootp-packet</li> <li>• dropped-v4relay-bad-bootp-opcode</li> <li>• dropped-v4relay-bad-options</li> <li>• dropped-v4relay-bad-address</li> <li>• dropped-v4relay-no-address</li> <li>• dropped-v4relay-no-interface-cfg</li> <li>• dropped-v4relay-no-local-address</li> <li>• dropped-v4relay-short-packet</li> <li>• dropped-v4relay-bad-send</li> <li>• dropped-v4relay-option-60</li> <li>• dropped-v4relay-relay-option</li> <li>• dropped-v4relay-option-82</li> <li>• dropped-v4relay-authentication</li> <li>• dropped-v4relay-dynamic-profile</li> <li>• dropped-v4relay-dynamic-profile</li> <li>• dropped-v4relay-license</li> <li>• dropped-v4relay-bad-dhcp-opcode</li> <li>• dropped-v4relay-no-options</li> <li>• dropped-v4relay-hop-limit</li> <li>• dropped-v4relay-ttl-expired</li> <li>• dropped-v4relay-bad-udp-checksum</li> <li>• dropped-v4relay-inactive-vlan</li> <li>• dropped-v4relay-era-start-failed</li> <li>• dropped-v4relay-client-lookup</li> <li>• dropped-v4relay-proxy-no-server-addr</li> <li>• dropped-v4relay-lease-time-violation</li> </ul>



Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>• dropped-v4relay-leasequery-repl-no-circuitid</li> <li>• dropped-v4relay-leasequery-repl-with-error-code</li> <li>• dropped-v4relay-leasequery-repl-with-query-term</li> <li>• dropped-v4relay-older-leasequery-reply</li> <li>• dropped-v4relay-abort-leasequery-reply-proc</li> <li>• dropped-v4relay-during-leasequery-reply</li> <li>• dropped-v4relay-relay-source-no-lpbk-interface</li> <li>• v4relay-bootp-request-rcvd</li> <li>• msg-recv-v4relay-decline</li> <li>• msg-recv-v4relay-discover</li> <li>• msg-recv-v4relay-inform</li> <li>• msg-recv-v4relay-release</li> <li>• msg-recv-v4relay-request</li> <li>• msg-recv-v4relay-leaseactive</li> <li>• msg-recv-v4relay-leaseunassigned</li> <li>• msg-recv-v4relay-leaseunknown</li> <li>• msg-recv-v4relay-leasequerydone</li> <li>• v4relay-bootp-reply-rcvd</li> <li>• msg-recv-v4relay-offer</li> <li>• msg-recv-v4relay-ack</li> <li>• msg-recv-v4relay-nak</li> <li>• msg-recv-v4relay-forcerenew</li> <li>• v4relay-bootp-reply-sent</li> <li>• msg-sent-v4relay-offer</li> <li>• msg-sent-v4relay-ack</li> <li>• msg-sent-v4relay-nak</li> <li>• msg-sent-v4relay-forcerenew</li> <li>• msg-sent-v4relay-leasequery</li> <li>• msg-sent-v4relay-bulkleasequery</li> <li>• v4relay-bootp-request-sent</li> <li>• msg-sent-v4relay-decline</li> <li>• msg-sent-v4relay-discover</li> <li>• msg-sent-v4relay-inform</li> <li>• msg-sent-v4relay-release</li> <li>• msg-sent-v4relay-request</li> <li>• v4relay-bootp-forwarded-total</li> <li>• v4relay-bootp-request-fwd</li> <li>• v4relay-bootp-reply-fwd</li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<code>/junos/system/subscriber-management/client-protocols/dhcp/v6/</code>	<p>Sensor for DHCPv6 statistics.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• <code>era-inflight-count</code></li> <li>• <code>era-reported-failures</code></li> <li>• <code>era-reported-successes</code></li> </ul>
<code>/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance/relay/bindings/</code>	<p>Sensor for DHCPv6 relay binding state statistics.</p> <p>The resource path can be refined to select a specific routing instance by adding a routing instance name:</p> <p><code>/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[name='routing-instance-name']/relay/bindings/</code></p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• <code>binding-state-v6relay-binding</code></li> <li>• <code>binding-state-v6relay-init</code></li> <li>• <code>binding-state-v6relay-bound</code></li> <li>• <code>binding-state-v6relay-selecting</code></li> <li>• <code>binding-state-v6relay-requesting</code></li> <li>• <code>binding-state-v6relay-renew</code></li> <li>• <code>binding-state-v6relay-release</code></li> <li>• <code>binding-state-relay-restoring</code></li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<del>/junos/system/management/protocols/dhcp/v6/relay/servers/server/response-time</del>	<p>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.</p> <p>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.</p> <p>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.</p> <p>The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path:</p> <pre>/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[name='routing-instance-name']/relay/servers/server/response-time</pre> <p>The resource path can be refined to select a specific DHCP server by adding a server address filter to the resource path:</p> <pre>/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance/relay/servers/server[server-ip='server-ip']/response-time</pre> <p>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:</p> <pre>/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</pre> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• one-minute-minimum-response-time</li> <li>• one-minute-average-response-time</li> <li>• one-minute-maximum-response-time</li> <li>• one-minute-messages-sent</li> <li>• one-minute-messages-received</li> <li>• one-minute-messages-no-response</li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<code>/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance/server/bindings/</code>	<p>Sensor for DHVPv6 binding state statistics.</p> <p>The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path:</p> <p><code>/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[name='routing-instance-name']/server/bindings/</code></p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"><li>• <code>binding-state-v6server-binding</code></li><li>• <code>binding-state-v6server-init</code></li><li>• <code>binding-state-v6server-bound</code></li><li>• <code>binding-state-v6server-selecting</code></li><li>• <code>binding-state-v6server-requesting</code></li><li>• <code>binding-state-v6server-renew</code></li><li>• <code>binding-state-v6server-release</code></li><li>• <code>binding-state-server-restoring</code></li></ul>

*Table 6: Broadband Edge gRPC Sensors (continued)*

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

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<p>Sensor for DHCPv6 server statistics.</p> <p>The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path:</p> <pre>/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[ri-name='routing-instance-name']/server/statistics/</pre> <p>For example, the following resource path defines server statistics for the default:n000015k routing instance: <code>/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[ri-name='n000015k']/server/statistics</code></p> <p>In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor <code>/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[ri-name='routing-instance-name']/server/statistics</code> the only value supported for <i>routing-instance-name</i> is <b>default</b>.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• dropped-v6server-total</li> <li>• dropped-v6server-no-routing-instance</li> <li>• dropped-v6server-bad-send</li> <li>• dropped-v6server-short-packet</li> <li>• dropped-v6server-bad-msgtype</li> <li>• dropped-v6server-bad-options</li> <li>• dropped-v6server-bad-srcaddress</li> <li>• dropped-v6server-relay-hop-count</li> <li>• dropped-v6server-bad-udp-checksum</li> <li>• dropped-v6server-no-client-id</li> <li>• dropped-v6server-strict-reconfigure</li> <li>• dropped-v6server-option-18</li> <li>• dropped-v6server-authentication{</li> <li>• dropped-v6server-dynamic-profile</li> <li>• dropped-v6server-license</li> <li>• dropped-v6server-inactive-vlan</li> <li>• dropped-v6server-era-start-failed</li> <li>• dropped-v6server-client-lookup</li> <li>• dropped-v6server-lease-time-violation</li> <li>• advertise-delayed</li> <li>• advertise-queued</li> <li>• advertise-total</li> <li>• msg-recv-v6server-dhcpv6-decline</li> <li>• msg-recv-v6server-dhcpv6-solicit</li> <li>• msg-recv-v6server-dhcpv6-information-request</li> <li>• msg-recv-v6server-dhcpv6-release</li> <li>• msg-recv-v6server-dhcpv6-request</li> <li>• msg-recv-v6server-dhcpv6-confirm</li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>• msg-recv-v6server-dhcpv6-renew</li> <li>• msg-recv-v6server-dhcpv6-rebind</li> <li>• msg-recv-v6server-dhcpv6-relay-forw</li> <li>• msg-recv-v6server-dhcpv6-leasequery</li> <li>• msg-sent-v6server-advertise</li> <li>• msg-sent-v6server-reply</li> <li>• msg-sent-v6server-logical_nak</li> <li>• msg-sent-v6server-reconfigure</li> <li>• msg-sent-v6server-relay-repl</li> <li>• msg-sent-v6server-leasequery-repl</li> <li>• msg-sent-v6server-leasequery-data</li> <li>• msg-sent-v6server-leasequery-done</li> </ul>

*Table 6: Broadband Edge gRPC Sensors (continued)*

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



Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<p>Sensor for DHVPv6 relay statistics.</p> <p>The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path:</p> <pre>/junos/system/subscriber-management/client-protocols/dhcp/v6/ routing-instances/routing-instance[ri-name='routing-instance-name']/relay/ statistics/</pre> <p>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</p> <p>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.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• dropped-v6relay-total</li> <li>• dropped-v6relay-no-safd</li> <li>• dropped-v6relay-no-routing-instance</li> <li>• dropped-v6relay-bad-send</li> <li>• dropped-v6relay-short-packet</li> <li>• dropped-v6relay-bad-msgtype</li> <li>• dropped-v6relay-bad-options</li> <li>• dropped-v6relay-bad-srcaddress</li> <li>• dropped-v6relay-relay-hop-count</li> <li>• dropped-v6relay-bad-udp-checksum</li> <li>• dropped-v6relay-no-client-id</li> <li>• dropped-v6relay-strict-reconfigure</li> <li>• dropped-v6relay-relay-option</li> <li>• dropped-v6relay-option-18</li> <li>• dropped-v6relay-option-37</li> <li>• dropped-v6relay-authentication</li> <li>• dropped-v6relay-dynamic-profile</li> <li>• dropped-v6relay-license</li> <li>• dropped-v6relay-inactive-vlan</li> <li>• dropped-v6relay-era-start-failed</li> <li>• dropped-v6relay-client-lookup</li> <li>• dropped-v6relay-lease-time-violation</li> <li>• dropped-v6relay-leasequery-repl-no-client-data</li> <li>• dropped-v6relay-leasequery-repl-no-interfaceid</li> <li>• dropped-v6relay-leasequery-repl-with-client-link</li> <li>• dropped-v6relay-leasequery-repl-no-relay-data</li> <li>• dropped-v6relay-leasequery-repl-with-hop-cnt</li> <li>• dropped-v6relay-leasequery-repl-with-error-code</li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>dropped-v6relay-leasequery-repl-with-query-term</li> <li>dropped-v6relay-older-leasequery-reply</li> <li>dropped-v6relay-abort-leasequery-reply-proc</li> <li>dropped-v6relay-during-leasequery-reply</li> <li>dropped-v6relay-relay-source-no-lpbk-interface</li> <li>msg-recv-v6relay-decline</li> <li>msg-recv-v6relay-solicit</li> <li>msg-recv-v6relay-information-request</li> <li>msg-recv-v6relay-release</li> <li>msg-recv-v6relay-request</li> <li>msg-recv-v6relay-confirm</li> <li>msg-recv-v6relay-renew</li> <li>msg-recv-v6relay-rebind</li> <li>msg-recv-v6relay-relay-forw</li> <li>msg-recv-v6relay-leasequery-repl</li> <li>msg-recv-v6relay-leasequery-data</li> <li>msg-recv-v6relay-leasequery-done</li> <li>msg-recv-v6relay-advertise</li> <li>msg-recv-v6relay-reply</li> <li>msg-recv-v6relay-reconfigure</li> <li>msg-recv-v6relay-relay-repl</li> <li>msg-recv-v6relay-leasequery</li> <li>msg-sent-v6relay-reply</li> <li>msg-sent-v6relay-reconfigure</li> <li>msg-sent-v6relay-relay-repl</li> <li>msg-sent-v6relay-leasequery</li> <li>msg-sent-v6relay-decline</li> <li>msg-sent-v6relay-solicit</li> <li>msg-sent-v6relay-information-request</li> <li>msg-sent-v6relay-release</li> <li>msg-sent-v6relay-request</li> <li>msg-sent-v6relay-confirm</li> <li>msg-sent-v6relay-renew</li> <li>msg-sent-v6relay-rebind</li> <li>msg-sent-v6relay-relay-forw</li> <li>msg-sent-v6relay-leasequery-repl</li> <li>msg-sent-v6relay-leasequery-data</li> <li>msg-sent-v6relay-leasequery-done</li> <li>v6relay-fwd-total</li> <li>v6relay-fwd-request</li> <li>v6relay-fwd-reply</li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<code>/junos/system/subscriber-management/client-protocols/l2tp/summary/</code>	<p>Sensor for L2TP telemetry information.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• <code>l2tp-stats-total-tunnels</code></li> <li>• <code>l2tp-stats-total-sessions</code></li> <li>• <code>l2tp-stats-control-rx-packets</code></li> <li>• <code>l2tp-stats-control-rx-bytes</code></li> <li>• <code>l2tp-stats-control-tx-packets</code></li> <li>• <code>l2tp-stats-control-tx-bytes</code></li> <li>• <code>l2tp-era-type-icrq-inflight-count</code></li> <li>• <code>l2tp-era-type-icrq-reported-successes</code></li> <li>• <code>l2tp-era-type-icrq-reported-failures</code></li> <li>• <code>l2tp-era-type-sccrq-inflight-count</code></li> <li>• <code>l2tp-era-type-sccrq-reported-successes</code></li> <li>• <code>l2tp-era-type-sccrq-reported-failures</code></li> </ul>
<code>/junos/system/subscriber-management/client-protocols/ppp/statistics/</code>	<p>Sensors for PPP telemetry information.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• <code>ppp-stats-total-subscriber-sessions</code></li> <li>• <code>ppp-stats-sessions-disable-phase</code></li> <li>• <code>ppp-stats-sessions-establish-phase</code></li> <li>• <code>ppp-stats-sessions-network-phase</code></li> <li>• <code>ppp-stats-sessions-authenticate-phase</code></li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<code>/junos/system/subscriber-management/client-protocols/pppoe/statistics/</code>	<p>Sensors for PPPoE counts.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• <code>padi-packets-sent</code></li> <li>• <code>padi-packets-received</code></li> <li>• <code>pado-packets-sent</code></li> <li>• <code>pado-packets-received</code></li> <li>• <code>padr-packets-sent</code></li> <li>• <code>padr-packets-received</code></li> <li>• <code>pads-packets-sent</code></li> <li>• <code>pads-packets-received</code></li> <li>• <code>padt-packets-sent</code></li> <li>• <code>padt-packets-received</code></li> <li>• <code>service-error-sent</code></li> <li>• <code>service-error-received</code></li> <li>• <code>ac-error-sent</code></li> <li>• <code>ac-error-received</code></li> <li>• <code>generic-error-sent</code></li> <li>• <code>generic-error-received</code></li> <li>• <code>malformed-packets-received</code></li> <li>• <code>unknown-packets-received</code></li> <li>• <code>era-inflight-count</code></li> <li>• <code>era-reported-successes</code></li> <li>• <code>era-reported-failures</code></li> </ul>
<code>/junos/system/subscriber-management/infra/resource-monitor/chassis</code>	<p>Sensor for chassis resource statistics.</p> <p>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.</p> <p>Unless limits are configured using <b>configured-subscriber-limit</b>, configured and current limit counts will not be visible.</p> <p>The following end paths are supported for chassis threshold crossing statistics:</p> <ul style="list-style-type: none"> <li>• <code>subscriber-limit-exceeded</code></li> <li>• <code>subscriber-limit-nominal</code></li> <li>• <code>configured-subscriber-limit</code></li> <li>• <code>current-subscriber-count</code></li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<code>/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc/statistics/</code>	<p>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).</p> <p>The resource path can be refined to select a specific slot by adding a slot number filter to the resource path:</p> <p><code>/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc[slot='slot number']/statistics/</code></p> <p>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.</p> <p>Unless limits are configured using <b>configured-subscriber-limit</b>, configured and current limit counts will not be visible.</p> <p>The following end paths are supported for FPC threshold crossing statistics:</p> <ul style="list-style-type: none"> <li>• <b>mem-heap-exceeded</b></li> <li>• <b>mem-heap-nominal</b></li> <li>• <b>subscriber-limit-exceeded</b></li> <li>• <b>subscriber-limit-nominal</b></li> <li>• <b>configured-subscriber-limit</b></li> <li>• <b>current-subscriber-count</b></li> </ul> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• <b>heap-memory-used</b></li> <li>• <b>client-session-denied-count</b></li> <li>• <b>service-session-denied-count</b></li> <li>• <b>rtt-throttled-sub-count-client</b></li> <li>• <b>rtt-throttled-sub-count-client</b></li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<code>/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc/statistics/pfes/pfe</code>	<p>Sensor for FPC resource statistics at the Packet Forwarding Engine level. Periodically tracks line card statistics and Packet Forwarding Engine statistics.</p> <p>The resource path can be refined to select a specific Packet Forwarding Engine by adding a Packet forwarding Engine filter to the resource path:</p> <p><code>/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc/statistics/pfes/pfe[pfe-no='pfe number']/</code></p> <p>The resource path can be refined to select a specific Packet Forwarding Engine by adding a slot number filter to the resource path:</p> <p><code>/junos/system/subscriber-management/infra/resource-monitor/fpcs/fpc[slot='slot number']/statistics/pfes/pfe[pfe-no='pfe number']/</code></p> <p>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.</p> <p>The following end paths are supported for packet forwarding threshold crossing statistics:</p> <ul style="list-style-type: none"> <li>• <code>mem-ift-exceeded</code></li> <li>• <code>mem-ift-nominal</code></li> <li>• <code>mem-expansion-exceeded</code></li> <li>• <code>mem-expansion-nominal</code></li> </ul> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• <code>pfe-no</code></li> <li>• <code>filter-memory-used</code></li> <li>• <code>ift-memory-used</code></li> <li>• <code>expansion-memory-used</code></li> <li>• <code>nh-memory</code></li> </ul>
<code>/junos/system/subscriber-management/infra/resource-monitor/rsmon-infra/fpcs/fpc[slot='slot number']/</code>	<p>Sensor for FPC resource statistics.</p> <p>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.</p> <p>The following end paths are supported for FPC threshold crossing statistics:</p> <ul style="list-style-type: none"> <li>• <code>delay-round-trip-exceeded</code></li> <li>• <code>delay-round-trip-nominal</code></li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<pre>/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']/</pre>	<p>Sensor for counts of CoS utilization threshold crossing events above (exceeded) and below (nominal).</p> <p>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.</p> <p>The following end paths are supported for CoS utilization threshold crossing statistics:</p> <ul style="list-style-type: none"> <li>• <b>cos-utilization-exceeded</b></li> <li>• <b>cos-utilization-nominal</b></li> </ul> <p>The following end paths are supported for statistical data:</p> <ul style="list-style-type: none"> <li>• <b>queues-max</b></li> <li>• <b>queues-allocated</b></li> </ul>
<pre>/junos/system/subscriber-management/infra/ resource-monitor/fpcs/fpc [slot=' slot number']/pics/ pic[pic-no='pic number']/</pre>	<p>Sensor for PIC threshold crossing.</p> <p>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.</p> <p>Unless limits are configured using <b>configured-subscriber-limit</b>, configured and current limit counts will not be visible.</p> <p>The following end paths are supported for PIC threshold crossing statistics:</p> <ul style="list-style-type: none"> <li>• <b>subscriber-limit-exceeded</b></li> <li>• <b>subscriber-limit-nominal</b></li> <li>• <b>configured-subscriber-limit</b></li> <li>• <b>current-subscriber-count</b></li> </ul>
<pre>/junos/system/subscriber-management/infra/ resource-monitor/fpcs/fpc [slot=' slot number']/pics/ pic[pic-no='pic number']/ports/port[port-no='port number']/</pre>	<p>Sensor for port threshold crossing.</p> <p>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.</p> <p>Unless limits are configured using <b>configured-subscriber-limit</b>, configured and current limit counts will not be visible.</p> <p>The following end paths are supported for port utilization threshold crossing statistics:</p> <ul style="list-style-type: none"> <li>• <b>subscriber-limit-exceeded</b></li> <li>• <b>subscriber-limit-nominal</b></li> <li>• <b>configured-subscriber-limit</b></li> <li>• <b>current-subscriber-count</b></li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
<code>/junos/system/subscriber-management/infra/network/dhcp/</code>	<p>Sensor for network stack DHCP. Periodically tracks packets processed by the BBE network stack to and from the DHCP application.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• <code>rx-packet-cnt</code></li> <li>• <code>era-drops</code></li> <li>• <code>rx-no-connection</code></li> <li>• <code>rx-malformed-cnt</code></li> <li>• <code>rx-no-if-cnt</code></li> <li>• <code>rx-ifl-invalid</code></li> <li>• <code>rx-send-failed</code></li> <li>• <code>tx-packet-cnt</code></li> <li>• <code>packets-transmitted</code></li> <li>• <code>tx-malformed-cnt</code></li> <li>• <code>tx-null-pkt</code></li> <li>• <code>tx-no-if-cnt</code></li> <li>• <code>tx-no-iff-cnt</code></li> <li>• <code>tx-no-rtt-cnt</code></li> <li>• <code>tx-arp-failed</code></li> <li>• <code>tx_arp_failed</code></li> <li>• <code>tx-if-invalid</code></li> <li>• <code>tx-send-failed</code></li> <li>• <code>rx-while-not-connected</code></li> </ul>
<code>/junos/system/subscriber-management/infra/network/dvlan/</code>	<p>Sensor for network stack dynamic VLAN. Periodically maintains a count of the number of packets received that triggered dynamic VLAN interface creations.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• <code>rx-packet-cnt</code></li> </ul>



Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
/junos/system/subscriber-management/infra/network/io/	<p>Sensor for network stack IO. Periodically provides basic network stack input and output and tracks network stack packet statistics.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• l2-rx-packets-cnt</li> <li>• l2-rx-packets-failed</li> <li>• l2-rx-malformed-cnt</li> <li>• l2-rx-ifd-invalid</li> <li>• l2-rx-ifl-invalid</li> <li>• l2-rx-no-iff-cnt</li> <li>• l2-rx-if-create-failed</li> <li>• l2-bbe-io-rcv-l3-unknown-address-family</li> <li>• l2-rx-unsupported-inet-protocol</li> <li>• l2-rx-unsupported-inet6-protocol</li> <li>• l2-rx-unsupported-udp-protocol</li> <li>• l2-rx-unsupported-punt-af</li> <li>• l2-rx-v4-data-path-punt-pkt</li> <li>• l2-rx-v4-data-path-punt-pkt-drop</li> <li>• l2-rx-v6-data-path-punt-pkt</li> <li>• l2-rx-v6-data-path-punt-pkt-drop</li> <li>• l2-tx-packets-cnt</li> <li>• l2-tx-malformed-cnt</li> <li>• l2-tx-no-ifd-cnt</li> <li>• l2-tx-ifl-invalid</li> <li>• l2-bbe-io-send-tx-failed</li> <li>• l2-bbe-io-send-tx-failed-partial</li> <li>• l2-tx-v4-out-error-local-intf</li> <li>• l2-tx-v6-out-error-local-intf</li> <li>• l3-rx-packet-cnt</li> <li>• l3-rx-unsupported-protocol</li> <li>• l3-tx-packet-cnt</li> <li>• l3-tx-send-failed</li> <li>• l3-tx-v4-kernel-forward</li> <li>• l3-tx-v4-kernel-forward-drops</li> <li>• l3-tx-v6-kernel-forward</li> <li>• l3-tx-v6-kernel-forward-drops</li> </ul>
/junos/system/subscriber-management/infra/network/dvlan/	<p>Sensor for network stack dynamic VLAN. Periodically maintains a count of the number of packets received that triggered dynamic VLAN interface creations.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• rx-packet-cnt</li> </ul>

*Table 6: Broadband Edge gRPC Sensors (continued)*

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

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<p>Sensor network stack L2TP. Periodically tracks L2TP packets processed by the BBE network stack to and from the L2TP application.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• rx-cnt</li> <li>• rx-pkt-cnt</li> <li>• ppp-rx-pkt-cnt</li> <li>• tx-pkt-cnt</li> <li>• ppp-rx-lcp-conf-req-count</li> <li>• ppp-rx-lcp-conf-ack-count</li> <li>• ppp-rx-lcp-conf-nack-count</li> <li>• ppp-rx-lcp-term-req-count</li> <li>• ppp-rx-lcp-term-ack-count</li> <li>• ppp-rx-lcp-echo-req-count</li> <li>• ppp-rx-lcp-echo-resp-count</li> <li>• ppp-rx-pap-req-count</li> <li>• ppp-rx-pap-ack-count</li> <li>• ppp-rx-pap-nack-count</li> <li>• ppp-rx-chap-challenge-count</li> <li>• ppp-rx-chap-resp-count</li> <li>• ppp-rx-chap-success-count</li> <li>• ppp-rx-chap-fail-count</li> <li>• ppp-rx-ipc-conf-req-count</li> <li>• ppp-rx-ipc-conf-ack-count</li> <li>• ppp-rx-ipc-conf-nack-count</li> <li>• rx-malformed-cnt</li> <li>• ppp-rx-unknown-protocol</li> <li>• rx-msg-cnt</li> <li>• rx-msg-processd-cnt</li> <li>• rx-msg-err</li> <li>• rx-invalid-msg-cnt</li> <li>• tx-cnt</li> <li>• ppp-tx-lcp-conf-req-count</li> <li>• ppp-tx-lcp-conf-ack-count</li> <li>• ppp-tx-lcp-conf-nack-count</li> <li>• ppp-tx-lcp-echo-req-count</li> <li>• ppp-tx-lcp-echo-resp-count</li> <li>• ppp-tx-lcp-term-req-count</li> <li>• ppp-tx-lcp-term-ack-count</li> <li>• ppp-tx-pap-req-count</li> <li>• ppp-tx-pap-ack-count</li> <li>• ppp-tx-pap-nack-count</li> <li>• ppp-tx-chap-challenge-count</li> </ul>

*Table 6: Broadband Edge gRPC Sensors (continued)*

resource path	Description
	<ul style="list-style-type: none"><li>• ppp-tx-chap-resp-count</li><li>• ppp-tx-chap-success-count</li><li>• ppp-tx-chap-fail-count</li><li>• ppp-tx-ipcp-conf-req-count</li><li>• ppp-tx-ipcp-conf-ack-count</li><li>• ppp-tx-ipcp-conf-nack-count</li><li>• ppp-tx-unknown-protocol</li><li>• tx-pkt-send-failed</li><li>• tx-pkt-err</li><li>• tx-msg-cnt</li><li>• tx-msg-err</li></ul>

Table 6: Broadband Edge gRPC Sensors (continued)

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

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<p>Sensor network stack PPP. Periodically tracks PPP packets processed by the BBE network stack to and from the PPP application.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• rx-network-pkt-cnt</li> <li>• rx-plugin-pkt-cnt</li> <li>• rx-lcp-conf-req-cnt</li> <li>• rx-lcp-conf-ack-cnt</li> <li>• rx-lcp-conf-nack-cnt</li> <li>• rx-lcp-conf-rej-cnt</li> <li>• rx-lcp-term-req-cnt</li> <li>• rx-lcp-term-ack-cnt</li> <li>• rx-lcp-code-rej-cnt</li> <li>• rx-lcp-protocol-rej-cnt</li> <li>• rx-lcp-echo-req-cnt</li> <li>• rx-lcp-echo-reply-cnt</li> <li>• rx-pap-req-cnt</li> <li>• rx-pap-ack-cnt</li> <li>• rx-pap-nack-cnt</li> <li>• rx-chap-challenge-cnt</li> <li>• rx-chap-resp-cnt</li> <li>• rx-chap-success-cnt</li> <li>• rx-chap-failure-cnt</li> <li>• rx-ipcp-req-cnt</li> <li>• rx-ipcp-ack-cnt</li> <li>• rx-ipcp-nack-cnt</li> <li>• rx-ipv6cp-req-cnt</li> <li>• rx-ipv6cp-ack-cnt</li> <li>• rx-ipv6cp-nack-cnt</li> <li>• rx-malformed-cnt</li> <li>• rx-no-if-cnt</li> <li>• rx-unsupported</li> <li>• tx-cnt</li> <li>• tx-lcp-conf-req-cnt</li> <li>• tx-lcp-conf-ack-cnt</li> <li>• tx-lcp-conf-nack-cnt</li> <li>• tx-lcp-echo-req-cnt</li> <li>• tx-lcp-echo-reply-cnt</li> <li>• tx-lcp-term-req-cnt</li> <li>• tx-lcp-term-ack-cnt</li> <li>• tx-pap-req-cnt</li> <li>• tx-pap-ack-cnt</li> <li>• tx-pap-nack-cnt</li> </ul>

Table 6: Broadband Edge gRPC Sensors (continued)

resource path	Description
	<ul style="list-style-type: none"> <li>• tx-chap-challenge-cnt</li> <li>• tx-chap-resp-cnt</li> <li>• tx-chap-success-cnt</li> <li>• tx-chap-failure-cnt</li> <li>• tx-ipcp-req-cnt</li> <li>• tx-ipcp-ack-cnt</li> <li>• tx-ipcp-nack-cnt</li> <li>• tx-ipv6cp-req-cnt</li> <li>• tx-ipv6cp-ack-cnt</li> <li>• tx-ipv6cp-nack-cnt</li> <li>• tx-unknown-pkt-cnt</li> <li>• tx-send-failed</li> <li>• tx-malformed-cnt</li> </ul>
/junos/system/subscriber-management/infra/network/pppoe/	<p>Sensor for network stack PPPoE statistics. PPPoE packets processed by the BBE network stack to and from the PPPoE application are tracked.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• rx-cnt</li> <li>• rx-padi-cnt</li> <li>• rx-padr-cnt</li> <li>• rx-ppp-cnt</li> <li>• rx-malformed-cnt</li> <li>• rx-no-if-cnt</li> <li>• rx-unsupported</li> <li>• rx-padi-era-discards</li> <li>• tx-cnt</li> <li>• tx-send-failed</li> </ul>
/junos/system/subscriber-management/infra/sdb/statistics/client-type/	<p>Sensor for session database resources session counts by client type.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"> <li>• dhcp-client-count</li> <li>• vlan-client-count</li> <li>• ppp-client-count</li> <li>• pppoe-client-count</li> <li>• l2tp-client-count</li> <li>• static-client-count</li> <li>• vpls-pw-client-count</li> <li>• mlppp-client-count</li> <li>• essm-client-count</li> <li>• total-client-count</li> </ul>

*Table 6: Broadband Edge gRPC Sensors (continued)*

resource path	Description
<code>/junos/system/subscriber-management/infra/sdb/statistics/state/</code>	<p>Sensor for session database resources tracking session counts by state.</p> <p>The following end paths are also supported for the resource path:</p> <ul style="list-style-type: none"><li>• <code>init-state-count</code></li><li>• <code>configured-state-count</code></li><li>• <code>active-state-count</code></li><li>• <code>terminating-state-count</code></li><li>• <code>terminated-state-count</code></li><li>• <code>total-state-count</code></li></ul>



Release History Table

Release	Description
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, virtual MX Series (vMX) routers are also supported.
17.3R1	Starting with Junos OS Release 17.3R1, QFX5110 switches, EX4600 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 <code>/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name='routing-instance-name']/server/statistics/</code> the only value supported for <i>routing-instance-name</i> is <b>default</b> .
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor <code>/junos/system/subscriber-management/client-ancpinstance[ri-name='routing-instance-name']/server/statistics/</code> the only value supported for <i>routing-instance-name</i> is <b>default</b> .
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor <code>/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name='routing-instance-name']/relay/statistics/</code> the only value supported for the value <i>routing-instance-name</i> is <b>default</b> .
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor <code>/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[ri-name='routing-instance-name']/server/statistics</code> the only value supported for <i>routing-instance-name</i> is <b>default</b> .
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor <code>/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[ri-name='routing-instance-name']/relay/statistics</code> the only value supported for <i>routing-instance-name</i> is <b>default</b> .
17.2R1	Starting with Junos OS Release 17.2R1, QFX10000 switches, QFX5200 switches, and PTX1000 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 on page 11](#)



## CHAPTER 3

# OpenConfig to Junos Mapping

- Mapping OpenConfig BGP Commands to Junos Configuration on page 111
- Mapping OpenConfig Interface Commands to Junos Configuration on page 120
- Mapping OpenConfig LLDP Commands to Junos Configuration on page 125
- Mapping OpenConfig Local Routing Commands to Junos Configuration on page 126
- Mapping OpenConfig MPLS Commands to Junos Configuration on page 127
- Mapping OpenConfig Network Instance Commands to Junos Operation on page 136
- Mapping OpenConfig Routing Policy Commands to Junos Configuration on page 138

### Mapping OpenConfig BGP Commands to Junos Configuration



NOTE: See “OpenConfig Data Model Version” on page 4 topic to understand the data models supported version and its Junos OS release for Juniper Networks MX Series, PTX Series, and QFX Series.

Table 7 on page 111 to Table 11 on page 117 show the mapping of OpenConfig BGP commands with the relevant configuration in Junos.

Table 7: Global BGP Configuration

Command Name	OpenConfig Command Path	Junos Configuration
Command path prefix: <code>/network-instances/network-instance/protocols/protocol/bgp/global</code>		
As	<code>/config/as</code>	<code>set routing-options autonomous-system as_number</code>
Router-ID	<code>/config/router-id</code>	<code>set routing-options router-id router-id</code>

Table 7: Global BGP Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Confederation	/confederation/config/identifier /confederation/config/member-as	set routing-options confederation confederation_as set routing-options confederation members <i>value</i>
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 <i>family</i> aigp
Ignore-Next-hop-IGP-Metric	/route-selection-options/config/ ignore-next-hop-igp-metric	Not supported
Use-Multiple-Paths	/use-multiple-paths/ebgp/config/ /use-multiple-paths/ibgp/config/	Not supported
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 <i>restart</i> -time set protocols bgp graceful-restart stale-routes-time stale- routes -time

Table 8: Global AFI-SAFI Configuration

Command Name	OpenConfig Command Path	Junos Configuration
Command path prefix:  /network-instances/network-instance/protocols/ protocol/bgp/global/afi-safi/afi-safi		
AFI-SAFI	/config/afi-safi-name /config/enabled	set protocols bgp family <i>family</i>
AFI-SAFI – Add-Paths	/add-paths/config/send	set protocols bgp group <i>group-name</i> family <i>family</i> add-path send path-count <i>number</i>

Table 8: Global AFI-SAFI Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Add-Paths: Receive	/add-paths/config/receive	set protocols bgp group <i>group-name</i> family <i>family</i> add-path receive
Add-Paths: Send-Max	/add-paths/config/send-max	set protocols bgp group <i>group-name</i> family <i>family</i> add-path send path-count <i>path-count</i>
Add-Paths: Eligible Prefix Policy	/add-paths/config/eligible-prefix-policy	set protocols bgp group <i>group-name</i> family <i>family</i> add-path send prefix-policy <i>policy</i>
AFI-SAFI – Prefix-Limit	/prefix-limit/config/prevent-teardown	set protocols bgp group <i>group-name</i> family <i>family</i> prefix-limit teardown
AFI-SAFI-Name – Prevent-Teardown	/afi-safi-name/<afi-name>/prefix-limit/config/prevent-teardown	set protocols bgp group <i>group</i> family <i>family</i> prefix-limit teardown
IPv4-Unicast: Max-Prefixes	/ipv4-unicast/prefix-limit/config/max-prefixes	set protocols bgp family inet unicast accepted-prefix-limit maximum <i>maximum</i>
IPv4-Unicast: Shutdown-Threshold-PCT	/ipv4-unicast/prefix-limit/config/shutdown-threshold-pct	set protocols bgp family inet unicast accepted-prefix-limit teardown <i>limit-threshold</i>
IPv4-Unicast: Restart-Timer	/ipv4-unicast/prefix-limit/config/restart-timer	set protocols bgp family inet unicast accepted-prefix-limit teardown idle-timeout <i>timeout</i>
IPv4-Unicast: Send-Default-Route	/ipv4-unicast/config/send-default-route	Not supported
IPv6-Unicast: Max-Prefixes	/ipv6-unicast/prefix-limit/config/max-prefixes	set protocols bgp family inet6 unicast accepted-prefix-limit maximum <i>maximum</i>
IPv6-Unicast: Shutdown-Threshold-PCT	/ipv6-unicast/prefix-limit/config/shutdown-threshold-pct	set protocols bgp family inet6 unicast accepted-prefix-limit teardown <i>limit-threshold</i>
IPv6-Unicast: Restart-Timer	/ipv6-unicast/prefix-limit/config/restart-timer	set protocols bgp family inet6 unicast accepted-prefix-limit teardown idle-timeout <i>timeout</i>
IPv6-Unicast: Send-Default-Route	/ipv6-unicast/config/send-default-route	Not supported
IPv4-Lbl-Unicast: Max-Prefixes	/ipv4-labeled-unicast/prefix-limit/config/max-prefixes	set protocols bgp family inet labeled-unicast accepted-prefix-limit maximum <i>maximum</i>
IPv4-Lbl-Unicast: Shutdown-Threshold-PCT	/ipv4-labelled-unicast/prefix-limit/config/shutdown-threshold-pct	set protocols bgp family inet labeled-unicast accepted-prefix-limit teardown <i>limit-threshold</i>

Table 8: Global AFI-SAFI Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
IPv4-Lbl-Unicast: Restart-Timer	/ipv4-labelled-unicast/prefix-limit/config/restart-timer	set protocols bgp family inet labeled-unicast accepted-prefix-limit teardown idle-timeout <i>timeout</i>
IPv6-Lbl-Unicast: Max-Prefixes	/ipv6-labelled-unicast/prefix-limit/config/max-prefixes	set protocols bgp family inet6 labeled-unicast accepted-prefix-limit maximum <i>maximum</i>
IPv6-Lbl-Unicast: Shutdown-Threshold-PCT	/ipv6-labelled-unicast/prefix-limit/config/shutdown-threshold-pct	set protocols bgp family inet6 labeled-unicast accepted-prefix-limit teardown <i>limit-threshold</i>
IPv6-Lbl-Unicast: Restart-Timer	/ipv6-labelled-unicast/prefix-limit/config/restart-timer	set protocols bgp family inet6 labeled-unicast accepted-prefix-limit teardown idle-timeout <i>timeout</i>
L3VPN-IPv4-Ucast: Max-Prefixes	/l3vpn-ipv4-unicast/prefix-limit/config/max-prefixes	set protocols bgp family inet-vpn unicast accepted-prefix-limit maximum <i>maximum</i>
L3VPN-IPv4-Ucast: Shutdown-Threshold-PCT	/l3vpn-ipv4-unicast/prefix-limit/config/shutdown-threshold-pct	set protocols bgp family inet-vpn unicast accepted-prefix-limit teardown <i>limit-threshold</i>
L3VPN-IPv4-Ucast: Restart-Timer	/l3vpn-ipv4-unicast/prefix-limit/config/restart-timer	set protocols bgp family inet-vpn unicast accepted-prefix-limit teardown idle-timeout <i>timeout</i>
L3VPN-IPv6-Ucast: Max-Prefixes	/l3vpn-ipv6-unicast/prefix-limit/config/max-prefixes	set protocols bgp family inet6-vpn unicast accepted-prefix-limit maximum <i>maximum</i>
L3VPN-IPv6-Ucast: Shutdown-Threshold-PCT	/l3vpn-ipv6-unicast/prefix-limit/config/shutdown-threshold-pct	set protocols bgp family inet6-vpn unicast accepted-prefix-limit teardown <i>limit-threshold</i>
L3VPN-IPv6-Ucast: Restart-Timer	/l3vpn-ipv6-unicast/prefix-limit/config/restart-timer	set protocols bgp family inet6-vpn unicast accepted-prefix-limit teardown idle-timeout <i>timeout</i>
L3VPN-IPv4-Mcast: Max-Prefixes	/l3vpn-ipv4-multicast/prefix-limit/config/max-prefixes	set protocols bgp family inet-vpn multicast accepted-prefix-limit maximum <i>maximum</i>
L3VPN-IPv4-Mcast: Shutdown-Threshold-PCT	/l3vpn-ipv4-multicast/prefix-limit/config/shutdown-threshold-pct	set protocols bgp family inet-vpn multicast accepted-prefix-limit maximum <i>maximum</i>
L3VPN-IPv4-Mcast: Restart-Timer	/l3vpn-ipv4-multicast/prefix-limit/config/restart-timer	set protocols bgp family inet-vpn multicast accepted-prefix-limit teardown idle-timeout <i>timeout</i>
L3VPN-IPv6-Mcast: Max-Prefixes	/l3vpn-ipv6-multicast/prefix-limit/config/max-prefixes	set protocols bgp family inet6-vpn multicast accepted-prefix-limit maximum <i>maximum</i>

Table 8: Global AFI-SAFI Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
L3VPN-IPv6-Mcast: Shutdown-Threshold-PCT	/l3vpn-ipv6-multicast/prefix-limit/ config/shutdown-threshold-pct	set protocols bgp family inet6-vpn multicast accepted-prefix-limit teardown <i>limit-threshold</i>
L3VPN-IPv6-Mcast: Restart-Timer	/l3vpn-ipv6-multicast/prefix-limit/ config/restart-timer	set protocols bgp family inet6-vpn multicast accepted-prefix-limit teardown idle-timeout <i>timeout</i>
L2VPN-VPLS: Max-Prefixes	/l2vpn-vpls/prefix-limit/ config/max-prefixes	set protocols bgp family l2vpn signaling accepted-prefix-limit maximum <i>maximum</i>
L2VPN-VPLS: Shutdown-Threshold-PCT	/l2vpn-vpls/prefix-limit/ config/shutdown-threshold-pct	set protocols bgp family l2vpn signaling accepted-prefix-limit teardown <i>limit-threshold</i>
L2VPN-VPLS: Restart-Timer	/l2vpn-vpls/prefix-limit/config/restart-timer	set protocols bgp family l2vpn signaling accepted-prefix-limit teardown idle-timeout <i>timeout</i>
L2VPN-EVPN: Max-Prefixes	/l2vpn-evpn/prefix-limit/config/max-prefixes	set protocols bgp family evpn signaling accepted-prefix-limit maximum <i>maximum</i>
L2VPN-EVPN: Shutdown-Threshold-PCT	/l2vpn-evpn/prefix-limit/ config/shutdown-threshold-pct	set protocols bgp family evpn signaling accepted-prefix-limit teardown <i>limit-threshold</i>
L2VPN-EVPN: Restart-Timer	/l2vpn-evpn/prefix-limit/config/restart-timer	set protocols bgp family evpn signaling accepted-prefix-limit teardown idle-timeout <i>timeout</i>

Table 9: Global Apply-Policy Configuration

Command Name	OpenConfig Command Path	Junos Configuration
	Command path prefix:  /network-instances/network-instance/protocols/ protocol/bgp/global/apply-policy	
Import-Policies	/import-policies	set protocols bgp import <i>value</i>
Default-Import-Policy	/default-import-policy	set protocols bgp import <i>value</i>
Export-Policies	/export-policies	set protocols bgp export <i>value</i>
Default-Export-Policy	/default-export-policy	set protocols bgp export <i>value</i>

Table 10: 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 <i>group-name</i>
Peer-AS	/config/peer-as	set protocols bgp group <i>group-name</i> peer-as <i>peer-as</i>
Peer-Type	/config/peer-type	set protocols bgp group <i>group-name</i> type <external   internal>
Auth-Password	/config/auth-password	set protocols bgp group <i>group-name</i> authentication-key <i>authentication-key</i>
Remove-Private-AS	/config/remote-private-as	set protocols bgp group <i>group-name</i> remove-private all  set protocols bgp group <i>group-name</i> remove-private all replace
Route-Flap-Damping	/config/route-flap-damping	set protocols bgp group <i>group-name</i> damping
Send-Community	/config/send-community	Not supported
Description	/config/description	set protocols bgp group <i>group-name</i> description <i>description</i>
Timers: Connect-Retry	/timers/config/connect-retry	set protocols bgp group <i>group-name</i> connect-retry-interval <i>connect-retry</i>
Timers: Hold-Time	/timers/config/hold-time	set protocols bgp group <i>group-name</i> hold-time <i>hold-time</i>
Timers: Keepalive-Interval	/timers/config/keepalive-interval	Not supported
Timers: Minimum-Advertisement-Interval	/timers/config/minimum-advertisement-interval	set protocols bgp group <i>group-name</i> out-delay <i>out-delay</i>
Timers: Send-Update-Delay	/timers/config/send-update-delay	Not supported
Transport: TCP-MSS	/transport/config/tcp-mss	set protocols bgp group <i>group-name</i> tcp-mss <i>tcp-mss</i>
Transport: MTU-Discovery	/transport/config/mtu-discovery	set protocols bgp group <i>group-name</i> mtu-discovery
Transport: Passive-Mode	/transport/config/passive-mode	set protocols bgp group <i>group-name</i> passive



Table 10: Peer-Group Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Transport: Local-Address	/transport/config/local-address	set protocols bgp group <i>group-name</i> local-address <i>local-address</i>
Error-Handling: Treat-AS-Withdraw	/error-handling/config/treat-as-withdraw	set protocols bgp group <i>group-name</i> bgp-error-tolerance
Logging-Options: Log-Neighbor-State-Changes	/logging-options/config/ log-neighbor-state-changes	set protocols bgp group <i>group-name</i> log-updown
EBGP-Multihop: MultiHop-TTL	/ebgp-multihop/config/multihop-ttl	set protocols bgp group <i>group-name</i> multihop ttl <i>ttl</i>
Route-Reflector: Route-Reflector-Cluster-ID	/route-reflector/config/route-reflector-cluster-id	set protocols bgp group <i>group-name</i> cluster cluster
Route-Reflector: Route-Reflector-Client	/route-reflector/config/route-reflector-client	set protocols bgp group <i>group-name</i> no-client-reflect
AS-Path-Options: Allow-Own-AS	/as-path-options/config/allow-own-as	set protocols bgp group <i>group-name</i> local-as loops <i>loops</i>
AS-Path-Options: Replace-Peer-AS	/as-path-options/config/replace-peer-as	set protocols bgp group <i>group-name</i> as-override
External-Route-Distance	/default-route-distance/config/ external-route-distance	set protocols bgp group <i>name</i> preference <i>preference</i>
Internal-Route-Distance	/default-route-distance/config/ internal-route-distance	set protocols bgp group <i>name</i> preference <i>preference</i>
AFI-SAFI	/afi-safi/afi-safi/	Supported. See <a href="#">Table 8 on page 112</a> .
Graceful-Restart	/graceful-restart/config/	Supported. See <a href="#">Table 7 on page 111</a> .
Apply-Policy	/apply-policy/	Supported. See <a href="#">Table 9 on page 115</a> .

Table 11: 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 <i>group-name</i> neighbor <i>address</i>

Table 11: Neighbors Configuration (continued)

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

Table 11: Neighbors Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Transport – TCP-MSS	/transport/config/tcp-mss	set protocols bgp group <i>group-name</i> neighbor address tcp-mss <i>tcp-mss</i>
Transport – MTU-Discovery	/transport/config/mtu-discovery	set protocols bgp group <i>group-name</i> neighbor address mtu-discovery
Transport – Passive-Mode	/transport/config/passive-mode	set protocols bgp group <i>group-name</i> neighbor address passive
Transport – Local-Address	/transport/config/local-address	set protocols bgp group <i>group-name</i> neighbor address local-address <i>local-address</i>
Error-Handling – Treat-AS-Withdraw	/error-handling/config/treat-as-withdraw	set protocols bgp group <i>group-name</i> neighbor address bgp-error-tolerance
Logging-Options – Log-Neighbor-State-Changes	/logging-options/config/log-neighbor-state-changes	set protocols bgp group <i>group-name</i> neighbor address log-updown
EBGP-Multihop – Multihop-TTL	/ebgp-multihop/config/multihop-ttl	set protocols bgp group <i>group-name</i> neighbor address multihop ttl <i>ttl</i>
Route-Reflector – Route-Reflector-Cluster-ID	/route-reflector/config/route-reflector-cluster-id	set protocols bgp group <i>group-name</i> neighbor address cluster <i>cluster</i>
Route-Reflector – Route-Reflector-Client	/route-reflector/config/route-reflector-client	set protocols bgp group <i>group-name</i> neighbor address no-client-reflect
AS-Path-Options – Allow-Own-AS	/as-path-options/config/allow-own-as	set protocols bgp group <i>group-name</i> neighbor address local-as loops <i>loops</i>
AS-Path-Options – Replace-Peer-AS	/as-path-options/config/replace-peer-as	set protocols bgp group <i>group-name</i> neighbor address as-override
AS-Path-Options – Send-Max	/as-path-options/config/send-max	set protocols bgp group <i>group-name</i> neighbor address family <i>family</i> add-path send path-count <i>path-count</i>
External-Route-Distance	/default-route-distance/config/external-route-distance	set protocols bgp group <i>name</i> preference <i>preference</i>

Table 11: Neighbors Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Internal-Route-Distance	/default-route-distance/config/internal-route-distance	set protocols bgp group <i>name</i> preference <i>preference</i>
AFI-SAFI	/afi-safi/afi-safi/	Supported. See <a href="#">Table 8 on page 112</a> .
Graceful-Restart	/graceful-restart/config/	Supported. See <a href="#">Table 7 on page 111</a> .
Apply-Policy	/apply-policy/	Supported. See <a href="#">Table 9 on page 115</a> .

#### Related Documentation

- [Mapping OpenConfig Routing Policy Commands to Junos Configuration on page 138](#)
- [Mapping OpenConfig Interface Commands to Junos Configuration on page 120](#)
- [Mapping OpenConfig LLDP Commands to Junos Configuration on page 125](#)
- [Mapping OpenConfig Local Routing Commands to Junos Configuration on page 126](#)
- [Mapping OpenConfig MPLS Commands to Junos Configuration on page 127](#)

## Mapping OpenConfig Interface Commands to Junos Configuration



NOTE: See “OpenConfig Data Model Version” on [page 4](#) 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 120](#) to [Table 19 on page 124](#) shows the mapping of OpenConfig interface commands to the relevant configuration in Junos.

Table 12: VRRP Configuration

Command Name	OpenConfig Command Path	Junos Configuration
Virtual Router ID	ifa/vrrp/vrrp-group/config/virtual-router-id	set interfaces <i>interface-name</i> unit <i>unit-number</i> family inet address <i>address</i> vrrp-group <i>virtual-router-id</i>  set interfaces <i>interface-name</i> unit <i>unit-number</i> family inet6 address <i>address</i> vrrp-inet6-group <i>virtual-router-id</i>

Table 12: VRRP Configuration (continued)

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

Table 12: VRRP Configuration (continued)

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

Table 13: 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 <i>interface-name</i> unit <i>unit-number</i> family inet address <i>address</i>  set interfaces <i>interface-name</i> unit <i>unit-number</i> family inet6 address <i>address</i>
Neighbor Address	ipv4/neighbors/neighbor/ip ipv6/neighbors/neighbor/ip	set interfaces <i>interface-name</i> unit <i>unit-number</i> family inet address <i>address</i> arp <i>address</i>  set interfaces <i>interface-name</i> unit <i>unit-number</i> family inet6 address <i>address</i> ndp <i>address</i>
Link Layer Address	ip4/neighbors/neighbor/ip/link-layer-address ip6/neighbors/neighbor/ip/link-layer-address	set interfaces <i>interface-name</i> unit <i>unit-number</i> family inet address <i>address</i> arp <i>address</i> mac <i>address</i>  set interfaces <i>interface-name</i> unit <i>unit-number</i> family inet6 address <i>address</i> ndp <i>address</i> mac <i>address</i>

Table 14: Interface AE Configuration

Command Name	OpenConfig Command Path	Junos Configuration
LAG Type	/aggregation/config/lag-type/lacp /aggregation/config/lag-type/static	set interfaces <i>ae-name</i> aggregated-ether-options lacp

Table 14: Interface AE Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Minimum Links	/aggregation/config/min-links	set interfaces <i>ae-name</i> aggregated-ether-options minimum-links

Table 15: LACP Configuration

Command Name	OpenConfig Command Path	Junos Configuration
LACP Interval	/lacp/interfaces/interface/config/interval	set interfaces <i>ae-name</i> aggregated-ether-options lacp periodic fast  set interfaces <i>ae-name</i> aggregated-ether-options lacp periodic slow
LACP Mode	/lacp/interfaces/interface/config/lacp-mode	set interfaces <i>ae-name</i> aggregated-ether-options lacp active  set interfaces <i>ae-name</i> aggregated-ether-options lacp passive
System ID	/lacp/interfaces/interface/config/system-id-mac	set interfaces <i>ae-name</i> aggregated-ether-options lacp system-id <i>address</i>
System Priority	/lacp/interfaces/interface/config/system-priority	set interfaces <i>ae-name</i> aggregated-ether-options lacp system-priority <i>system-priority</i>
Ethernet Options	/lacp/interfaces/interface/members/member	set interface <i>interface</i> gigether-options 802.3ad  set interface <i>interface</i> fastether-options 802.3ad  set interface <i>interface</i> ether-options 802.3ad

Table 16: Member Interface Configuration

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

Table 17: Ethernet Configuration

Command Name	OpenConfig Command Path	Junos Configuration
Auto-negotiate	/ethernet/config/auto-negotiate	set interfaces <i>interface</i> gigether-options <i>auto-negotiation/no-auto-negotiation</i>
MAC Address	/ethernet/config/mac-address	set interfaces <i>interface</i> mac

Table 17: Ethernet Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Duplex Mode	/ethernet/config/duplex-mode	set interfaces <i>interface</i> link-mode
Port Speed	/ethernet/config/port-speed	set interface <i>interface</i> speed
Flow Control	/ethernet/config/enable-flow-control	set interface <i>interface</i> gigether-options flow-control

Table 18: 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 <i>interface</i> mtu
Interface Name	/interfaces/interface/config/name	set interface <i>interface</i>
Interface Description	/interfaces/interface/config/description	set interface <i>interface</i> description
Interface Enabled/Disabled	/interfaces/interface/config/enabled	set interface <i>interface</i> disabled set interface <i>interface</i> enabled
Hold Time Up	/interfaces/interface/config/hold-time/config/up	set interface <i>interface</i> hold-time up
Hold Time Down	/interfaces/interface/config/hold-time/config/down	set interface <i>interface</i> hold-time down

Table 19: IFL Configuration

Command Name	OpenConfig Command Path	Junos Configuration
Unit Name	/interfaces/interface/subinterfaces/subinterface/config/index	set interfaces <i>interface</i> unit <i>unit</i>
Unnumbered Address	/interfaces/interface/config/subinterfaces/subinterface/config/unnumbered	set interfaces <i>interface</i> unit <i>unit</i> family <i>family</i> unnumbered-address source <i>ifl</i>
Unit Description	/interfaces/interface/subinterfaces/subinterface/config/description	set interfaces <i>interface</i> unit <i>unit</i> description
Unit Enabled/Disabled	/interfaces/interface/subinterfaces/subinterface/config/enabled	set interfaces <i>interface</i> unit <i>unit</i> enabled set interfaces <i>interface</i> unit <i>unit</i> disabled



Table 19: IFL Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Interface Alias	/interfaces/interface/subinterfaces/subinterface/config/name	set interfaces <i>interface</i> alias

#### Related Documentation

- [Mapping OpenConfig Routing Policy Commands to Junos Configuration on page 138](#)
- [Mapping OpenConfig BGP Commands to Junos Configuration on page 111](#)
- [Mapping OpenConfig LLDP Commands to Junos Configuration on page 125](#)
- [Mapping OpenConfig Local Routing Commands to Junos Configuration on page 126](#)
- [Mapping OpenConfig MPLS Commands to Junos Configuration on page 127](#)

## Mapping OpenConfig LLDP Commands to Junos Configuration



NOTE: See “OpenConfig Data Model Version” on page 4 topic to understand the data models supported version and its Junos OS release for Juniper Networks MX Series and PTX Series.

Table 20 on page 125 and Table 21 on page 125 show the mapping of OpenConfig LLDP commands with the relevant configuration in Junos.

Table 20: Global LLDP Configuration

Command Name	OpenConfig Command Path	Junos Configuration
Enable	/lldp/config/enabled	set protocols lldp <i>enable/disable</i>
Hello time	/lldp/config/hello-timer	set protocols lldp advertisement-interval <i>advertisement-interval</i>
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 21: 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 <i>interface-name</i> enable

#### Related Documentation

- [Mapping OpenConfig Routing Policy Commands to Junos Configuration on page 138](#)

- Mapping OpenConfig Interface Commands to Junos Configuration on page 120
- Mapping OpenConfig Local Routing Commands to Junos Configuration on page 126
- Mapping OpenConfig BGP Commands to Junos Configuration on page 111
- Mapping OpenConfig MPLS Commands to Junos Configuration on page 127

## Mapping OpenConfig Local Routing Commands to Junos Configuration



NOTE: See “OpenConfig Data Model Version” on page 4 topic to understand the data models supported version and its Junos OS release for Juniper Networks MX Series, PTX Series, and QFX Series.

Table 22 on page 126 and Table 23 on page 126 show the mapping of OpenConfig local routing commands to the relevant configuration in Junos.

**Table 22: 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 <i>prefix</i>
Local Static Next Hop	/static/config/prefix	set routing-options static route <i>prefix</i> next-hop ( <i>address</i>   <i>interface</i> )
	/static/config/next-hop/ip-address	
	/static/config/next-hop/local-defined-next-hop	set routing-options static route <i>prefix</i> discard
	/static/config/next-hop/string	
Local Static Tag	/static/config/prefix	set routing-options static route <i>prefix</i> tag <i>tag</i>
	/static/config/set-tag	

**Table 23: 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 <i>prefix</i>
Local Aggregate Discard	/aggregate/config/prefix	set routing-options aggregate route <i>prefix</i> discard
	/aggregate/config/discard	

Table 23: Local Aggregate Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Local Aggregate Tag	/aggregate/config/prefix	set routing-options aggregate route <i>prefix</i>
	/aggregate/config/set-tag	tag <i>tag</i>

#### Related Documentation

- [Mapping OpenConfig BGP Commands to Junos Configuration on page 111](#)
- [Mapping OpenConfig Interface Commands to Junos Configuration on page 120](#)
- [Mapping OpenConfig LLDP Commands to Junos Configuration on page 125](#)
- [Mapping OpenConfig MPLS Commands to Junos Configuration on page 127](#)
- [Mapping OpenConfig Routing Policy Commands to Junos Configuration on page 138](#)

## Mapping OpenConfig MPLS Commands to Junos Configuration



**NOTE:** See “OpenConfig Data Model Version” on page 4 topic to understand the data models supported version and its Junos OS release for Juniper Networks MX Series, PTX Series, and QFX Series.

Table 24 on page 127 to Table 29 on page 133 show the mapping of OpenConfig MPLS commands with the relevant configuration in Junos.

Table 24: Global MPLS Configuration

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

Table 25: 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
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 26: TE Interface Attributes

Command Name	OpenConfig Command Path	Junos Configuration
TE Interface	/mpls/te-interface-attributes/interface/config/interface-id	set protocols ospf area <i>id</i> interface <i>interface</i>
	/mpls/te-interface-attributes/interface/interface-ref/config/interface	
	/mpls/te-interface-attributes/interface/interface-ref/config/subinterface	
TE Metric	/mpls/te-interface-attributes/interface/config/te-metric	set protocols ospf area <i>id</i> interface <i>interface</i> te-metric <i>te-metric</i>
		set protocols isis interface <i>interface</i> level level <i>level</i> te-metric <i>te-metric</i>
SRLG Membership	/mpls/te-interface-attributes/interface/config/srlg-membership	set protocols mpls interface <i>name</i> srlg <i>name</i>
Admin Groups	/mpls/te-interface-attributes/interface/config/admin-group	If protocols mpls admin-groups <i>name</i> is configured:
		set protocols mpls interface <i>name</i> admin-group <i>name</i>
		If routing-options admin-groups-extended <i>name</i> is configured:  set protocols mpls interface <i>name</i> admin-group-extended <i>name</i>
IGP Flooding Bandwidth	/mpls/te-interface-attributes/interface/igp-flooding-bandwidth/config/threshold-type	set protocols rsvp interface <i>name</i> update-threshold <i>threshold</i>
	/mpls/te-interface-attributes/interface/igp-flooding-bandwidth/config/delta-percentage	
	/mpls/te-interface-attributes/interface/igp-flooding-bandwidth/config/threshold-specification	Not supported
	/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	

Table 27: RSVP Signaling Protocols

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

Table 27: RSVP Signaling Protocols (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Subscription	/mpls/signaling-protocols/rsvp-te/interface-attributes/ interface/config/interface-id	set protocols rsvp interface <i>name</i> subscription <i>subscription</i>
	/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	
Link Protection	/mpls/signaling-protocols/rsvp-te/interface-attributes/ interface/config/interface-id	set protocols rsvp interface <i>name</i> link-protection
	/mpls/signaling-protocols/rsvp-te/interface-attributes/ interface/interface-ref/config/interface	To disable node-protection:
	/mpls/signaling-protocols/rsvp-te/interface-attributes/ interface/interface-ref/config/subinterface	set protocols rsvp interface <i>name</i> link-protection no-node-protection
	/mpls/signaling-protocols/rsvp-te/interface-attributes/interface/ protection/config/link-protection-style-requested/unprotected	set protocols rsvp interface <i>name</i> link-protection optimize-timer <i>timer</i>
	/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	

Table 28: Label Switched Paths

Command Name	OpenConfig Command Path	Junos Configuration
Path	/mpls/lsp/constrained-path/named-explicit-paths/config/name	set protocols mpls path <i>name</i> <i>address</i>
	/mpls/lsp/constrained-path/named-explicit-paths/explicit-route-objects/ config/address	<i>hop-type</i>
	/mpls/lsp/constrained-path/named-explicit-paths/explicit-route-objects/ config/hop-type	
	/mpls/lsp/constrained-path/named-explicit-paths/explicit-route-objects/ config/index	
Name	/mpls/lsp/constrained-path/tunnel/config/name	set protocols mpls label-switched-path <i>name</i>
	/mpls/lsp/constrained-path/tunnel/config/type/P2P	
	/mpls/lsp/constrained-path/tunnel/config/ signaling-protocol/path-setup-rsvp	

Table 28: Label Switched Paths (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Description	/mpls/lsp/constrained-path/tunnel/config/description	set protocols mpls label-switched-path <i>name</i> description <i>description</i>
Admin-Status	/mpls/lsp/constrained-path/tunnel/config/admin-status	set protocols mpls label-switched-path <i>name</i> disable
Preference	/mpls/lsp/constrained-path/tunnel/config/preference	set protocols mpls label-switched-path <i>name</i> preference <i>preference</i>
Metric	/mpls/lsp/constrained-path/tunnels/tunnel/config/metric-type /mpls/lsp/constrained-path/tunnels/tunnel/config/shortcut-eligible /mpls/lsp/constrained-path/tunnel/config/metric	set protocols mpls label-switched-path <i>name</i> metric <i>metric</i>
Link Protection	/mpls/lsp/constrained-path/tunnel/config/ protection-style-requested/unprotected  /mpls/lsp/constrained-path/tunnel/config/ protection-style-requested/link-protection-requested  /mpls/lsp/constrained-path/tunnel/config/ protection-style-requested/link-node-protection-requested	set protocols mpls label-switched-path <i>name</i> link-protection  set protocols mpls label-switched-path <i>name</i> node-link-protection
Optimize Timer	/mpls/lsp/constrained-path/tunnel/config/reoptimize-timer	set protocols mpls label-switched-path <i>name</i> optimize-timer <i>timer</i>
Source	/mpls/lsp/constrained-path/tunnel/config/source	set protocols mpls label-switched-path <i>name</i> from <i>from</i>
Soft Preemption	/mpls/lsp/constrained-path/tunnel/config/soft-preemption	set protocols mpls label-switched-path <i>name</i> soft-preemption
Priority	/mpls/lsp/constrained-path/tunnel/config/setup-priority /mpls/lsp/constrained-path/tunnel/config/hold-priority	set protocols mpls label-switched-path <i>name</i> priority <i>setup reservation</i>
Bandwidth	/mpls/lsp/constrained-path/tunnel/bandwidth/config/ specification-type/specified  /mpls/lsp/constrained-path/tunnel/bandwidth/config/set-bandwidth	set protocols mpls label-switched-path <i>name</i> bandwidth <i>bandwidth</i>



Table 28: Label Switched Paths (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Min/Max Bandwidth	/mpls/lsp/constrained-path/tunnel/bandwidth/config/specification-type/auto	set protocols mpls label-switched-path <i>name</i> minimum-bandwidth <i>minimum</i>
	/mpls/lsp/constrained-path/tunnel/bandwidth/auto-bandwidth/config/enabled	set protocols mpls label-switched-path <i>name</i> maximum-bandwidth <i>maximum</i>
	/mpls/lsp/constrained-path/tunnel/bandwidth/auto-bandwidth/config/min-bw	set protocols mpls label-switched-path <i>name</i> adjust-interval <i>interval</i>
	/mpls/lsp/constrained-path/tunnel/bandwidth/auto-bandwidth/config/max-bw	set protocols mpls label-switched-path <i>name</i> adjust-threshold <i>threshold</i>
	/mpls/lsp/constrained-path/tunnel/bandwidth/auto-bandwidth/config/adjust-interval	
	/mpls/lsp/constrained-path/tunnel/bandwidth/auto-bandwidth/config/adjust-threshold	
Overflow Bandwidth	/mpls/lsp/constrained-path/tunnel/bandwidth/config/specification-type/auto	set protocols mpls label-switched-path <i>name</i> auto-bandwidth adjust-threshold-overflow-limit
	/mpls/lsp/constrained-path/tunnel/auto-bandwidth/overflow/config/enabled	
	/mpls/lsp/constrained-path/tunnel/bandwidth/auto-bandwidth/overflow/config/overflow-threshold	
	/mpls/lsp/constrained-path/tunnel/bandwidth/auto-bandwidth/overflow/config/trigger-event-count	
Underflow Bandwidth	/mpls/lsp/constrained-path/tunnel/bandwidth/config/specification-type/auto	set protocols mpls label-switched-path <i>name</i> auto-bandwidth adjust-threshold-underflow-limit
	/mpls/lsp/constrained-path/tunnel/auto-bandwidth/underflow/config/enabled	
	/mpls/lsp/constrained-path/tunnel/bandwidth/auto-bandwidth/underflow/config/underflow-threshold	
	/mpls/lsp/constrained-path/tunnel/bandwidth/auto-bandwidth/underflow/config/trigger-event-count	

Table 29: RSVP P2P Tunnel

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

Table 29: RSVP P2P Tunnel (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Primary Path - Locally-Computed	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/ p2p-primary-paths/config/path-computation-method/ locally-computed	set protocols mpls label-switched-path <i>name</i> no-cspf
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/ p2p-primary-paths/config/use-cspf	set protocols mpls label-switched-path <i>name</i> random
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/ p2p-primary-paths/config/cspf-tiebreaker/random	set protocols mpls label-switched-path <i>name</i> least-fill
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/ p2p-primary-paths/config/cspf-tiebreaker/least-fill	set protocols mpls label-switched-path <i>name</i> most-fill
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/ p2p-primary-paths/config/cspf-tiebreaker/most-fill	
Primary Path - Externally Queried	/mpls/lsp/constrained-path/tunnel/ p2p-tunnel-attributes/p2p-primary-paths/config/ path-computation-method/externally-queried	set protocols mpls label-switched-path <i>name</i> lsp-external-controller pccd
		set protocols pcep pce <i>name</i> destination-ipv4-address <i>address</i>
		set protocols pcep pce <i>name</i> destination-port 4189
Primary Path - Explicitly Defined	/mpls/lsp/constrained-path/tunnel/ p2p-tunnel-attributes/p2p-primary-paths/config/ path-computation-method/explicitly-defined	set protocols mpls label-switched-path <i>name</i> primary <i>path</i>
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/ p2p-primary-paths/config/explicit-path-name	
Primary Path - Preference	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/ p2p-primary-paths/config/preference	set protocols mpls label-switched-path <i>name</i> primary <i>path</i> preference <i>preference</i>
Primary Path - Priorities	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/ p2p-primary-paths/config/setup-priority	set protocols mpls label-switched-path <i>name</i> primary <i>path</i> priority <i>setup reservation</i>
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/ p2p-primary-paths/config/hold-priority	
Primary Path - Retry Timer	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/ p2p-primary-paths/config/retry-timer	set protocols mpls label-switched-path <i>name</i> retry-timer
Primary Path - Candidate Secondary Paths	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/ p2p-primary-paths/candidate-secondary-paths	Not supported

Table 29: RSVP P2P Tunnel (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Primary Path – Admin-Groups	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/admin-groups/config/exclude-group	set protocols mpls label-switched-path <i>name</i> primary path admin-group exclude <i>group</i>
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/admin-groups/config/include-all-group	set protocols mpls label-switched-path <i>name</i> primary path admin-group exclude <i>group</i>
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-primary-paths/admin-groups/config/include-any-group	set protocols mpls label-switched-path <i>name</i> primary path admin-group include-any group
Secondary Path	/mpls/lsp/constrained-path/tunnel/config/name	set protocols mpls label-switched-path <i>name</i>
	/mpls/lsp/constrained-path/tunnel/config/type/P2P	
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/name	
Secondary Path - Locally-Computed	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/path-computation-method/locally-computed	set protocols mpls label-switched-path <i>name</i> secondary path <i>name</i> no-cspf
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/use-cspf	
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/cspf-tiebreaker/random	
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/cspf-tiebreaker/least-fill	
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/cspf-tiebreaker/most-fill	
Secondary Path - Externally Queried	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/path-computation-method/externally-queried	Not supported
Secondary Path - Explicitly Defined	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/path-computation-method/explicitly-defined	set protocols mpls label-switched-path <i>name</i> secondary path
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/explicit-path-name	
Secondary Path - Preference	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/preference	set protocols mpls label-switched-path <i>name</i> secondary path preference preference

Table 29: RSVP P2P Tunnel (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Secondary Path - Priorities	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/setup-priority	set protocols mpls label-switched-path <i>name</i> secondary <i>path</i> priority <i>setup</i>
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/hold-priority	<i>reservation</i>
Secondary Path - Retry Timer	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/config/retry-timer	set protocols mpls label-switched-path <i>name</i> secondary <i>path</i> retry-timer
Secondary Path - Admin-Groups	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/admin-groups/config/exclude-group	set protocols mpls label-switched-path <i>name</i> secondary <i>path</i> admin-group <i>exclude</i> <i>group</i>
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/admin-groups/config/include-all-group	set protocols mpls label-switched-path <i>name</i> secondary <i>path</i> admin-group <i>include-all</i> <i>group</i>
	/mpls/lsp/constrained-path/tunnel/p2p-tunnel-attributes/p2p-secondary-paths/admin-groups/config/include-any-group	set protocols mpls label-switched-path <i>name</i> secondary <i>path</i> admin-group <i>include-any</i> <i>group</i>
		set protocols mpls label-switched-path <i>name</i> secondary <i>path</i> admin-group <i>include-any</i> <i>group</i>

#### Related Documentation

- [Mapping OpenConfig BGP Commands to Junos Configuration on page 111](#)
- [Mapping OpenConfig Interface Commands to Junos Configuration on page 120](#)
- [Mapping OpenConfig LLDP Commands to Junos Configuration on page 125](#)
- [Mapping OpenConfig Local Routing Commands to Junos Configuration on page 126](#)
- [Mapping OpenConfig Routing Policy Commands to Junos Configuration on page 138](#)

## Mapping OpenConfig Network Instance Commands to Junos Operation



**NOTE:** See “OpenConfig Data Model Version” on page 4 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 30 on page 137 details the network instance commands.

**Table 30: Network Instance**

Resource Path	Description
/network-instances/network-instance/config/name	<p>An assigned unique name for the forwarding instance.</p> <p>In Junos, you need to provide a name because you do not run different BGP in the same routing instance.</p>
/network-instances/network-instance/config/name/description	Description of the network instance.
/network-instances/network-instance/config/type	<p>Type of network instance:</p> <ul style="list-style-type: none"> <li>• default_instance</li> <li>• l3vrf</li> <li>• l2vsi</li> <li>• l2p2p</li> <li>• l2l3</li> </ul> <p><b>NOTE:</b> Only default_instance and l3vrf instances are supported.</p>
/network-instances/network-instance/config/enabled	<p>Whether the network instance should be configured to be active on the network element: <i>True</i> or <i>False</i>.</p> <p>By default, the value is <i>True</i>.</p>
/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.
/network-instances/network-instance/interfaces/config/interface	Name of interfaces belonging to this routing instance.

Table 30: Network Instance (continued)

Resource Path	Description
/network-instances/network-instance/protocols/protocol/config/identifier	Type of identifier: <ul style="list-style-type: none"> <li>• BGP</li> <li>• ISIS</li> <li>• OSPF</li> <li>• OSPF3</li> <li>• STATIC</li> <li>• DIRECTLY_CONNECTED</li> <li>• LOCAL_AGGREGATE</li> </ul> <p>NOTE: Only BGP is supported.</p>
/network-instances/network-instance/protocols/protocol/config/name	A unique name for the protocol instance. This is not a mandatory field.
<ul style="list-style-type: none"> <li>• /network-instances/network-instance/protocols/protocol/config/name/enable</li> <li>• /network-instances/network-instance/protocols/protocol/config/name/target-table</li> <li>• /network-instances/network-instance/inter-instance-policies/apply-policy/config/</li> <li>• /network-instances/network-instance/table-connections/table-connection/config/src-table</li> <li>• /network-instances/network-instance/table-connections/table-connection/config/dst-table</li> <li>• /network-instances/network-instance/table-connections/table-connection/config/tables</li> </ul>	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 on page 111](#)
- [Mapping OpenConfig Interface Commands to Junos Configuration on page 120](#)

## Mapping OpenConfig Routing Policy Commands to Junos Configuration



NOTE: See “OpenConfig Data Model Version” on page 4 topic to understand the data models supported version and its Junos OS release for Juniper Networks MX Series, PTX Series, and QFX Series.

Table 31 on page 139 to Table 33 on page 139 show the mapping of OpenConfig routing policy commands to the relevant configuration in Junos.

Table 31: Defined Set Configuration

Command Name	OpenConfig Command Path	Junos Configuration
Prefix Set	/routing-policy/defined-sets/prefix-set	set policy-options prefix-list <i>name</i>
Neighbor Set	/routing-policy/defined-sets/neighbor-set	Not supported
Tag Set	/routing-policy/defined-sets/tag-set	Not supported

Table 32: 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 <i>name</i> members <i>value</i>
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 <i>name</i> members <i>value</i>

Table 33: 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 <i>name</i> from policy <i>value</i>
Prefix Set	/conditions/match-prefix-set/prefix-set	set policy-options policy-statement <i>name</i> from prefix-list <i>name</i>  set policy-options policy-statement <i>name</i> from route-filter <i>address</i> prefix-length-range <i>range</i>
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 <i>name</i> from neighbor <i>address</i>
Match Neighbor Set	/conditions/match-neighbor-set/match-set-options	Not supported

Table 33: Policy Definition Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Tag Set	/conditions/match-tag-set/tag-set	set policy-options policy-statement <i>name</i> from tag <i>tag</i>
Match Tag Set	/conditions/match-tag-set/match-set-options	Not supported
Install Protocol EQ	/conditions/install-protocol-eq	set policy-options policy-statement <i>name</i> from protocol <i>protocol</i>
IGP Conditions	/conditions/igp-conditions	Not supported
BGP Match Community Set	/conditions/bgp-conditions/match-community-set/community-set	set policy-options policy-statement <i>name</i> from community <i>name</i>
BGP Match Ext Community Set	/conditions/bgp-conditions/match-ext-community-set	set policy-options policy-statement <i>name</i> from community <i>name</i>
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 <i>name</i> from metric <i>metric</i>
BGP Origin EQ	/conditions/bgp-conditions/origin-eq	set policy-options policy-statement <i>name</i> from origin (egp   igp   incomplete)
BGP Next Hop	/conditions/bgp-conditions/next-hop-in	set policy-options policy-statement <i>name</i> from next-hop <i>address</i>
BGP Local Preference EQ	/conditions/bgp-conditions/local-pref-eq	set policy-options policy-statement <i>name</i> from local-preference <i>preference</i>
BGP Community Count	/conditions/bgp-conditions/community-count	set policy-options policy-statement <i>name</i> from community-count <i>count</i> (equal   orhigher   orlower)
BGP AS Path Length	/conditions/bgp-conditions/as-path-length	Not supported



Table 33: Policy Definition Configuration (continued)

Command Name	OpenConfig Command Path	Junos Configuration
Accept/Reject	/actions/accept-reject	set policy-options policy-statement example-accept then accept  set policy-options policy-statement example-accept then reject
IGP Actions	/actions/igp-actions/set-tag	set policy-options policy-statement <i>name</i> then tag <i>tag</i>
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 <i>name</i> then community (set   replace   add) <i>name</i>
BGP Actions Set Ext Community	/actions/bgp-actions/set-ext-community	set policy-options policy-statement <i>name</i> then community (set   replace   add) <i>name</i>
BGP Actions Set Route Origin	/actions/bgp-actions/set-route-origin	set policy-options policy-statement <i>name</i> then origin (egp   igp   incomplete)
BGP Actions Set Local Preferences	/actions/bgp-actions/set-local-pref	set policy-options policy-statement <i>name</i> then local-preference <i>preference</i>
BGP Actions Set Next Hop	/actions/bgp-actions/set-next-hop	set policy-options policy-statement <i>name</i> then next-hop <i>address</i>
BGP Actions Set Med	/actions/bgp-actions/set-med	set policy-options policy-statement <i>name</i> then metric <i>metric</i>

#### Related Documentation

- [Mapping OpenConfig BGP Commands to Junos Configuration on page 111](#)
- [Mapping OpenConfig Interface Commands to Junos Configuration on page 120](#)
- [Mapping OpenConfig LLDP Commands to Junos Configuration on page 125](#)
- [Mapping OpenConfig Local Routing Commands to Junos Configuration on page 126](#)
- [Mapping OpenConfig MPLS Commands to Junos Configuration on page 127](#)



## CHAPTER 4

# Configuration Statements

- [netconf on page 144](#)

## netconf

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<b>Syntax</b>	<pre>netconf {   rfc-compliant;   ssh {     connection-limit <i>limit</i>;     port <i>port</i>;     rate-limit <i>limit</i>;   }   traceoptions {     file &lt;filename&gt; &lt;files <i>number</i>&gt; &lt;match <i>regular-expression</i>&gt; &lt;size <i>size</i>&gt;       &lt;world-readable   no-world-readable&gt;;     flag <i>flag</i>;     no-remote-trace;     on-demand;   }   yang-compliant;   yang-modules {     device-specific;     emit-extensions;   } }</pre>
<b>Hierarchy Level</b>	[edit system services]
<b>Release Information</b>	Statement introduced in Junos OS Release 7.5.
<b>Description</b>	<p>Configure the NETCONF XML management protocol.</p> <p>The remaining statements are explained separately. See <a href="#">CLI Explorer</a>.</p>
<b>Default</b>	If you do not include the <b>netconf</b> statement, NETCONF connections are not permitted.
<b>Required Privilege Level</b>	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <i>connection-limit</i></li><li>• <i>port (NETCONF)</i></li><li>• <i>rate-limit</i></li><li>• <i>ssh (NETCONF)</i></li><li>• <i>traceoptions (NETCONF and Junos XML Protocol)</i></li></ul>