Juniper Networks | Engineering Simplicity

Junos OS

Junos Telemetry Interface User Guide

Published
2021-03-23

JUNOS

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

Juniper Networks, the Juniper Networks logo, Juniper, and Junos are registered trademarks of Juniper Networks, Inc. in the United States and other countries. All other trademarks, service marks, registered marks, or registered service marks are the property of their respective owners.

Juniper Networks assumes no responsibility for any inaccuracies in this document. Juniper Networks reserves the right to change, modify, transfer, or otherwise revise this publication without notice.

Junos OS Junos Telemetry Interface User Guide
Copyright © 2021 Juniper Networks, Inc. All rights reserved.

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

YEAR 2000 NOTICE

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

END USER LICENSE AGREEMENT

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

Table of Contents

About This Guide | vii

1 **Junos Telemetry Interface**

Understanding Junos Telemetry Interface | 2

Overview of the Junos Telemetry Interface | **2**

Native Sensors for Junos Telemetry Interface | 6

Understanding the Junos Telemetry Interface Export Format of Collected Data | **6**

Configuring a Junos Telemetry Interface Sensor (CLI Procedure) | **11**

- Configuring an Export Profile | **13**
- Configuring a Streaming Server Profile | **16**
- Configuring a Sensor Profile | **17**
- Verifying Junos Telemetry Interface Sensor Configuration | **20**

Decoding Junos Telemetry Interface Data With UNIX Utilities | **22**

OpenConfig and gRPC for Junos Telemetry Interface | 36

Understanding OpenConfig and gRPC on Junos Telemetry Interface | **36**

Installing the Network Agent Package (Junos Telemetry Interface) | **65**

gRPC Services for Junos Telemetry Interface | **68**

- Configuring gRPC for the Junos Telemetry Interface | **68**
- Configuring Bidirectional Authentication for gRPC for Junos Telemetry Interface | **70**

Supported Data Types | **72**

Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface) | **73**

NPU Utilization Properties | **394**

Understanding YANG on Devices Running Junos OS | **413**

Configure a NETCONF Proxy Telemetry Sensor in Junos | **414**

- Create a User-Defined YANG File | **418**
- Load the Yang File in Junos | **423**
- Collect Sensor Data | **424**

Installing a User-Defined YANG File | **427**

Troubleshoot Telemetry Sensors | **428**

Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | **430**

Understanding Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | **430**

Enable Export of Subscriber Statistics and Queue Statistics | **432**

Guidelines for Exporting Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | **434**

gRPC Sensors for Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets (Junos Telemetry Interface) | **435**

Enabling Export of Transit SPRING Statistics | **440**

Understanding Enabling Export of Transit SPRING Statistics | **440**

Enabling Collection of SPRING Statistics and Exporting Them | **442**

Understanding Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | **444**

Enable Export of Subscriber Statistics and Queue Statistics | **446**

Using gRPC Dial-Out for Secure Telemetry Collection | **448**

Understanding gRPC Dial-Out | **448**

Best Practices for Implementing Junos Telemetry Interface | 451

Guidelines for Specifying Data Reporting Intervals Junos Telemetry Interface | **451**

Guidelines for Aggregating Junos Telemetry Interface Data | **452**

Guidelines for Exporting Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | **458**

2 **Junos Telemetry Interface Plug-ins**

Network Telemetry Framework (NTF) Agent | 461

NTF Agent Overview | **461**

Configuring NTF Agent | **462**

Open Source Plug-ins | 465

JTI Plug-ins for Open Source Data Collectors | **465**

3 **J-Insight Device Monitor**

Understanding J-Insight Device Monitor | 467

J-Insight Device Monitor Overview | **467**

J-Insight Device Monitor Basic Configuration | **470**

- Before you Begin | **470**
- J-Insight Health Monitoring | **473**
- J-Insight Fault Monitoring | **474**

4 **Configuration Statements and Operational Commands**

Native Sensors Configuration Statements and Operational Commands | 478

show configuration services analytics sensor ddos | **478**

export-profile (Junos Telemetry Interface) | **480**

sensor (Junos Telemetry Interface) | **484**

sensor-based-stats (Junos Telemetry Interface) | **517**

source-packet-routing | **518**

streaming-server (Junos Telemetry Interface) | **521**

show agent sensors | **524**

gRPC Services Configuration Statements and Operational Commands | 533

request system yang add | **533**

request system yang delete | **537**

request system yang update | **539**

request system yang validate | **542**

show spring-traffic-engineering | **544**

show network-agent statistics | **553**

show extension-service request-response clients | **558**

show extension-service request-response servers | **561**

show spring-traffic-engineering | **562**

source-packet-routing | **572**

ssl | **575**

telemetry | 578

Network Telemetry Framework (NTF) Configuration Statements and Operational Commands | 582

agent (Analytics) | 582

analytics | 585

inputs (Analytics) | 591

outputs (Analytics) | 595

service-agents (Analytics) | 598

show services analytics agent | 601

traceoptions (Analytics Agent) | 604

J-Insight Device Monitor Configuration Statements and Operational Commands | 607

clear chassis fpc errors | 607

clear system errors | 609

clear trace | 611

delete services jinsightd subscribe health-monitor | 612

error | 613

set services jinsightd subscribe health-monitor | 617

set services jinsightd traceoptions | 618

show chassis alarms | 620

show system errors active | 647

show system errors count | 653

show system errors error-id | 655

show system errors fru | 659

show system health-monitor | 666

show trace | 670

About This Guide

Junos Telemetry Interface enables you to export telemetry data from supported interface hardware. Line card sensor data, such as interface events, are sent directly to configured collection points without involving polling. OpenConfig for Junos OS and the gRPC remote procedure call (gRPC) framework for exporting data are also supported. The J-Insight device monitor consumes the telemetry data delivered by the Junos Telemetry Interface to provide visibility and insight into the health of a running system.

1

PART

Junos Telemetry Interface

Understanding Junos Telemetry Interface | 2

Native Sensors for Junos Telemetry Interface | 6

OpenConfig and gRPC for Junos Telemetry Interface | 36

Best Practices for Implementing Junos Telemetry Interface | 451

CHAPTER 1

Understanding Junos Telemetry Interface

IN THIS CHAPTER

- Overview of the Junos Telemetry Interface | 2

Overview of the Junos Telemetry Interface

IN THIS SECTION

- Telemetry Sensors and Data Models | 3
- Uses and Benefits | 3

As the number of objects on the network and the metrics they generate have grown, the traditional models, such as SNMP, used to gather operational statistics for monitoring the health of a network, have imposed limits on network element scale and efficiency. The so-called pull model used by SNMP and the CLI, which requires additional processing to periodically poll the network element, directly limits scaling.

The Junos Telemetry Interface (JTI) overcomes these limits by relying on a so-called push model to deliver data asynchronously, which eliminates polling. A request to send data is sent once by a management station to stream periodic updates. As a result, JTI is highly scalable and can support the monitoring of thousands of objects in a network.

NOTE: Junos Telemetry Interface was introduced in Junos OS Release 15.1F3, on MX Series routers with interfaces configured on MPC1 through MPC6E, and on PTX Series routers with interfaces configured on FPC3. Starting in Junos OS Release 15.1F5, Junos Telemetry Interface is also supported on MPC7E, MPC8E, and MPC9E on MX Series routers.

Starting with Junos OS Release 16.1R3, FPC1, FPC2, and dual Routing Engines on PTX Series routers are also supported.

Starting with Junos OS Release 17.2R1, QFX10002, QFX10008, and QFX10016 switches, QFX5200 switches, and PTX1000 and PTX10008 routers are also supported. QFX5200 swtiches support only gRPC sensors.

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

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

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

Telemetry Sensors and Data Models

The Junos Telemetry Interface enables you to provision sensors to collect and export data for various system resources, such as physical interfaces and firewall filters. Two data models, each of which uses a different mode of transport, are supported:

- An open and extensible data model defined by Juniper Networks. Data is generated as Google protocol buffers (gpb) structured messages. The files that define each **.proto** message are published on the Juniper Networks web site. Native sensors export data close to the source, such as the line card or network processing unit (NPU), using the User Datagram Protocol (UDP). Because this model features a distributed architecture, it scales easily.

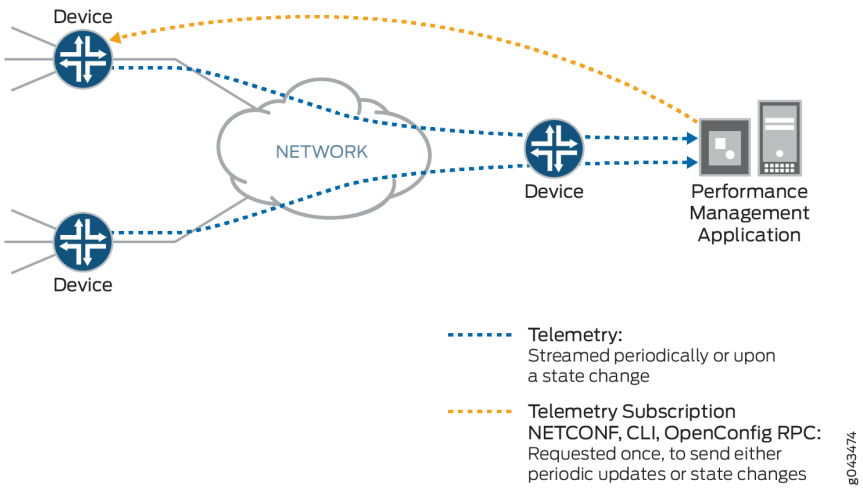
- An OpenConfig data model that generates data as gpb messages in a universal key/value format. OpenConfig for Junos OS, which you must download, supports the YANG data models. gRPC remote procedure calls (gRPC) are used to provision sensors and to subscribe to and receive telemetry data. gRPC is based on TCP, and supports SSL encryption, so it is considered secure and reliable. If your Juniper Networks device is running a version of Junos OS with the upgraded FreeBSD kernel, this model requires you to download the Junos Network Agent package, which runs on the Routing Engine and provides interfaces to manage gRPC subscriptions. For other versions of Junos OS, Network Agent functionality is embedded in the software.Starting in Junos OS Release 18.2R1, OpenConfig-based routing engine (RE) sensors can stream data as gpb structured messages over UDP.

Uses and Benefits

One primary function of the Junos Telemetry Interface is performance monitoring. Streaming data to a performance management system enables network administrators to measure trends in link and node utilization, and troubleshoot such issues as network congestion in real time.

In a typical deployment, the network element, or device, streams duplicate data to two destination servers that function as performance management system collectors. Streaming data to two collectors provides redundancy. See Figure 1 on page 4 for an illustration of how the performance management system collectors request data and how the device streams data. The device provisions sensors to collect and export data using command-line interface (CLI), configuration through NETCONF, or gRPC subscription calls. The collectors request data by initiating a telemetry subscription. Data is requested only once and is streamed periodically.

Figure 1: Telemetry Streaming for Performance Management



Starting in Junos OS Release 18.1R1, a new sensor is available that allows syslog data to be streamed to network telemetry collector systems. Using the /junos/events/ sensor, and an export profile with a **reporting-rate** of 0, you can now stream event data along with statistical data to your telemetry-collection systems.

Other applications of the Junos Telemetry Interface include providing real-time data to support operational state synchronization between a network element and an external controller, such as the Northstar Controller, which automates the creation of traffic-engineering paths across the network. The NorthStar Controller can subscribe to telemetry data about certain network elements, such as label-switched path (LSP) statistics.

Release History Table

Release	Description
18.2R1	Starting with Junos OS Release 18.2R1, PTX10002 routers are also supported.
18.2R1	Starting in Junos OS Release 18.2R1, OpenConfig-based routing engine (RE) sensors can stream data as gpb structured messages over UDP.

18.1R1	Starting in Junos OS Release 18.1R1, a new sensor is available that allows syslog data to be streamed to network telemetry collector systems.
17.4R1	Starting with Junos OS Release 17.4R1, PTX10016 routers and virtual MX Series (vMX) routers are supported.
17.3R1	Starting with Junos OS Release 17.3R1, QFX5110 switches, EX4600, EX4600-VC, and EX9200 switches, and the Routing and Control Board (RCB) on PTX3000 routers are also supported. QFX5110 switches support only gRPC sensors.
17.2R1	Starting with Junos OS Release 17.2R1, QFX10002, QFX10008, and QFX10016 switches, QFX5200 switches, and PTX1000 and PTX10008 routers are also supported. QFX5200 swtiches support only gRPC sensors.
16.1R3	Starting with Junos OS Release 16.1R3, FPC1, FPC2, and dual Routing Engines on PTX Series routers are also supported.
15.1F5	Starting in Junos OS Release 15.1F5, Junos Telemetry Interface is also supported on MPC7E, MPC8E, and MPC9E on MX Series routers.
15.1F3	Junos Telemetry Interface was introduced in Junos OS Release 15.1F3, on MX Series routers with interfaces configured on MPC1 through MPC6E, and on PTX Series routers with interfaces configured on FPC3.

RELATED DOCUMENTATION

Understanding the Junos Telemetry Interface Export Format of Collected Data | 6

Understanding OpenConfig and gRPC on Junos Telemetry Interface | 36

CHAPTER 2

Native Sensors for Junos Telemetry Interface

IN THIS CHAPTER

- Understanding the Junos Telemetry Interface Export Format of Collected Data | 6
- Configuring a Junos Telemetry Interface Sensor (CLI Procedure) | 11
- Decoding Junos Telemetry Interface Data With UNIX Utilities | 22

Understanding the Junos Telemetry Interface Export Format of Collected Data

IN THIS SECTION

- Understanding the Sensor Data Encapsulation Format | 7

The Junos telemetry interface supports two ways of exporting data in the protocol buffers (gpb) format:

- Through UDP from so-called native sensors that export data close to the source, such as the line card or network processing unit (NPU). Juniper Networks defines the data model, which is open and extensible.
- Through gRPC remote procedure calls (gRPC) that export data through the Routing Engine. The data model is defined by OpenConfig, which supports the use of vendor-neutral data models to configure and manage the network. OpenConfig for Junos OS supports the YANG data models. For platforms that are running a version of Junos OS based on an upgraded FreeBSD kernel only, you must install a separate package called Network Agent that functions as a gRPC server and terminates the RPC interfaces. . For all other versions of Junos OS, the Network Agent functionality is embedded in the software. You must also install the OpenConfig for Junos OS module and the YANG models.

This section describes the format of data exported from native senors using UDP. The data is encapsulated into a UDP header, which is in turn encapsulated in the IPv4 payload. This model of the

Junos telemetry interface is based a distributed architecture, through which the data generated by configured sensors is exported directly from the data plane, bypassing the control plane, and thus conserving these resources to perform other necessary functions.

NOTE: The Junos telemetry interface was introduced in Junos OS Release 15.1F3, on MX Series routers with interfaces configured on MPC1 through MPC6E, and on PTX Series routers with interfaces configured on FPC3. Starting in Junos OS Release 15.1F5, Junos telemetry interface is also supported on MPC7E, MPC8E, and MPC9E on MX Series routers.

Starting with Junos OS Release 16.1R3, FPC1, FPC2, and dual Routing Engines on PTX Series routers are also supported.

Starting with Junos OS Release 17.2R1, QFX10000 and QFX5200 switches are also supported. On QFX5200 switches, only gRPC streaming is supported.

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.

Starting with Junos OS Release 17.4R1, MX2008 routers are supported.

Understanding the Sensor Data Encapsulation Format

A native sensor exports data close to the source using UDP. Various types of telemetry data, such as physical interface statistics, firewall filter counter statistics, or statistics for label-switched paths (LSPs) can be exported. A sensor starts to emit data as soon as it is enabled.

The sensor data is represented as a single structured protocol buffers message, named **TelemetryStream**. The message, or **.proto** file, shown below, includes several attributes that identify the data source, such as a line card, a Packet Forwarding Engine, or a Routing Engine. The name of the configured sensor is also included. For more information about how to configure sensors, see "Configuring a Junos Telemetry Interface Sensor (CLI Procedure)" on page 11 For a a list of supported native sensors, see "sensor" on page 484.

You must also download the **.proto** files for all the sensors supported to a streaming server or collector. From a Web browser, navigate to the All Junos Platforms software download URL on the Juniper Networks page: https://www.juniper.net/support/downloads/. After you select the name of the Junos OS platform and the release number, go to the **Tools** section and download the **Junos telemetry interface Data Model Files** package. For more information about configuring a streaming-server, see "streaming-server (Junos Telemetry Interface)" on page 521.

Protocol buffers message Definition

Following is the message definition for **TelemetryStream** in the Protocol Buffers definition language. It shows several optional nested structures, such as **EnterpriseSensors**, which carry privately defined sensor data.

```
//
// This file defines the top level message used for all Juniper
// Telemetry packets encoded to the protocol buffer format.
// The top level message is TelemetryStream.
//

import "google/protobuf/descriptor.proto";

extend google.protobuf.FieldOptions {
    optional TelemetryFieldOptions telemetry_options = 1024;
}

message TelemetryFieldOptions {
    optional bool is_key             = 1;
    optional bool is_timestamp       = 2;
    optional bool is_counter         = 3;
    optional bool is_gauge           = 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];

    // configured sensor name
    optional string sensor_name      = 4 [(telemetry_options).is_key = true];

    // sequence number, monotonically increasesing for each
    // system_id, component_id, sub_component_id + sensor_name.
    optional uint32 sequence_number  = 5;

    // timestamp (milliseconds since 00:00:00 UTC 1/1/1970)
    optional uint64 timestamp        = 6 [(telemetry_options).is_timestamp =
```

```
true];

    // major version
    optional uint32 version_major    = 7;

    // minor version
    optional uint32 version_minor    = 8;

    optional IETFSensors ietf        = 100;

    optional EnterpriseSensors enterprise = 101;
}

message IETFSensors {
    extensions 1 to max;
}

message EnterpriseSensors {
    extensions 1 to max;
}

extend EnterpriseSensors {
    // re-use IANA assigned numbers
    optional JuniperNetworksSensors juniperNetworks = 2636;
}

message JuniperNetworksSensors {
    extensions 1 to max;
}
```

The **TelemetryStream** message also includes optional nested structures that carry different types of data. One structure carries enterprise, that is, privately defined data. Individual companies, such as Juniper Networks, define and maintain the attributes generated by enterprise sensors. Each company is assigned a unique attribute identifier. The current convention is to use IANA-assigned enterprise MIB identifiers for each attribute. For Juniper Networks, this assigned identifier is 2636.

BEST PRACTICE: To verify that a particular message type has been exported and received, check for those attributes under **TelemetryStream.enterprise.juniperNetworks** in the gpb message.

See Table 1 on page 10 for descriptions of each element collected by sensor data, including semantics and corresponding schema.

Table 1: Individual Data Element Types in the gpb Message

Element Type	Description
Counter	An unsigned integer that increases monotonically. When it reaches its maximum value, it starts back at zero.
Gauge	An unsigned 32-bit or 64-bit integer that can increase or decrease in value. An example of the data represented by this element is the instantaneous value of a specific resource, such as queue depth or temperature.
Rate	Rate at which a base metric changes, such as a counter or a gauge. For this element type, units of measurement are defined explicitly (such as bits per second), as well the interval over which the rate is collected.
Average	The average of several samples of a base metric. For example, an *average queue depth* data element would be calculated by averaging several elements of the queue depth. For this element type, we strongly recommend defining the number of measurements used to compute the average, as well as the time interval between the measurements. Otherwise, you should define explicitly the means by which this average value is calculated.
Peak	Maximum value among several samples of a base metric. For example, a *peak queue depth* element would be calculated by comparing several measurements of the queue depth and selecting the maximum. For this data element type, we strongly recommend that you define the number of measurements used to compute the peak value, as well as the time interval between measurements. Otherwise, define explicitly how this peak value is defined. You must also know whether this value is never cleared and thus represents the overall maximum value over all time.

NOTE: Each data element type also includes element subsets. For example, the data elements **Counter** and **Gauge** would include subsets for **rate**, **average**, and **peak** measurements.

Release History Table

Release	Description
17.4R1	Starting with Junos OS Release 17.4R1, MX2008 routers 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, QFX10000 and QFX5200 switches are also supported. On QFX5200 switches, only gRPC streaming is supported.
16.1R3	Starting with Junos OS Release 16.1R3, FPC1, FPC2, and dual Routing Engines on PTX Series routers are also supported.
15.1F5	Starting in Junos OS Release 15.1F5, Junos telemetry interface is also supported on MPC7E, MPC8E, and MPC9E on MX Series routers.
15.1F3	The Junos telemetry interface was introduced in Junos OS Release 15.1F3, on MX Series routers with interfaces configured on MPC1 through MPC6E, and on PTX Series routers with interfaces configured on FPC3.

RELATED DOCUMENTATION

Decoding Junos Telemetry Interface Data With UNIX Utilities | 22

Configuring a Junos Telemetry Interface Sensor (CLI Procedure)

IN THIS SECTION

Configuring an Export Profile | 13

- Configuring a Streaming Server Profile | **16**
- Configuring a Sensor Profile | **17**
- Verifying Junos Telemetry Interface Sensor Configuration | **20**

Junos telemetry interface provides for the highly scalable streaming of telemetry information. Unlike previous monitoring systems, such as SNMP, which use the so-called pull model, the Junos telemetry interface uses the push model to collect data. The push model overcomes earlier scaling limits and reduces the processing required by the management station. You can enable monitoring and streaming of data for various system resources, such as physical and logical interfaces and firewall filters. To monitor a specific system resource, you configure a sensor. Each sensor configuration requires three main components:

- Sensor profile—Enables the system resource to monitor and allows you to set related parameters, such as the destination server to send data.
- Export profile—Specifies the attributes for the process of exporting collected data, such as the transport protocol to use and the interval at which to collect data.
- Streaming server profile—Specifies the server for collecting data and related parameters, including the destination IP address and port number.

NOTE: Junos telemetry interface was introduced in Junos OS Release 15.1F3 on MX Series routers with interfaces configured on MPC1 through MPC6E and on PTX Series routers with interfaces configured on FPC3. Starting in Junos OS Release 15.1F5, Junos telemetry interface is also supported on MPC7E, MPC8E, and MPC9E on MX Series routers.

Starting with Junos OS Release 16.1R3, FPC1 and FPC2 on PTX Series routers are also supported.

Starting with Junos OS Release 17.2R1, QFX10000 and PTX1000 switches are also supported.

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

Starting with Junos OS Release 17.4R1, virtual MX Series (vMX) routers are supported. All sensors are supported except for those for fabric statistics and high queue-scale statistics.

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

BEST PRACTICE: We recommend that you configure at least one export profile and at least one streaming server before you configure a sensor profile. This way you can associate an export profile and a streaming server with the sensor profile configuration.

Before you begin:

- Configure a connection from your Juniper Networks device to a server that is using in-band management interfaces.

Configuring an Export Profile

An export profile defines the parameters of the export process of data generated through the Junos telemetry interface. You must configure at least one export profile, but you can configure multiple export profiles. Each export profile can be associated with multiple sensor profiles. However, you can associate only one export profile with a specific sensor profile.

NOTE: Starting with Junos OS Release 17.3R1 on MX Series routers only, you can specify a packet loss priority for an export profile. As a result, you can apply the appropriate packet loss priority to each sensor. Loss priority settings help determine which packets are dropped from the network during periods of congestion. Previously, you could specify only the forwarding class and the DSCP value in an export profile. The following packet loss priority settings are supported: **high**, **low**, **medium-high** and **medium-low**. For more information about packet loss priority settings, see *Mapping PLP to RED Drop Profiles*.

To configure an export profile:

1. Specify a name for the export profile.

```
[edit services analytics]
user@host# set export-profile name]
```

For example, to specify an export-profile name of **export-params**:

```
[edit services analytics]
user@host# set export-profile export-params
```

2. Specify the source IP address of exported packets.

```
[edit services analytics export-profile name]
user@host# set local-address ip-address
```

For example, to specify a source IP address of 192.0.2.3 for an export profile with the name **export-params**:

```
[edit services analytics export-profile export-params]
user@host# set local-address 192.0.2.3
```

3. Specify the source port number of exported packets.

```
[edit services analytics export-profile name]
user@host# set local-port number
```

For example, to specify a source port number of 21111 for an export profile with the name **export-params**:

```
[edit services analytics export-profile export-params]
user@host# set local-port 21111
```

4. Specify the interval, in seconds, at which the sensor generates telemetry data.

```
[edit services analytics export-profile name]
user@host# set reporting-rate seconds
```

For example, to specify an interval of 20 seconds at which any sensor associated with the export-profile with the name **export-params** generates telemetry data :

```
[edit services analytics sensor export-profile export-params]
user@host# set reporting-rate 20
```

5. Specify the format to define the structure of the exported data.

NOTE: The only currently supported format is Google protocol buffers (gpb)

```
[edit services analytics export-profile name]
user@host# set format gpb
```

For example, to specify the Google protocol buffers format for exported data for an export-profile with the name **export-params**:

```
[edit services analytics export-profile export-params]
user@host# set format gpb
```

6. Specify the transport protocol to carry the telemetry data in the IP packets.

```
[edit services analytics export-profile name]
user@host# set transport protocol-name
```

For example, to specify the UDP as the transport protocol for telemetry data for an export profile with the name **export-params**:

```
[edit services analytics export-profile export-params]
user@host# set transport udp
```

7. (Optional) Specify the DiffServ code point (DSCP) value to assign to exported packets.

NOTE: The default value is **0** (zero).

Any interface-level DSCP rewrite rules you have configured override the DSCP value you specify for the export profile. You need to specify a DSCP value for the export profile only if you do not configure DSCP rewrite rules on the outgoing interface. For more information, see *Configuring Rewrite Rules*.

```
[edit services analytics export-profile name]
user@host# set dscp value
```

For example, to specify a DSCP value of 20 for an export profile with the name **export-params**:

```
[edit services analytics export-profile export-params]
user@host# set dscp 20
```

8. (Optional) Specify a forwarding class to assign to exported packets.

> **NOTE**: You can specify a forwarding class only for packets exported by Packet Forwarding Engine sensors. The default value is **best-effort**.

```
[edit services analytics export-profile name]
user@host# set forwarding-class class-name
```

For example, to specify a forwarding class of **assured-forwarding** for an export-profile with the name **export-params**:

```
[edit services analytics export-profile export-params]
user@host# set forwarding-class assured forwarding
```

9. (Optional) (MX Series routers only on Junos OS Release 17.3R1 or later) Specify a packet loss priority to assign to exported packets.

```
[edit services analytics export-profile name]
user@host# set loss-priority (low | high | medium-low | medium-high)
```

For example, to specify a loss priority of **high** for an export profile with the name **export-params**:

```
[edit services analytics export-profile export-params]
user@host# set loss-priority high
```

Configuring a Streaming Server Profile

A server profile defines the parameters of the server that collects exported telemetry data. You can define more than one server profile. You can also associate the same server profile with more than one sensor profile. Starting in Junos OS Release 15.1F6, you can associate more than one server with a specific sensor.

To define the profile of a streaming server to collect exported telemetry data:

1. Specify the name of the streaming sever.

```
[edit services analytics]
user@host# set streaming-server server-name
```

For example, to specify a streaming-server name of **telemetry server**:

```
[edit services analytics]
user@host# set streaming-server telemetry-server
```

2. Specify a destination IP address for the exported packets.

```
[edit services analytics streaming-server server-name]
user@host# set remote-address ip-address
```

For example, to specify a destination address of 192.0.2.2 for a streaming server with the name **telemetry-server**:

```
[edit services analytics streaming-server telemetry-server]
user@host# set remote-address 192.0.2.2
```

3. Specify a destination port number for the exported packets.

```
[edit services analytics streaming-server server-name]
user@host# set remote-port number
```

For example, to specify a destination port number of 30000 for a streaming server with the name **telemetry-server**:

```
[edit services analytics streaming-server telemetry-server]
user@host# set remote-port 30000
```

Configuring a Sensor Profile

A sensor profile defines the parameters of the system resource to monitor and stream data. You can enable only one system resource to monitor for each sensor profile. Configure a different sensor profile for each system resource you want to monitor. You can, however, configure more than one sensor to

monitor the same system resource. For example, you might want to configure different parameters for exporting data for the same system resource.

To configure a sensor profile:

1. Specify the name of the sensor.

```
[edit services analytics]
user@host# set sensor sensor-name
```

   For example, to specify a sensor name of **interface-1**:

```
[edit services analytics]
user@host# set sensor interface-1
```

2. Specify the system resource to monitor and stream data.

```
[edit services analytics sensor sensor-name]
user@host# set resource resource-string-identifier
```

   For example, to enable monitoring of logical interfaces for sensor **interface-1**:

```
[edit services analytics sensor interface-1]
user@host# set resource /junos/system/linecard/interface/logical/usage/
```

   NOTE: You must enter the resource string exactly.

3. (Optional) Specify a regular expression to filter data for the system resource you specified in Step 2. If you do not specify a regular expression, the system resource is monitored globally, that is, systemwide.

```
[edit services analytics sensor sensor-name]
user@host# set resource-filter regular-expression
```

For example, to filter data only for Ethernet logical interfaces for sensor **interface-1**:

```
[edit services analytics sensor interface-1]
user@host# set resource-filter et-*
```

4. Specify the name of a export profile configured at the **[edit export-profile *profile-name*]** hierarchy level to associate with the sensor profile. This export profile defines the parameters for exporting telemetry data.

```
[edit services analytics sensor sensor-name]
user@host# set export-name export-profile-name
```

For example, to associate an export profile named **export-params** with a sensor named **interface-1**:

```
[edit services analytics sensor interface-1]
user@host# set export-name export-params
```

5. Specify the name of a streaming server name configured at the **[edit services analytics streaming-server *server-name*]** hierarchy level to collect exported data.

NOTE: Starting in Junos OS Release 15.1F6, you can specify more than one streaming server for a sensor profile. To specify more than one streaming server for a sensor, you must enclose the names in brackets.

```
[edit services analytics sensor sensor-name]
user@host# set streaming-server server-name
```

For example, to associate a streaming server name **telemetry-server** with a sensor named **interface-1**:

```
[edt services analytics sensor interface-1]
user@host# set streaming-server telemetry-server
```

Verifying Junos Telemetry Interface Sensor Configuration

IN THIS SECTION

- Purpose | 20
- Action | 20

Purpose

Confirm your configuration.

Action

From configuration mode, confirm your configuration by entering the **show services analytics** command. If your output does not display the intended configuration, repeat the instructions in this configuration procedure to correct the configuration.

```
user@host# show services analytics
streaming-server telemetry-server {
    remote-address 192.0.2.2;
    remote-port 30000;
}
export-profile export-params {
    local-address 192.0.2.3;
    local-port 21111;
    dscp 20;
    forwarding-class assured-forwarding;
    loss-priority high;
    reporting-rate 20;
    format gpb;
    transport udp;
}
sensor interface-1 {
    server-name telemetry-server;
    export-name export-params;
    resource /junos/system/linecard/interface/logical/usage/;
    resource-filter et-*;
}
```

After you commit the configuration, verify that the sensor is enabled by issuing the **show agent sensors** operational command.

```
user@host> show agent sensors
Sensor Information :

   Name                                    : interface-1
   Resource                                : /junos/system/linecard/interface/
logical/usage/
   Version                                 : 1.0
   Sensor-id                               : 193570469
   Resource-filter                         : et-*

   Server Information :

       Name                                : telemetry-server
       Scope-id                            : 0
       Remote-Address                      : 192.0.2.2
       Remote-port                         : 30000

   Profile Information :

       Name                                : export-params
       Rep-interval                        : 20
       Address                             : 192.0.2.3
       Port                                : 21111
       Timestamp                           : 1
       Format                              : GPB
       Transport                           : UDP
       DSCP                                : 20
       Forwarding-class                    : assured-forwarding
       Loss-priority                       : high
```

Release History Table

Release	Description
19.1R1	Starting with Junos OS Release 19.1R1, MX Series routers operating with MS-MIC and MS-MPC, QFX10002 switches, and PTX10002 routers are also supported.
17.4R1	Starting with Junos OS Release 17.4R1, virtual MX Series (vMX) routers are supported.

17.3R1	Starting with Junos OS Release 17.3R1, EX9200 switches, and the Routing and Control Board (RCB) on PTX3000 routers are also supported.
17.3R1	Starting with Junos OS Release 17.3R1 on MX Series routers only, you can specify a packet loss priority for an export profile.
17.2R1	Starting with Junos OS Release 17.2R1, QFX10000 and PTX1000 switches are also supported.
16.1R3	Starting with Junos OS Release 16.1R3, FPC1 and FPC2 on PTX Series routers are also supported.
15.1F5	Starting in Junos OS Release 15.1F5, Junos telemetry interface is also supported on MPC7E, MPC8E, and MPC9E on MX Series routers.
15.1F3	Junos telemetry interface was introduced in Junos OS Release 15.1F3 on MX Series routers with interfaces configured on MPC1 through MPC6E and on PTX Series routers with interfaces configured on FPC3.

Decoding Junos Telemetry Interface Data With UNIX Utilities

IN THIS SECTION

- Preparing the Collector to Decode Data | 22
- Decoding Data on the Collector | 24

You can use UNIX utilities to decode Junos telemetry interface data on a server, or collector, that is streaming data from a Juniper Networks device. The example in this section shows you how to decode a single packet of streamed data.

Preparing the Collector to Decode Data

This example requires the following:

- UNIX OS with the Netcat (nc) utility.
- Protocol buffers compiler.
- Junos telemetry interface protocol buffers files.

This procedure shows how to prepare the collector to decode data using the Ubuntu OS.

1. Install the Netcat utility.

```
sudo apt-get install netcat
```

2. Install the protocol buffers compiler.

```
sudo apt-get install protobuf-compiler
```

3. Install the protocol buffers developer's library.

```
sudo apt-get install libprotobuf-dev
```

4. Verify that the library files are installed.

```
ls /usr/include/google/protobuf/descriptor.proto
/usr/include/google/protobuf/descriptor.proto
```

5. Download and install the latest version of the Junos Telemetry interface protocol buffers files.

   From a Web browser, navigate to the All Junos Platforms software download URL on the Juniper Networks page: https://www.juniper.net/support/downloads/. After you select the name of the Junos OS platform and the release number, go to the **Tools** section and download the **Junos telemetry interface Data Model Files** package.

```
tar -xvzf junos-telemetry-interface-15.1F6.9.tgz
junos-telemetry-interface/telemetry_top.proto
junos-telemetry-interface/logical_port.proto
junos-telemetry-interface/lsp_mon.proto
junos-telemetry-interface/firewall.proto
junos-telemetry-interface/lsp_stats.proto
junos-telemetry-interface/port.proto
junos-telemetry-interface/NOTICE
junos-telemetry-interface/license.txt
```

NOTE: Be sure to note the location of the extracted files.

Decoding Data on the Collector

This procedure shows you how to capture data, decode raw data, and use the protocol buffers files to decode data.

To decode data:

1. Capture the data.

   Run netcat on a destination streaming telemetry server, or collector, in UDP listener mode to store all incoming datagrams into a file. Use the destination port number configured in streaming-server profile on your Juniper Networks device.

```
nc -ul 0.0.0.0 20000 > data.gpb
```

   NOTE: This command stores datagrams into a file named **data.gpb**. Run this program to capture data. When you want to stop receiving data, stop with the program by sending the break signal (**Control + C**)

2. Decode raw data.

   NOTE: This step is optional. It is not required if you know the encoded message type of the data.

   Decode the message from the **data.gpb** file.

```
protoc --decode_raw  < ../data.gpb
1: "hillrock:160.1.1.25"
2: 0
4: "S1:/junos/system/linecard/interface/logical/usage/:/junos/system/linecard/
interface/logical/usage/:PFE"
5: 65265
6: 1477686534474
7: 1
8: 1
```

```
101 {
  2636 {
    7 {
      1 {
        1: "et-0/0/4:2.32767"
        2: 1477642750
        3: 813
        4 {
          12: 0x37363732332e3165
        }

.
.
.
```

The next nested structure under **2636** identifies the sensor type. The numerical value **2636** identifies the **JuniperNetworksSensor** message, which is defined in the **telemetry_top.proto** file. In this example, the numerical identifier **7** corresponds to the **LogicalPort** message defined in the **logical_port.proto** file. Use this information in the next step to generate more detailed output.

3. Decode the message to include field names.

   Run the protocol buffers compiler with the decode option. Additionally, specify the top-level message type (**TelemetryStream**) and the file with the message definition, **logical_port.proto**. You must also include the Goggle protocol buffers (gpb) library.

```
protoc --decode TelemetryStream logical_port.proto -I /usr/include -I .  <
data.gpb
system_id: "hillrock:160.1.1.25"
component_id: 0
sensor_name: "S1:/junos/system/linecard/interface/logical/usage/:/junos/
system/linecard/interface/logical/usage/:PFE"
sequence_number: 65268
timestamp: 1477686536484
version_major: 1
version_minor: 1
enterprise {
  [juniperNetworks] {
    [jnprLogicalInterfaceExt] {
      interface_info {
        if_name: "et-0/0/4:2.32767"
        init_time: 1477642750
        snmp_if_index: 813
```

```
        parent_ae_name: "ae1.32767"
        ingress_stats {
          if_packets: 0
          if_octets: 0
        }
        egress_stats {
          if_packets: 0
          if_octets: 0
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/7:3.0"
        init_time: 1477642750
        snmp_if_index: 520
        parent_ae_name: "ae0.0"
        ingress_stats {
          if_packets: 61203309
          if_octets: 6487548454
        }
        egress_stats {
          if_packets: 87416547
          if_octets: 9266153982
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.0"
        init_time: 1477642750
        snmp_if_index: 2512
        ingress_stats {
          if_packets: 26266247
          if_octets: 2784214806
        }
        egress_stats {
          if_packets: 26247215
          if_octets: 2781829290
        }
        op_state {
```

```
      operational_status: "up"
    }
  }
  interface_info {
    if_name: "et-0/0/13:0.1"
    init_time: 1477642750
    snmp_if_index: 2522
    ingress_stats {
      if_packets: 26266249
      if_octets: 2784214972
    }
    egress_stats {
      if_packets: 26249115
      if_octets: 2781935590
    }
    op_state {
      operational_status: "up"
    }
  }
  interface_info {
    if_name: "et-0/0/13:0.2"
    init_time: 1477642750
    snmp_if_index: 2523
    ingress_stats {
      if_packets: 26266248
      if_octets: 2784214912
    }
    egress_stats {
      if_packets: 26249106
      if_octets: 2781935086
    }
    op_state {
      operational_status: "up"
    }
  }
  interface_info {
    if_name: "et-0/0/13:0.3"
    init_time: 1477642750
    snmp_if_index: 2524
    ingress_stats {
      if_packets: 26266248
      if_octets: 2784214820
    }
```

```
        egress_stats {
          if_packets: 26248520
          if_octets: 2781902320
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.4"
        init_time: 1477642750
        snmp_if_index: 2525
        ingress_stats {
          if_packets: 26266247
          if_octets: 2784214760
        }
        egress_stats {
          if_packets: 26247302
          if_octets: 2781834112
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.5"
        init_time: 1477642750
        snmp_if_index: 2526
        ingress_stats {
          if_packets: 26266247
          if_octets: 2784214760
        }
        egress_stats {
          if_packets: 26247209
          if_octets: 2781828904
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.6"
        init_time: 1477642750
```

```
        snmp_if_index: 2527
        ingress_stats {
          if_packets: 26266248
          if_octets: 2784214820
        }
        egress_stats {
          if_packets: 26247196
          if_octets: 2781828226
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.7"
        init_time: 1477642750
        snmp_if_index: 2528
        ingress_stats {
          if_packets: 26266247
          if_octets: 2784214760
        }
        egress_stats {
          if_packets: 26247203
          if_octets: 2781828618
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.8"
        init_time: 1477642750
        snmp_if_index: 2529
        ingress_stats {
          if_packets: 26266247
          if_octets: 2784214760
        }
        egress_stats {
          if_packets: 26247225
          if_octets: 2781829850
        }
        op_state {
          operational_status: "up"
```

```
    }
  }
  interface_info {
    if_name: "et-0/0/13:0.9"
    init_time: 1477642750
    snmp_if_index: 2530
    ingress_stats {
      if_packets: 26266247
      if_octets: 2784214760
    }
    egress_stats {
      if_packets: 26247209
      if_octets: 2781828954
    }
    op_state {
      operational_status: "up"
    }
  }
  interface_info {
    if_name: "et-0/0/13:0.32767"
    init_time: 1477642750
    snmp_if_index: 648
    ingress_stats {
      if_packets: 4
      if_octets: 240
    }
    egress_stats {
      if_packets: 0
      if_octets: 0
    }
    op_state {
      operational_status: "up"
    }
  }
  interface_info {
    if_name: "et-0/0/4:2.32767"
    init_time: 1477642750
    snmp_if_index: 813
    parent_ae_name: "ae1.32767"
    ingress_stats {
      if_packets: 0
      if_octets: 0
    }
```

```
        egress_stats {
          if_packets: 0
          if_octets: 0
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/7:3.0"
        init_time: 1477642750
        snmp_if_index: 520
        parent_ae_name: "ae0.0"
        ingress_stats {
          if_packets: 61206122
          if_octets: 6487846632
        }
        egress_stats {
          if_packets: 87420567
          if_octets: 9266580102
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.0"
        init_time: 1477642750
        snmp_if_index: 2512
        ingress_stats {
          if_packets: 26267458
          if_octets: 2784343172
        }
        egress_stats {
          if_packets: 26248420
          if_octets: 2781957020
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.1"
```

```
        init_time: 1477642750
        snmp_if_index: 2522
        ingress_stats {
          if_packets: 26267460
          if_octets: 2784343338
        }
        egress_stats {
          if_packets: 26250320
          if_octets: 2782063320
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.2"
        init_time: 1477642750
        snmp_if_index: 2523
        ingress_stats {
          if_packets: 26267459
          if_octets: 2784343278
        }
        egress_stats {
          if_packets: 26250311
          if_octets: 2782062816
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.3"
        init_time: 1477642750
        snmp_if_index: 2524
        ingress_stats {
          if_packets: 26267460
          if_octets: 2784343292
        }
        egress_stats {
          if_packets: 26249725
          if_octets: 2782030050
        }
        op_state {
```

```
        operational_status: "up"
      }
    }
    interface_info {
      if_name: "et-0/0/13:0.4"
      init_time: 1477642750
      snmp_if_index: 2525
      ingress_stats {
        if_packets: 26267459
        if_octets: 2784343232
      }
      egress_stats {
        if_packets: 26248507
        if_octets: 2781961842
      }
      op_state {
        operational_status: "up"
      }
    }
    interface_info {
      if_name: "et-0/0/13:0.5"
      init_time: 1477642750
      snmp_if_index: 2526
      ingress_stats {
        if_packets: 26267459
        if_octets: 2784343232
      }
      egress_stats {
        if_packets: 26248414
        if_octets: 2781956634
      }
      op_state {
        operational_status: "up"
      }
    }
    interface_info {
      if_name: "et-0/0/13:0.6"
      init_time: 1477642750
      snmp_if_index: 2527
      ingress_stats {
        if_packets: 26267460
        if_octets: 2784343292
      }
```

```
        egress_stats {
          if_packets: 26248401
          if_octets: 2781955956
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.7"
        init_time: 1477642750
        snmp_if_index: 2528
        ingress_stats {
          if_packets: 26267459
          if_octets: 2784343232
        }
        egress_stats {
          if_packets: 26248408
          if_octets: 2781956348
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.8"
        init_time: 1477642750
        snmp_if_index: 2529
        ingress_stats {
          if_packets: 26267459
          if_octets: 2784343232
        }
        egress_stats {
          if_packets: 26248430
          if_octets: 2781957580
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.9"
        init_time: 1477642750
```

```
        snmp_if_index: 2530
        ingress_stats {
          if_packets: 26267459
          if_octets: 2784343232
        }
        egress_stats {
          if_packets: 26248414
          if_octets: 2781956684
        }
        op_state {
          operational_status: "up"
        }
      }
      interface_info {
        if_name: "et-0/0/13:0.32767"
        init_time: 1477642750
        snmp_if_index: 648
        ingress_stats {
          if_packets: 4
          if_octets: 240
        }
        egress_stats {
          if_packets: 0
          if_octets: 0
        }
        op_state {
          operational_status: "up"
        }
      }
    }
  }
}
```

RELATED DOCUMENTATION

Configuring a Junos Telemetry Interface Sensor (CLI Procedure) | 11

CHAPTER 3

OpenConfig and gRPC for Junos Telemetry Interface

IN THIS CHAPTER

- Understanding OpenConfig and gRPC on Junos Telemetry Interface | **36**
- Installing the Network Agent Package (Junos Telemetry Interface) | **65**
- gRPC Services for Junos Telemetry Interface | **68**
- Supported Data Types | **72**
- Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface) | **73**
- NPU Utilization Properties | **394**
- Understanding YANG on Devices Running Junos OS | **413**
- Configure a NETCONF Proxy Telemetry Sensor in Junos | **414**
- Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | **430**
- Enabling Export of Transit SPRING Statistics | **440**
- Understanding Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | **444**
- Enable Export of Subscriber Statistics and Queue Statistics | **446**
- Using gRPC Dial-Out for Secure Telemetry Collection | **448**

Understanding OpenConfig and gRPC on Junos Telemetry Interface

IN THIS SECTION

- Network Agent Software | **39**
- Using OpenConfig for Junos OS to Enable Junos telemetry interface | **40**
- Using gRPC to Stream Data | **40**
- Exporting Packet Forwarding Engine Traffic Sensor Data | **43**

- Enabling “ON CHANGE” Sensor Support Through gNMI | **45**
- Enabling “TARGET_DEFINED” Subscription Mode through gNMI | **46**
- Enabling “INITIAL_SYNC” Subscription Mode through gNMI | **48**
- Enabling Client Streaming and Bidirectional Streaming of Telemetry Sensor Information | **49**
- Enabling Streaming of Telemetry Sensor Information for SR-TE policies (BGP or Static) | **50**
- Support for LSP Statistics | **51**
- Dynamic Tunnel Statistics Support | **54**
- FPC and Optics Support | **54**
- JTI Broadband Edge Statistics Support for Junos Fusion on MX Series | **55**
- CPU and NPU Sensor Support for MX Series Routers with MPC10E-15C-MRATE Line Cards | **55**
- Interface Express Sensor | **56**
- Standby Routing Engine Sensors for Subscribers | **56**
- Diameter Application Protocol and Diameter Peer Sensors for Subscribers | **57**
- Interface Burst Monitoring | **58**
- Transceiver Diagnostics | **59**
- Physical Ethernet Interface Sensor | **59**
- VLAN Sensors | **60**

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.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Starting with Junos OS Release 20.1R1, gRPC services version v1.18.0 is supported with JTI. This version includes important enhancements for gRPC. In earlier Junos OS releases, gRPC version v1.3.0 is supported with JTI.

Starting with Junos OS Evolved Release 20.2R1, gRPC service for streaming NDP statistics is supported on PTX10001 routers.

Starting with Junos OS Release 20.2R1, gRPC service for streaming Packet forwarding Engine and Routing Engine statistics is supported on EX2300, EX2300-MP, and EX3400 switches.

Starting with Junos OS Release 20.2R1, gRPC service for streaming BGP routing information base (RIB) and BGP peer statistics is supported on any platform family that supports containerized routing protocol process (cRPD). cRPD is Juniper's routing protocol process (rpd) decoupled from Junos OS and packaged as a Docker container to run in Linux-based environments.

Starting with Junos OS Release 20.2R1, ON_CHANGE BGP peer statistics export using gRPC services and gNMI services is supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000, PTX10000 routers and QFX5100 and QFX5200 switches.

Starting with Junos OS Release 20.2R1, streaming BGP global, peer and perr groups statistics using gRPC services is supported on EX2300, EX3400, EX4300, EX4600, and EX9200 switches.

Starting with Junos OS Release 20.2R1, streaming revenue interface statistics through Packet Forwarding Engine sensors and pseudo interface statistics through Routing Engine sensors using gRPC services and gNMI services is supported on SRX5400, SRX5600, and SRX5800 Services Gateways..

Starting with Junos OS Release 20.2R1, streaming revenue interface statistics through Packet Forwarding Engine sensors and pseudo interface statistics through Routing Engine sensors using gRPC services and gNMI services is supported on SRX5400, SRX5600, and SRX5800 Services Gateways.

Starting with Junos OS Release 20.2R1 sensors to stream standby Routing Engine statistics are supported on MX480, MX960, MX10003, MX2010, and MX2020 routers.

Starting with Junos OS Release 20.2R1 sensors to stream EVPN statistics using gRPC services are supported with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.

Network Agent Software

Implementing OpenConfig with gRPC for Junos telemetry interface requires that you download and install a package called Network Agent if your Juniper Networks device is running a version of Junos OS with Upgraded FreeBSD. For all other versions of Junos OS, the Network Agent functionality is embedded in the software. Network Agent functions as a gRPC server and terminates the OpenConfig

RPC interfaces. It is also responsible for streaming the telemetry data according to the OpenConfig specification. To view the OpenConfig specification for telemetry, see the OpenConfig Telemetry specification. For more information about OpenConfig for Junos OS, see the OpenConfig User Guide.

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

For information about installing the Network Agent package, see "Installing the Network Agent Package" on page 65.

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* 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.

NOTE: The Juniper telemetry header that was exported as part of updates is now exported as an extension header. GnmiJuniperTelemetryHeader.proto is used to decode the updates from Juniper devices running Junos OS Release 19.3 or earlier and GnmiJuniperTelemetryHeaderExtension.proto is used for devices running Junos OS Release 19.4 or later.

See Table 2 on page 41 for a list and descriptions of the RPCs implemented to support the Junos telemetry interface.

Table 2: Telemetry RPCs

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

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

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

The following shows the universal key/value format:

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

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

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

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

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

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

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

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

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

Exporting Packet Forwarding Engine Traffic Sensor Data

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

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

- **/components/component[name='FPC*id*:NPU*id*']/properties/property[name='*counter*']/state/value**, where FPC refers to the Flexible PIC Concentrator and NPU refers to the network processing unit (packet forwarding engine). A sample resource path is **/components/component[name='FPC0:NPU3']/properties/property[name='ts-output-pps']/state/value** where **hwds-data-error** is the counter for **Hardware Discards: Data Error**.

- **/components/component[name='FPC*id*:CC*id*']/properties/property[name='*counter*']/state/value** , where FPC refers to the Flexible PIC Concentrator and CC refers to the center chip. A sample resource path is **/components/component[name='FPC0:CC1']/properties/property[name='lpbk-packets'']/state/value** where **lpbk-packets** is the count of **Forward packets** specific to FPC0, center chip 1.

- **/components/component[name='FPC*id*']/properties/property[name='*counter*']/state/value** , where FPC refers to the Flexible PIC Concentrator. A sample resource path is **/components/component[name='FPC0']/properties/property[name='lts-input-packets'']/state/value** where **lts-input-packets** is the CPU counter **Local packets input**.

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

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

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

```
    Software input high drops          :                    0
    Software input medium drops        :                    0
    Software input low drops           :                    0
    Software output drops              :                    0
    Hardware input drops               :                    0


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


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


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

Packet Forwarding Engine loopback statistics:
    Forward packets :                  0                    0 pps
    Forward bytes   :                  0                    0 bps
    Drop packets    :                  0                    0 pps
    Drop bytes      :                  0                    0 bps


Counter
lpbk-packets                □  Forward packets
```

```
lpbk-packets-pps            □  Forward packets pps
lpbk-packets-byte           □  Forward bytes
lpbk-packets-bps            □  Forward bytes   bps

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



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

Enabling “ON CHANGE” Sensor Support Through 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/primary/rpc/gnmi/gnmi-specification.md
- https://github.com/openconfig/gnmi/blob/primary/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 “TARGET_DEFINED” Subscription Mode through gNMI

Starting with Junos OS Release 20.2R1, TARGET_DEFINED subscription mode with gRPC Network Management Interface (gNMI) services is supported for JTI on MX5, MX10, MX40, MX80, MX104, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX10016 routers.

Using a gNMI subscription, an external collector stipulates how sensor data should be delivered:

- STREAMING mode periodically streams sensor data from the DUT at a specified interval.
- ON_CHANGE mode sends updates for sensor data from the DUT only when data values change.
- Newly supported TARGET_DEFINED mode (submode 0) instructs the DUT to select the relevant mode (STREAMING or ON_CHANGE) to deliver each element (leaf) of sensor data to the external collector. When a subscription for a sensor with submode 0 is sent from the external collector to the DUT, the DUT responds, activating the sensor subscription so that periodic streaming does not

include any of the ON_CHANGE updates. However, the DUT will notify the collector whenever qualifying ON_CHANGE events occur.

Subscriptions will default to a periodic streaming frequency of 30 seconds unless otherwise specified by the collector in the subscription request.

The Java Script Object Notification (JSON) file below shows a sample gNMI subscription. TARGET_DEFINED mode is set using **submode=0** for the resource (sensor) path **/interfaces/interface[name='lo0']/state**.

```
$ cat gnmi.json
{
   "dut_list":[
      {
         "port":50051,
         "rpc":["sub_request"],
         "sub_request":{
            "subscription":[
               {
                    "path":"/interfaces/interface[name='lo0']/state",
                  "submode":0,
                  "sample_interval":30
               }
            ],
            "mode":0,
            "encoding":2
         }
      }
   ]
$ python ./gnmi_subscribe_client_sample.py -c ./gnmi.json -d 10.53.32.102 -l
client.log
```

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

For more information, see the gNMI specifications and gNMI protocol file here:

gNMI telemetry specification gNMI protocol definition

- https://github.com/openconfig/reference/blob/primary/rpc/gnmi/gnmi-specification.md#35152-stream-subscriptions
- https://github.com/openconfig/gnmi/blob/primary/proto/gnmi/gnmi.proto

Enabling “INITIAL_SYNC” Subscription Mode through gNMI

Starting in Junos OS Release 20.2R1, INITIAL_SYNC statistics from Packet Forwarding Engine sensors using gNMI services on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000 routers, PTX10000 line of routers, and QFX5100 and QFX5200 switches is supported.

Starting in Junos OS Evolved Release 20.4R1, INITIAL_SYNC statistics from Packet Forwarding Engine sensors using gNMI services on QFX5130-32CD switches is supported.

When an external collector sends a subscription request for a sensor with INITIAL_SYNC (gnmi-submode 2), the host sends all supported target leaves (fields) under that resource path at least once to the collector with the current value. This is valuable because:

- The collector has a complete view of the current state of every field on the device for that sensor path.
- Event-driven data (ON_CHANGE) is received by the collector at least once before the next event is seen. In this way, the collector is aware of the data state before the next event happens.
- Packet Forwarding Engine sensors that contain zero counter values (zero-suppressed) that normally do not show up in streamed data are sent, ensuring that all fields from each line card (also referred to as source) are known to the collector.

INITIAL_SYNC submode requires that at least one copy to be sent to the collector; however, sending more than one is acceptable.

Subscriptions will default to a periodic streaming frequency of 30 seconds unless otherwise specified by the collector in the subscription request.

The Java Script Object Notification (JSON) file below shows a sample gNMI subscription. INITIAL_SYNC mode is set using **gnmi_submode 2** for the resource (sensor) path **/interfaces/**. The **gnmi_mode** is set to **0**. The protocol encoding is set to **2** for GBP.

```
{
  "influx": {
    "server": "server1",
    "port": 8086,
    "dbname": "gD40",
    "measurement": "OC",
    "user": "influx",
    "password": "influxdb",
    "recreate": true
  },
  "gnmi": {
    "mode": 0,     <---- STREAM
```

```
     "encoding": 2, <--- PROTO encoding
   "prefix":  "/x/y/z"
   },
   "host": "10.10.130.73",
   "port": 10162,
   "user": "user1",
   "password": "password1",
   "cid": "cid-1jk",
    "paths":[
       {
          "path": "/interfaces/",
          "Freq": 10000000000,
          "gnmi_submode": 2    <----  SAMPLE
       }
    ]
}
```

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

For more information, see the gNMI specifications and gNMI protocol file here:

gNMI telemetry specification gNMI protocol definition

- https://github.com/openconfig/reference/blob/primary/rpc/gnmi/gnmi-specification.md#35152-stream-subscriptions
- https://github.com/openconfig/gnmi/blob/primary/proto/gnmi/gnmi.proto

Enabling Client Streaming and Bidirectional Streaming of Telemetry Sensor Information

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

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

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

requests. The client and server can read and write in any order. The streams operate completely independently.

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

- rpc Capabilities (CapabilityRequest)

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

- rpc Get (GetRequest)

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

- rpc Set (SetRequest)

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

- rpc Subscribe (stream SubscribeRequest)

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

Juniper Extension Toolkit (JET) support provides insight to users regarding the status of clients connected to JSD. JET support for gRPC includes expanding the maximum number of clients that can connect to JSD from 8 to 30 (the default remains 5). To specify the maximum number of connections, include the **max-connections** statement at the [**edit system services extension-service request-response grpc**] hierarchy level.

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

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

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

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

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

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

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

See "Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface)" on page 73 for further information about resource paths.

Support for LSP Statistics

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

Initial support of this feature in Junos OS Release 15.1F6 supported ingress LSPs only when a subscription was made to **/junos/services/label-switched-path/usage/**. With bypass support added to this feature in Junos OS Release 17.4R1, this subscription now streams both ingress LSP and bypass LSP statistics to a collector.

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

For bypass LSPs, the following are exported:

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

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

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

See "Configuring a Junos Telemetry Interface Sensor (CLI Procedure)" on page 11 for information about configuring a UDP (native) sensor.

See Table 3 on page 52 for the level of LSP sensor support by platform.

Table 3: LSP Support by Platform

Platform	Ingress LSP, UDP Feature Introduced	Ingress LSP, gRPC Str Feature Introduced
ACX6360		
MX80/MX104	Junos OS Release 15.1F6 Junos OS Release 16.1R3 Junos OS Release 17.2R1	
MX Series with MPC	Junos OS Release 15.1F6	Junos OS Release 16. Junos OS Release 17.
PTX5000 with FPC3		Junos OS Release 18.
PTX3000 with FPC3	Junos OS Release 15.1F6 Junos OS Release 16.1R3 Junos OS Release 17.2R1	Junos OS Release 16. Junos OS Release 17. Junos OS Release 18.
PTX Series with FPC1/2	Junos OS Release 15.1F6 Junos OS Release 16.1R3 Junos OS Release 17.2R1	Junos OS Release 16. Junos OS Release 17. Junos OS Release 18.
PTX1000	Junos OS Release 16.1R3	Junos OS Release 16. Junos OS Release 17.
PTX10000	Junos OS Release 17.3R1	Junos OS Release 17.

Table 3: LSP Support by Platform *(Continued)*

Platform	Ingress LSP, UDP Feature Introduced	Ingress LSP, gRPC Str Feature Introduced
PTX10001-20C		
PTX10002	Junos OS Release 19.1R1	Junos OS Release 19.
VMX	Junos OS Release 17.3R1	Junos OS Release 17.
MX150	Junos OS Release 17.4R1	Junos OS Release 17.
EX4600	Junos OS Release 18.4R1	
EX4650	Junos OS Release 18.3R1	Junos OS Release 18.
EX9200	Junos OS Release 17.3R1	
QFX10000		
QFX5200	Junos OS Release 17.2R1	Junos OS Release 17.
QFX10002	Junos OS Release 19.1R1	Junos OS Release 19.
QFX5100	Junos OS Release 18.2R1	Junos OS Release 18.
QFX5110	Junos OS Release 18.2R1	Junos OS Release 18.
QFX5120-48Y	Junos OS Release 18.3R1	Junos OS Release 18.

Table 3: LSP Support by Platform *(Continued)*

Platform	Ingress LSP, UDP Feature Introduced	Ingress LSP, gRPC Str Feature Introduced
QFX5200	Junos OS Release 18.2R1	Junos OS Release 18.

Dynamic Tunnel Statistics Support

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

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

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

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

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

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

To configure export of statistics through UDP, include the sensor **/junos/services/ip-tunnel/usage/** in the "sensor (Junos Telemetry Interface)" on page 484 configuration statement at the [**edit services analytics**] hierarchy level. All parameters for UDP sensors are configured at that hierarchy level. MX80 and MX104 routers support only UDP streaming. They do not support gRPC.

FPC and Optics Support

Starting in Junos OS Release 19.2R1, JTI supports streaming of Flexible PIC Concentrator (FPC) and optics statistics for the MX Series using Remote Procedure Calls (gRPC). gRPC is a protocol for configuration and retrieval of state information. Support includes the addition of a new process

(SensorD daemon) to export telemetry data for integration with AFTTelementry and LibTelemetry libraries in the OpenConfig model called AFT platform.

The following base resource paths are supported:

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

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

JTI Broadband Edge Statistics Support for Junos Fusion on MX Series

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

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

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

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

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

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

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

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

Use the following resource path to export statistics:

/junos/system/linecard/cpu/memory/

/junos/system/linecard/npu/memory/

/junos/system/linecard/npu/utilization/

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

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

Interface Express Sensor

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

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

For either export method, include the following resource path:

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

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

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

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

Standby Routing Engine Sensors for Subscribers

JTI supports streaming standby Routing Engine statistics using gRPC services. This feature is supported on both single chassis and virtual chassis unless otherwise indicated. Use this feature to better track the state of software components running on a standby Routing Engine. Statistics exported to an outside collector through the following sensors (primarily under subscriber management) provide a more complete view of the system health and resiliency state:

- Chassis role (backup or primary) sensor **/junos/system/subscriber-management/chassis** and **/junos/system/subscriber-management/chassis[chassis-index=*chassis-index*]** (for specifying an index for an MX Series Virtual Chassis)

- Routing Engine status and GRES notification sensor **/junos/system/subscriber-management/chassis/routing-engines/routing-engine** and **/junos/system/subscriber-management/chassis/routing-engines/routing-engine[re-index=*RoutingEngineIndex*]** (to specify an index number for a specific Routing Engine)

- Subscriber management process sensor **/junos/system/subscriber-management/chassis/routing-engines/process-status/subscriber-management-processes/subscriber-management-process** and **/junos/system/subscriber-management/chassis/routing-engines/process-status/subscriber-management-processes/subscriber-management-process[pid=*ProcessIdentifier*]** (to specify a PID for a specific process)

- Per Routing Engine DHCP binding statistics for server or relay sensor **/junos/system/subscriber-management/chassis/routing-engines/routing-engine/dhcp-bindings/dhcp-element[dhcp-type-name=*RelayOrServer*/v4]** and **/junos/system/subscriber-management/chassis/routing-engines/routing-engine/dhcp-bindings/dhcp-element[dhcp-type-name=*RelayOrServer*/v6]**

- Virtual Chassis port counter sensor **/junos/system/subscriber-management/chassis/virtual-chassis-ports/virtual-chassis-port** and **/junos/system/subscriber-management/chassis/virtual-chassis-ports/virtual-chassis-port[vcp-interface-name=*vcp-interface-port-string*] (to specify the interface name)**. This resource path is only supported on a virtual chassis.

Junos OS Release 20.2R1 supports standby Routing Engine sensors for MX480, MX960, MX10003, MX2010, and MX2020 routers.

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

Diameter Application Protocol and Diameter Peer Sensors for Subscribers

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

To stream diameter application statistics, include the resource paths:

- For NASREQ statistics, **/junos/system/subscriber-management/aaa/diameter/clients/nasreq**

- For PCRF statistics, **/junos/system/subscriber-management/aaa/diameter/clients/gx**

- For OCS statistics, **/junos/system/subscriber-management/aaa/diameter/clients/gy**

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

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

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

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

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

Junos OS Release 19.3R1 supports diameter application protocol sensors for MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers.

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

Interface Burst Monitoring

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

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

The peak byte is the average of the number of bytes seen in a sampling interval. For bursts lasting less than the sampling interval, the peak byte is averaged out over the interval. Exported statistics also include the time peak bytes are detected, as well as the direction (transmit or receive). The maximum

byte rate detected during the export interval among all the samples is considered as the burst. If there are multiple bursts of the same number of bytes rate in the interval, then the first occurring burst is considered as the maximum burst and the timestamp of that burst is considered as the burst timestamp.

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

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

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

NOTE: This feature does not detect microbursts.

Transceiver Diagnostics

Junos OS Release 19.4R1 supports transciever diagnostic sensors for ON_CHANGE and streaming statistics using JTI and gRPC services or gNMI services on MX960, MX2010, MX2020, PTX1000, PTX5000, and the PTX10000 line of routers. Use transceiver diagnostics to help troubleshoot problems, make decisions, and adjust resources as needed.

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

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

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

Physical Ethernet Interface Sensor

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

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

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

VLAN Sensors

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

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

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

Other end points you can use in a subscription include:

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

Release History Table

Release	Description
20.4R1 Evolved	Starting in Junos OS Evolved Release 20.4R1, INITIAL_SYNC statistics from Packet Forwarding Engine sensors using gNMI services on QFX5130-32CD switches is supported.
20.2R1	Starting with Junos OS Evolved Release 20.2R1, gRPC service for streaming NDP statistics is supported on PTX10001 routers.
20.2R1	Starting with Junos OS Release 20.2R1, gRPC service for streaming Packet forwarding Engine and Routing Engine statistics is supported on EX2300, EX2300-MP, and EX3400 switches.
20.2R1	Starting with Junos OS Release 20.2R1, gRPC service for streaming BGP routing information base (RIB) and BGP peer statistics is supported on any platform family that supports containerized routing protocol process (cRPD). cRPD is Juniper's routing protocol process (rpd) decoupled from Junos OS and packaged as a Docker container to run in Linux-based environments.

20.2R1	Starting with Junos OS Release 20.2R1, ON_CHANGE BGP peer statistics export using gRPC services and gNMI services is supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000, PTX10000 routers and QFX5100 and QFX5200 switches.
20.2R1	Starting with Junos OS Release 20.2R1, streaming BGP global, peer and perr groups statistics using gRPC services is supported on EX2300, EX3400, EX4300, EX4600, and EX9200 switches.
20.2R1	Starting with Junos OS Release 20.2R1, streaming revenue interface statistics through Packet Forwarding Engine sensors and pseudo interface statistics through Routing Engine sensors using gRPC services and gNMI services is supported on SRX5400, SRX5600, and SRX5800 Services Gateways..
20.2R1	Starting with Junos OS Release 20.2R1, streaming revenue interface statistics through Packet Forwarding Engine sensors and pseudo interface statistics through Routing Engine sensors using gRPC services and gNMI services is supported on SRX5400, SRX5600, and SRX5800 Services Gateways.
20.2R1	Starting with Junos OS Release 20.2R1 sensors to stream standby Routing Engine statistics are supported on MX480, MX960, MX10003, MX2010, and MX2020 routers.
20.2R1	Starting with Junos OS Release 20.2R1 sensors to stream EVPN statistics using gRPC services are supported with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.
20.2R1	Starting with Junos OS Release 20.2R1, TARGET_DEFINED subscription mode with gRPC Network Management Interface (gNMI) services is supported for JTI on MX5, MX10, MX40, MX80, MX104, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX10016 routers.
20.2R1	Starting in Junos OS Release 20.2R1, INITIAL_SYNC statistics from Packet Forwarding Engine sensors using gNMI services on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000 routers, PTX10000 line of routers, and QFX5100 and QFX5200 switches is supported.
20.2R1	Junos OS Release 20.2R1 supports standby Routing Engine sensors for MX480, MX960, MX10003, MX2010, and MX2020 routers.
20.1R1	Starting with Junos Release 20.R1, gNMI service for streaming telemetry sensors for Packet Forwarding Engine statistics is supported on MX2K-MPC11E line cards on MX2010 and MX2020 routers.

20.1R1	Starting with Junos OS Release 20.1R1, gRPC services version v1.18.0 is supported with JTI. This version includes important enhancements for gRPC. In earlier Junos OS releases, gRPC version v1.3.0 is supported with JTI.
19.4R1 Evolved	Starting with Junos Release 19.4R1, gRPC service for streaming Packet Forwarding Engine and Routing Engine statistics is supported on EX4300-MP switches.
19.4R1	Junos OS Release 19.4R1 supports transciever diagnostic sensors for ON_CHANGE and streaming statistics using JTI and gRPC services or gNMI services on MX960, MX2010, MX2020, PTX1000, PTX5000, and the PTX10000 line of routers.
19.4R1	Junos OS Release 19.4R1 supports physical Ethernet interface statistics for ON_CHANGE and streaming statistics using JTI and gRPC services or gNMI services on MX960, MX2020, PTX1000, and PTX5000 routers.
19.4R1	Junos OS Release 19.4R1 supports streaming VLAN statistics for ON_CHANGE using JTI and gRPC services on EX4650 and QFX5120 switches.
19.3R1-Evolved	Starting with Junos OS Evolved Release 19.3R1, gRPC service for exporting statistics is supported on QFX5220-128C and QFX5220-32CD switches.
19.3R1-Evolved	Junos OS Evolved Release 19.3R1supports interface burst monitoring on Junos telemetry interface (JTI) to monitor physical interfaces for bursts on QFX5220-128C and QFX5220-32CD switches.
19.3R1	Starting with Junos OS Release 19.3R1, gRPC service for exporting statistics is supported on MX Series routers hosting MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards.
19.3R1	Junos OS Release 19.3R1 supports CPU and network processing unit (NPU) sensors on MX Series routers with MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards.
19.3R1	Junos OS Release 19.3R1 supports interface express sensor for MX960, MX2010, and MX2020 routers.
19.3R1	Junos OS Release 19.3R1 supports diameter application protocol sensors for MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers.
19.2R1	Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800, and vSRX Series Services Gateways.

19.2R1	Starting with Junos OS Release 19.2R1, gNMI services for streaming Packet Forwarding Engine statistics is supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches.
19.2R1	Starting with Junos OS Release 19.2R1, gNMI services for streaming statistics is supported on QFX5100, QFX5110, QFX5120, QFX5200 and QFX5210 switches.
19.2R1	Starting in Junos OS Release 19.2R1, JTI supports streaming of Flexible PIC Concentrator (FPC) and optics statistics for the MX Series using Remote Procedure Calls (gRPC).
19.2R1	Starting in Junos OS Release 19.2R1, subscriber-based telemetry streaming is enabled when an MX router is configured for Broadband Network Gateway (BNG) and Junos Fusion where subscribers are connected through Junos Fusion Satellite devices.
19.1R1 EVO	Starting in Junos OS Evolved Release 19.1R1, OpenConfig (OC) and Junos telemetry interface (JTI) are supported. Both gRPC APIs and the customer-facing CLI remain the same as for the Junos OS. As was standard for Junos OS, Network Agent (NA) and OC packages are part of the Junos OS Evolved image.
19.1R1	Starting with Junos OS Release 19.1R1, MX Series routers operating with MS-MIC and MS-MPC, QFX10002 switches, and PTX10002 routers are also supported.
19.1R1	Starting with Junos OS Evolved 19.1R1, Packet Forwarding Engine sensors on PTX10003 routers are also supported.
18.4R1	Starting with Junos OS Release 18.4R1, MX480, MX960, MX2010, MX2020, MX2008 and MX-ELM routers are also supported.
18.3R1	Starting with Junos OS Release 18.3R1, ON_CHANGE streaming of LLDP telemetry sensor information is supported through gRPC for MX Series and PTX Series routers.
18.3R1	Starting with Junos OS Release 18.3R1, QFX5120-AY and EX4650 switches are also supported.
18.3R1	Starting with Junos OS Release 18.4R1, EX4600 switches are also supported.
18.3R1	Starting in Junos OS Release 18.3R1, OpenConfig and Network Agent packages are bundled into the Junos OS image by default. Both packages support JTI.
18.3R1	Starting in Junos OS Release 18.3R1, OpenConfig and Network Agent packages are bundled into the Junos OS image by default. Both packages support JTI.

18.2R1	Starting in Junos OS Release 18.2R1, when an external streaming server, or collector, provisions sensors to export data through gRPC on devices running Junos OS, the sensor configuration is committed to the junos-analytics instance of the ephemeral configuration database, and the configuration can be viewed by using the show ephemeral-configuration instance junos-analytics operational command.
18.1R1	Starting with Junos OS Release 18.1R1, OpenConfig support through Remote Procedure Calls (gRPC) and JTI is extended to support client streaming and bidirectional streaming of telemetry sensor information on MX Series and PTX Series routers.
18.1R1	Starting with Junos OS Release 18.3R1, OpenConfig support through gRPC and JTI provides continuous statistics streaming via the same sensor irrespective of the route that is active (BGP or static) for a given Segment Routing Traffic Engineering (SR-TE) policy.
18.1R1	Junos OS Release 18.1R1 supports interface express sensor for PTX1000, PTX3000, PTX5000, and PTX10000 routers.
17.4R1	Starting with Junos OS Release 17.4R1, MX2008 routers are supported.
17.4R1	Starting with Junos OS Release 17.4R1, you can export Packet Forwarding Engine traffic statistics through the Junos telemetry interface for MX Series and PTX Series routers. Both UDP and gRPC are supported.
17.4R1	With bypass support added to this feature in Junos OS Release 17.4R1, this subscription now streams both ingress LSP and bypass LSP statistics to a collector.
17.4R1	Starting with Junos OS Release 17.4R1, you can export counter statistics for Packet Forwarding Engine dynamic tunnels to an outside collector using either native (UDP) or OpenConfig telemetry sensors through JTI.
17.3R1	Starting with Junos OS Release 17.3R1, Junos telemetry interface is supported on the Routing Control and Board (RCB) on PTX3000 routers, QFX5110 switches, and EX4600 and EX9200 switches.
17.2R1	Starting with Junos OS Release 17.2R1, OpenConfig and gRPC are also supported on QFX10000 switches, QFX5200 switches, and PTX1000 routers.
16.1R3	Starting in Junos OS Release 16.1R3, you can use a set of remote procedure call (RPC) interfaces to configure the Junos telemetry interface and stream telemetry data using the gRPC framework.
16.1R3	OpenConfig for Junos OS and gRPC are supported only on MPCs on MX Series and on PTX Series routers starting with Junos OS Release 16.1R3.

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

RELATED DOCUMENTATION

Installing the Network Agent Package (Junos Telemetry Interface) | 65

Release Information for Junos OS with Upgraded FreeBSD

Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface) | 73

statistics

telemetry

Installing the Network Agent Package (Junos Telemetry Interface)

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*.
- 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.

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

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

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

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

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

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

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

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

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

An example of a valid Network Agent package name is:

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

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

To download and install the Network Agent package:

1. Using a Web browser, navigate to the All Junos Platforms software download URL on the Juniper Networks webpage: https://www.juniper.net/support/downloads/.
2. Select the name of the Junos OS platform for the software that you want to download.
3. Select the release number (the number of the software version that you want to download) from the **Release** drop-down list to the right of the Download Software page.

4. Select the **Software** tab.
5. In the **Tools** section of the **Software** tab, select the **Junos Network Agent** package for the release.
6. Log in to the Juniper Networks authentication system using the username (generally your e-mail address) and password supplied by a Juniper Networks representative.
7. Download the software to a local host.
8. Copy the software to Juniper Networks device or to your internal software distribution site.
9. Install the new **network-agent** package on the device by issuing the `request system software add` ***package-name*** from the operational mode:

   For example:

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

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

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

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

For information about configuring gRPC services on your Juniper Networks device, see "gRPC Services for Junos Telemetry Interface" on page 68.

Release History Table

Release	Description
18.3R1	Starting in Junos OS Release 18.3R1, the Junos OS image includes the Network Agent.
17.3R1	Starting with Junos OS Release 17.3R1, the Junos Network Agent Package is supported on QFX5110 switches and EX9200 switches.
17.2R1	Starting with Junos OS Release 17.2R1, the Junos Network Agent Package is also supported on QFX10000 switches and QFX5200 switches.

16.1R3	Starting with Junos OS Release 16.1R3, the Junos Network Agent software package provides a framework to support OpenConfig and gRPC for the Junos Telemetry Interface on MX Series routers and PTX5000 routers.

RELATED DOCUMENTATION

Understanding OpenConfig and gRPC on Junos Telemetry Interface | 36

gRPC Services for Junos Telemetry Interface

IN THIS SECTION

- Configuring gRPC for the Junos Telemetry Interface | 68
- Configuring Bidirectional Authentication for gRPC for Junos Telemetry Interface | 70

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*.

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*.

To configure your system for gRPC services:

1. Specify the API connection setting either based on Secure Socket Layer (SSL) technology.

   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 and you can rely on the default IP address (::) to enable Junos to "listen" for all IPv4 and IPv6 addresses on incoming connections. If you would rather specify an IP address, follow stp b. below.

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

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

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

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

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

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

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

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

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

SEE ALSO

Understanding OpenConfig and gRPC on Junos Telemetry Interface

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*.
- Configure the gRPC server. For more information, see *Configuring gRPC for the Junos Telemetry Interface*.

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

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

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

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

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

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

2. Specify the certificate authority.

NOTE: For the certificate authority, specify a certificate-authority profile you have configured at the **[edit security pki** `ca-profile`**]** hierarchy level. This profile is used to validate the certificate provided by the client.

A digital certificate provides a way of authenticating users through a trusted third-party called a certificate authority (CA). The CA validates the identity of a certificate holder and "signs" the certificate to attest that it has not been forged or altered. For more information, see *Digital Certificates Overview* and *Example: Requesting a CA Digital Certificate*.

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

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

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

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

SEE ALSO

ssl | 575

Release History Table

Release	Description
17.4R1	Starting with Junos OS Release 17.4R1, you can configure bidirectional authentication for gRPC sessions used to stream telemetry data.
17.3R1	The Junos Telemetry Interface and gRPC streaming are supported on QFX5110, EX4600, and EX9200 switches starting with Junos OS Release 17.3R1.

17.2R1	The Junos Telemetry Interface and gRPC streaming are supported on QFX10000 and QFX5200 switches, and PTX1000 routers starting with Junos OS Release 17.2R1.
16.1R3	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.

Supported Data Types

A GetRequest is sent when a collector client initiates a Get RPC to receive telemetry data. Specified within the GetRequest are the data elements with which the target should return data to the collector, including the data type. The data type is the variable that specifies the form in which data should be delivered.

Table 4 on page 72 lists the data types supported with Junos telemetry interface (JTI). Unless specified, the data type is supported for JTI data export using remote procedure call (gRPC) services, gRPC Network Management Interface (gNMI) services, or through UDP.

Table 4: Data Types

Type	Value	Description
string	**string_val = 1**	String value.
int64	**int_val = 2**	Integer value.
uint64	**uint_val = 3**	Unsigned integer value.
bool	**bool_val = 4**	Bool value.
float	**float_val = 6**	Floating point value.

Table 4: Data Types *(Continued)*

Type	Value	Description

Decimal64	**decimal_val = 7)**	Decimal64 encoded value. Supported only with gNMI services. Use decimal64 to encode a fixed precision decimal number. The value is expressed as a set of digits with the precision specifying the number of digits following the decimal point in the digit set. For example:
		
		`message Decimal64 {`
		`  int64 digits = 1;  // Set of digits.`
		`  uint32 precision = 2;  // Number of digits following the decimal point.`

ScalarArray	**leaflist_val = 8**	Mixed type scalar array value. An homogenous array of the values of mixed datatypes (string, int64, uint64, bool float or decimal64). Supported only with gNMI services.

For more information on data types, see github

Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface)

IN THIS SECTION

- Supported gRPC and gNMI Sensors | **76**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Starting with Junos OS Release 19.3R1, gRPC service for exporting statistics is supported on MX Series routers hosting MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards. The resource paths **/junos/system/linecard/cpu/memory/**, **/junos/system/linecard/npu/memory/**, and **/junos/system/linecard/npu/utilization/** can be updated to call out individual sensors (leaves) and their respective paths for better clarity.

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

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

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

Starting with Junos OS Evolved Release 20.2R1, gRPC service for streaming NDP statistics is supported on PTX10001 routers.

Starting with Junos OS Release 20.2R1, gRPC service for streaming Packet forwarding Engine and Routing Engine statistics is supported on EX2300, EX2300-MP, and EX3400 switches.

Starting with Junos OS Release 20.2R1, gRPC service for streaming BGP routing information base (RIB) and BGP peer statistics is supported on any platform family that supports containerized routing protocol process (cRPD). cRPD is Juniper's routing protocol process (rpd) decoupled from Junos OS and packaged as a Docker container to run in Linux-based environments.

Starting with Junos OS Release 20.2R1, ON_CHANGE BGP peer statistics export using gRPC services and gNMI services is supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000, PTX10000 routers and QFX5100 and QFX5200 switches.

Starting with Junos OS Release 20.2R1, streaming BGP global, peer and perr groups statistics using gRPC services is supported on EX2300, EX3400, EX4300, EX4600, and EX9200 switches.

Starting with Junos OS Release 20.2R1, streaming revenue interface statistics through Packet Forwarding Engine sensors and pseudo interface statistics through Routing Engine sensors using gRPC services and gNMI services is supported on SRX5400, SRX5600, and SRX5800 Services Gateways..

Starting with Junos OS Release 20.2R1, streaming revenue interface statistics through Packet Forwarding Engine sensors and pseudo interface statistics through Routing Engine sensors using gRPC services and gNMI services is supported on SRX5400, SRX5600, and SRX5800 Services Gateways.

Starting with Junos OS Release 20.2R1 sensors to stream standby Routing Engine statistics are supported on MX480, MX960, MX10003, MX2010, and MX2020 routers.

Starting with Junos OS Release 20.2R1 sensors to stream EVPN statistics using gRPC services are supported with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.

Starting with Junos OS Release 20.2R1, gRPC service for exporting LDP and mLDP statistics is supported on MX Series routers.

Starting with Junos OS Release 20.3R1, gRPC service for exporting LDP and mLDP statistics is supported on MPC10E-10C-MRATE, MPC10E-15C-MRATE, and MX2K-MPC11E line cards.

See Table 5 on page 77 for information about which sensors are supported with gRPC and on which platforms.

See Table 6 on page 318 for a description of supported broadband edge (BBE) gRPC sensors, which are supported on all platforms supporting gRPC unless otherwise noted.

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

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

Supported gRPC and gNMI Sensors

See Table 5 on page 77 for a description of supported gRPC and gNMI sensors and Table 6 on page 318 for a description of supported broadband edge (BBE) gRPC sensors, including the subscription path you use to provision the sensors.

Starting with Junos OS Release 20.1R1, the on-device gRPC framework is upgraded to version v1.18.0 and is applicable to both JET and JTI. This version includes important enhancements for gRPC. Earlier legacy Junos OS platform versions (non-Occam) will continue to use version v1.3.0.

Starting with Junos OS Release 20.2R1, JTI supports MX routers with dual Routing Engines or MX Series Virtual Chassis on all Packet Forwarding Engine and Routing Engine sensors currently supported on MX Series routers. The level of sensor support currently available for MX Series routers applies, whether through streaming or ON_CHANGE statistics export, using UDP, remote procedure call (gRPC) services or gRPC Network Management Interface (gNMI) services. Additionally, JTI operational mode commands will provide details for all Routing Engines and MX Series Virtual Chassis, too.

Table 5: gRPC Sensors

resource path	Description
/bgp-rib/	Sensor for BGP routing information base (RIB). Periodic streaming using gRPC services is supported on any platform family that supports containerized routing protocol process (cRPD) starting with Junos OS Release 20.2R1. cRPD is Juniper's routing protocol process (rpd) decoupled from Junos OS and packaged as a Docker container to run in Linux-based environments.
/bgp-rib/afi-safis/afi-safi/	Sensor for BGP routing information base (RIB). Periodic streaming using gRPC services is supported on PTX10003 starting with Junos OS Release 20.2R1. You can also add the following endpoints to **/bgp-rib/afi-safis/afi-safi/**: • **/ipv4-unicast/loc-rib** • **ipv6-unicast/loc-rib/** • **ipv6-unicast/neighbors/** • **ipv4-unicast/neighbors/**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/components/component/	Sensor for chassis components. ON_CHANGE notification is triggered if a component (FPC) is inserted or removed or if a component's power is on or off (FPC is online or offline). Instant reporting of such events is handled with this sensor. ON_CHANGE streaming is supported on MX960, MX2010, MX2020, PTX-5000, PTX1000, and PTX10000 routers starting with Junos OS Release 18.4R1. Starting with Junos OS Release 19.1R1, periodic streaming on QFX10002 switches and PTX10002 routers is supported. Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Starting with Junos OS Release 19.4R1, ON_CHANGE statistics using gRPC services or gNMI services with MX960 routers is supported. Previously, these sensors were only supported to stream statistics. Starting with Junos OS Release 20.1R1, ON_CHANGE statistics using gNMI services with MX960, MX2020, PTX1000, and PTX5000 routers. These routers support OpenConfig model: • openconfig-platform.yang: oc-ext:openconfig-version 0.12.1 Starting with Junos OS Release 20.2R1, streaming pseudo interface statistics through Routing Engine sensors is supported using gRPC services or gNMI services with SRX5400, SRX5600, and SRX5800 Service Gateways. Previously, streaming statistics was only supported through gRPC services. You can also add the following endpoints to the path to stream specific statistics:

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **name** • **state/id** • **state/description** • **state/serial-no** • **state/part-no** The **state/type** identifies the ON_CHANGE event type. Event types are: **FRU_ADD**, **FRU_REMOVE**, **FRU_POWERON**, and **FRU_POWEROFF** For more information about ON_CHANGE statistics, see "Understanding OpenConfig and gRPC on Junos Telemetry Interface" on page 36.
/components/component/cpu/	Individual process level information sensor. Use this sensor to stream CPU usage per process statistics that are similar to output from the **show system process detail** operational mode command. Starting in Junos OS Release 20.2R1, streaming statistics using gRPC services or gNMI services on MX960, MX2010, MX2020, PTX1000, PTX5000, and PTX10000 routers QFX5100, and QFX5200 switches is supported.

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **hwds-input-checksum** • **hwds-output-mtu** • **lts-input-packets** • **lts-output-packets** • **lts-sw-input-control-drops** • **lts-sw-input-high-drops** • **lts-sw-input-medium-drops** • **lts-sw-input-low-drops** • **lts-sw-output-low-drops**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/components/component/subcomponents/subcomponent[name='FPC*ID*']/properties/property/[name=' *counter*']/state/value	Sensor for packet forwarding engine statistics. The subcomponent name **FPC*id*** refers to the number of the Flexible PIC Concentrator. This sensor provides visibility into packet forwarding engine errors and drops. This sensor pulls CPU counters. Supported on MX Series routers and PTX Series routers starting with Junos OS Release 17.4R1. The value for ***counter*** is one of the following; • **lts-hw-input-drops** • **lts-input-packets** • **lts-output-packets** • **lts-sw-input-control-drops** • **lts-sw-input-high-drops** • **lts-sw-input-medium-drops** • **lts-sw-input-low-drops** • **lts-sw-output-low-drops**
/components/component[name='CB0']/properties/property[name='*state*'/	Sensor for Control Board (CB) state information. This information can also be found using the operational mode command **show chassis hardware**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/components/component[name='FPM Board']/properties/property[name='*fru-model-number*']/	Sensor for field-replaceable unit (FRU) for a craft interface (FPM). This information can also be found using the operational mode command **show chassis hardware models**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='FPM Board']/properties/ property[name='*manufacture-date*']/	Sensor for a craft interface (FPM) manufacturing date. This information can also be found using the operational mode command **show chassis hardware extensive**. Starting in Junos OS Evolved Release 19.1R1, PTX10003 routers are supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component[name='SIB0']/ properties/property[name='*state*']/	Sensor for Switch Interface Boards (SIBs). **SIB0** and **SIB1** are supported. This information can also be found using the operational mode command **show chassis sibs**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/components/component['Chassis']/ properties/property[name='*state*'/	Sensor for the chassis state. The chassis state is always **ONLINE**. This information can also be found using the operational mode command **show chassis environment**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component['PSM2']/ properties/property[name='*fru-model-number*'/ **/components/component['PSM2']/ properties/property[name='*manufacture-date*'/** **/components/component['PSM2']/ properties/property[name='*Temperature*'/** **/components/component['PSM2']/ properties/property[name='*state*'/**	Sensors for the power supply module (PSM) FRU model number, manufacture date, temperature, and state. This information can also be found using the operational mode command **show chassis environment**. Starting in Junos OS Evolved Release 19.1R1, periodic streaming using gRPC services on PTX10003 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.
/components/component/properties/ property/state/value	Sensor for chassis components. Starting with Junos OS Release 19.2R1, periodic streaming using gNMI services is supported on QFX5110, QFX5120, QFX5200 and QFX5210 switches.

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **components/ component[name='FPC19:PIC1:PORT11:Xcvr0']/ transceiver/state/laser-bias-current/instant** • **components/ component[name='FPC19:PIC1:PORT11:Xcvr0']/ transceiver/state/input-power/instant** • **/components/ component[name='FPC19:PIC1:PORT11:Xcvr0']/ transceiver/state/form-factor-preconf** • **/components/ component[name='FPC19:PIC1:PORT11:Xcvr0']/ transceiver/state/form-factor** • **/components/ component[name='FPC19:PIC1:PORT11:Xcvr0']/ transceiver/state/ethernet-pmd-preconf** • **/components/ component[name='FPC19:PIC1:PORT11:Xcvr0']/ transceiver/state/ethernet-pmd** • **/components/ component[name='FPC19:PIC1:PORT11:Xcvr0']/ transceiver/state/enabled** • **/components/ component[name='FPC19:PIC1:PORT11:Xcvr0']/ transceiver/state/date-code**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/chassis/aggregated-devices	Sensor for kernel link aggregation group (LAG) information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/chassis/aggregated-devices/: • **ae-lp-link-down-cnt** • **ae-unstack-cnt** • **ps-ifl-ccc-down-cnt** • **ps-lt-unstack-cnt** • **rlt-lp-link-down-cnt**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/chassis/gres	Sensor for graceful Routing Engine switchover (GRES) information. Starting with Junos OS Release 19.1R1, EX9200, EX9251, EX9253, MX Series, and PTX Series are supported. You can also add the following as the end path for /junos/chassis/gres/: • **configured-state** • **error-state** • **gres-time** • **is-protocol-master** • **master-kernel-ready** • **other-re-present** • **other-re-alive** • **slave-connect-time** • **slave-kernel-ready**
/junos/chassis/issu/	Sensor for in-service software upgrade (ISSU) information. Starting with Junos OS Release 19.1R1, EX9200, EX9251, EX9253, MX Series, and PTX Series are supported. You can also add the following as the end path for /junos/chassis/issu/: • **failure-stage** • **current-issu-stage**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/events	System events sensor. Starting with Junos OS Release 18.1R1, this sensor corresponds to system log messages (syslog). Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX are also supported. Starting with Junos OS Release 20.2R1, streaming pseudo interface statistics through Routing Engine sensors is supported using gRPC services or gNMI services with SRX5400, SRX5600, and SRX5800 Service Gateways. Previously, streaming statistics was only supported through gRPC services. The sensor must be used with an **export-profile** that has a **reporting-rate** of 0. To subscribe for specific events, you can subscribe for /junos/events/event[id='EVENT_NAME'] where event EVENT_NAME is the event id that you are interested in. Many event names can be found in the messages log file. Alternatively, you can subscribe to any resource path.
/junos/evpn/evpn-smet-forwarding/	Global EVPN resource counters and current usage sensor. Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/evpn/l3-context/	EVPN IP prefix sensor. Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **dpd-response-payload-maximum-delay** • **dpd-response-seq-payload-missed** • **invalid-spi-notify-received** • **invalid-spi-notify-transmitted** • **routing-instance**
/junos/kernel/multicast/	Sensor for kernel IP multicast information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/multicast/: • **iifmismatch-err-cnt** • **rslv-req-err-cnt**
/junos/kernel/peer-infra/	Sensor for PFEMAN connection information. Starting with Junos OS Release 19.1R1, EX9200, EX9251, EX9253, MX Series, and PTX Series are supported. You can also add the following as the end path for /junos/kernel/peer-infra/: • **pfeman-conn-drops** • **spurious-ppt-wkups**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/kernel/record-meta-data/record_time	Sensor for system time at which Routing Engine metadata is created. Starting with Junos OS Release 19.1R1, EX9200, EX9251, EX9253, MX Series, and PTX Series are supported.
/junos/kernel/tcpip/arp	Sensor for kernel Address Resolution Protocol (ARP) cache information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/tcpip/arp/: • **nbrcache-iri-max** • **nbrcache-mgmt-max** • **nbrcache-public-max** • **nbrcache-iri-cnt** • **nbrcache-mgmt-cnt** • **nbrcache-public-cnt** • **nbrcache-iri-drop-cnt** • **nbrcache-mgmt-drop-cnt** • **nbrcache-public-drop-cnt**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/kernel/tcpip/rtstock	Sensor for kernel routing table socket (RTSOCK) information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/rtsock/: • **total-error-cnt** • **total-veto-cnt**
/junos/kernel/tcpip/tcp	Sensor for kernel Transport Control Protocol (TCP) information. Starting with Junos OS Release 19.3R1, EX9200, EX9251, EX9253, MX240, MX480, MX960, MX2010, MX2020, vMX, PTX1000, PTX10008, PTX10016, PTX3000 with RE-PTX-X8-64G, and PTX5000 with RE-PTX-X8-64G are supported. You can also add the following as the end path for /junos/kernel/tcpip/tcp/: • **tcp-ddos-attack-cnt** • **tcp-conndrops-cnt** • **tcp-time-wait-conn**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **rtt-stddev-thresh** • **igr-thresh** • **igr-jitter-thresh** • **igr-stddev-thresh** • **egr-thresh** • **egr-jitter-thresh** • **egr-stddev-thresh** • **probe-tests-hw-ts-err/invalid-client-recv-ts-cntr** • **probe-tests-hw-ts-err/invalid-client-nots-cntr** • **probe-tests-hw-ts-err/invalid-server-send-ts-cntr** • **probe-tests-hw-ts-err/invalid-server-spent-time-cntr** • **probe-single-results** • **probe-single-results/probe-time** • **probe-single-results/probe-sent-time** • **probe-single-results/probe-status** • **probe-single-results/hardware-timestamp-status** • **probe-single-results/rtt** • **probe-single-results/egress** • **probe-single-results/ingress** • **probe-single-results/round-trip-jitter** • **probe-single-results/egress-jitter** • **probe-single-results/round-trip-interarrival-jitter**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **rtt-stddev-thresh** • **igr-thresh** • **igr-jitter-thresh** • **igr-stddev-thresh** • **egr-thresh** • **egr-jitter-thresh** • **egr-stddev-thresh** • **probe-single-results** • **probe-single-results/probe-time** • **probe-single-results/probe-sent-time** • **probe-single-results/probe-status** • **probe-single-results/hardware-timestamp-status** • **probe-single-results/rtt** • **probe-single-results/egress** • **probe-single-results/ingress** • **probe-single-results/round-trip-jitter** • **probe-single-results/egress-jitter** • **probe-single-results/ingress-jitter** • **probe-single-results/round-trip-interarrival-jitter** • **probe-single-results/egress-interarrival-jitter** • **probe-single-results/ingress-interarrival-jitter**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/services/ip-tunnel[name='tunnel-name']/usage/counters[name='counter-name']/	Sensor for Packet Forwarding Engine dynamic tunnels statistics. The statistics are used to report various network element performance metrics in a scalable and efficient way, providing visibility into Packet Forwarding Engine errors and drops. A timestamp indicating when the counters were last reset is included with all the exported data to allow collectors to determine if and when a reset event happened; for example, if the Packet Forwarding Engine hardware restarted. Exported statistics are similar to the output of the operational mode command **show nhdb hw dynamic-ip-tunnels**. Starting with Junos OS Release 17.4R1, MX Series devices are supported on gRPC services, with the exception of MX80 and MX104 routers. These routers support UDP export only for this sensor. To configure UDP export, include the sensor **/junos/services/ip-tunnel/usage/** in the "sensor (Junos Telemetry Interface)" on page 484 configuration statement at the [**edit services analytics**] hierarchy level.

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	Supported on QFX5200 switches starting with Junos OS Release 19.2R1 for streaming telemetry information using gNMI services. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. Starting with Junos OS Evolved Release 20.2R1, periodic streaming using gRPC services with PTX10001 routers is supported. For bypass LSPs, the following are exported: • Bypass LSP originating at the ingress router of the protected LSP. • Bypass LSP originating at the transit router of the protected LSP. • Bypass LSP protecting the transit LSP as well as the locally originated LSP. When the bypass LSP is active, traffic is exported both on the bypass LSP and the ingress (protected) LSP. **NOTE**: When you enable a sensor for LSP statistics only, you must also configure the `sensor-based-stats` statement at the **[edit protocols mpls]** hierarchy level. MX Series routers should operate in enhanced mode. If not enabled by default, include either the **enhanced-ip** statement or the **enhanced-ethernet** statement at the **[edit chassis network-services]** hierarchy level.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/twamp/client/control-connection/	Sensor for client control connection results for Two-Way Active Management Protocol (TWAMP). TWAMP (described in RFC 5357). Used to measure traffic performance between end-points, you can use this information to assure service level agreements, improve network design, and optimize traffic engineering. Starting with Junos OS Release 18.3R1, MX Series routers are supported. The following end paths are also supported for the resource path: • **control-name** • **client-address** • **client-port** • **server-address** • **server-port** • **session-count** • **auth-mode** • **server-address** • **server-port** • **test-session/session-name** • **test-session/sender-address** • **test-session/sender-port** • **test-session/reflector-address** • **test-session/reflector-port**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **rtt-jitter-thresh** • **rtt-stddev-thresh** • **igr-thresh** • **igr-jitter-thresh** • **igr-stddev-thresh** • **egr-thresh** • **egr-jitter-thresh** • **egr-stddev-thresh** • **probe-tests-hw-ts-err/invalid-client-recv-ts-cntr** • **probe-tests-hw-ts-err/invalid-client-nots-cntr** • **probe-tests-hw-ts-err/invalid-server-send-ts-cntr** • **probe-tests-hw-ts-err/invalid-server-spent-time-cntr** • **probe-single-results/** • **probe-single-results/probe-time** • **probe-single-results/probe-sent-time** • **probe-single-results/probe-status** • **probe-single-results/hardware-timestamp-status** • **probe-single-results/rtt** • **probe-single-results/egress** • **probe-single-results/ingress** • **probe-single-results/round-trip-jitter** • **probe-single-results/egress-jitter**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **probe-single-results/ingress-jitter** • **probe-single-results/round-trip-interarrival-jitter** • **probe-single-results/egress-interarrival-jitter** • **probe-single-results/ingress-interarrival-jitter** • **probe-test-generic-results/** • **probe-test-generic-results/results-scope** • **probe-test-generic-results/probes-sent** • **probe-test-generic-results/probe-responses** • **probe-test-generic-results/loss-percentage** • **probe-test-generic-results/probe-test-rtt** • **probe-test-generic-results/probe-test-generic-measurements/** • **probe-test-generic-results/probe-test-generic-measurements//probe-measurement-type** • **probe-test-generic-results/probe-test-generic-measurements/samples** • **probe-test-generic-results/probe-test-generic-measurements/min-delay** • **probe-test-generic-results/probe-test-generic-measurements/max-delay** • **probe-test-generic-results/probe-test-generic-measurements/avg-delay** • **probe-test-generic-results/probe-test-generic-measurements/jitter-delay**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **rtt-stddev-thresh** • **igr-thresh** • **igr-jitter-thresh** • **igr-stddev-thresh** • **egr-thresh** • **egr-jitter-thresh** • **egr-stddev-thresh** • **probe-single-results/** • **probe-single-results/probe-time** • **probe-single-results/probe-sent-time** • **probe-single-results/probe-status** • **probe-single-results/hardware-timestamp-status** • **probe-single-results/rtt** • **probe-single-results/egress** • **probe-single-results/ingress** • **probe-single-results/round-trip-jitter** • **probe-single-results/egress-jitter** • **probe-single-results/ingress-jitter** • **probe-single-results/round-trip-interarrival-jitter** • **probe-single-results/egress-interarrival-jitter** • **probe-single-results/ingress-interarrival-jitter**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **failover-normalization** • **time-to-normalize** • **sampling/sampling-outlier-cutoff** • **sampling/sampling-mode** • **sampling/sampling-percentile** • **normalization-status** which includes **normalize-init**, **normalize-complete**, and **avoid-normalize**
/network-instances/network-instance[name='*instance-name*']/mpls/lsps/constrained-path/tunnels/tunnel[name='*name*']/p2p-tunnel-attributes/p2p-primary-paths/p2p-primary-path[name='*path-name*']/lsp-instances/state/notify-status	Sensor for LSP events and properties. LSP events and properties are exported for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs. Supported on QFX5200 switches for streaming and ON_CHANGE statistics export through gNMI services starting with Junos OS Release 19.2R1.

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance[name='*instance-name*']/mpls/lsps/constrained-path/tunnels/tunnel[name='*name*']/p2p-tunnel-attributes/p2p-primary-paths/p2p-primary-path[name='*path-name*']/	Sensor for LSP events and properties. LSP events and properties are exported for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs. **NOTE**: Starting with Junos OS Release 17.4R1, telemetry data for LSP events and properties is reported separately for each routing instance. To export data for LSP events and properties, you must now include **/network-instances/network-instance[name='*instance-name*']/** in front of all supported paths. . Supported on MX Series and PTX Series routers and QFX10000 switches starting with Junos OS Release 17.2R1. Supported on EX4600 and EX9200 switches and QFX5110 and QFX5200 switches starting with Junos OS Release 17.3R1. Starting with Junos OS Release 18.1R1, QFX5100 switches are also supported. Starting with Junos OS Release 18.3R1, QFX5120-48Y and EX4650 switches are also supported. Starting with Junos OS Release 18.4R1, EX4600 switches are also supported. The following paths are also supported: • **lsp-instances/state/notify-status/initiated** • **lsp-instances/state/notify-status/lsp-up** • **lsp-instances/state/notify-status/lsp-down** • **lsp-instances/state/notify-status/lp-available** • **lsp-instances/state/notify-status/lp-unavailable**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **lsp-instances/state/notify-status/autobw-success** • **lsp-instances/state/notify-status/autobw-fail** • **lsp-instances/state/notify-status/patherr-recv** • **lsp-instances/state/notify-status/tunnel-local-repaired** • **lsp-instances/state/bandwidth** • **lsp-instances/state/metric** • **lsp-instances/state/max-avg-bandwidth** • **/state/associated-rsvp-sessions/associated-rsvp-session[local-index ='*index-number*']/** • **state/notify-status** • **state/notify-status/originate-mbb** • **state/notify-status/cspf-noroute** • **state/notify-status/cspf-success** • **state/notify-status/gr-recovery-fail** • **state/explicit-path-name** **NOTE**: To specify a specific LSP name and source address, include **[name='lsp-name',source='address']** after **mpls/lsp/constrained-path-tunnels/tunnel/** in any of the supported paths. If do not include a specific LSP name, data is exported for all configured LSPs.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance[name='*instance-name*']/mpls/lsps/constrained-path/tunnels/tunnel[name='*name*']/p2p-tunnel-attributes/p2p-primary-paths/p2p-primary-path[name='*path-name*'][local-index='local-index']/state/notify-status	Sensor for self-ping failure. This sensor supports self-ping logs. Starting with Junos OS Release 19.1R1, this sensor is supported on all platforms supporting JTI.
/network-instances/network-instance[name='*instance-name*']/mpls/lsps/constrained-path/tunnels/tunnel[name='*name*']/p2p-tunnel-attributes/p2p-primary-paths/p2p-primary-path[name='*path-name*'][local-index='local-index']/state/reason/	Sensor that indicates the reason for a self-ping failure. Starting with Junos OS Release 19.1R1, this sensor is supported on all platforms supporting JTI.

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **patherr-recv/label_allocation_failure** • **patherr-recv/non_rsvp_capable_router** • **patherr-recv/ttl_expired** • **patherr-recv/routing_loop_detected** • **patherr-recv/requested_bandwidth_unavailable** • **patherr-recv/ttl_expired** • **pathmtu-change**
/junos/system/cmerror/configuration	Sensor for error monitoring configuration. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services.
/junos/system/cmerror/counters	Sensor for error monitoring counters. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services.

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
junos/system/linecard/npu/memory/	Sensor for network processing unit (NPU) memory. Supported on MX Series routers with MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards starting with Junos OS Release 19.3R1 for exporting telemetry information using gRPC services. This feature provides a different level of exported statistics in comparison to previous releases because it use the OpenConfig AFT model. Supported on MX2010 and MX2020 routers with MX2K-MPC11E line cards starting with Junos OS Release 20.1R1 for streaming telemetry information using gRPC services. You can also add the following to the end of the path to stream specific statistics for NPU memory: • **mem-util-edmem-size** • **mem-util-edmem-allocated** • **mem-util-edmem-utilization** • **mem-util-idmem-size** • **mem-util-idmem-allocated** • **mem-util-idmem-utilization** • **mem-util-bulk-dmem-size** • **mem-util-bulk-dmem-allocated** • **mem-util-bulk-dmem-utilization** • **mem-util-next-hop-edmem-size** • **mem-util-next-hop-edmem-allocated** • **mem-util-next-hop-edmem-utilization** • **mem-util-next-hop-bulk-dmem-size**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **mem-util-next-hop-bulk-dmem-allocated** • **mem-util-next-hop-bulk-dmem-utilization** • **mem-util-next-hop-idmem-size** • **mem-util-next-hop-idmem-allocated** • **mem-util-next-hop-inline-services-free-count** • **mem-util-next-hop-mobile:-timing-profile-bytes-allocated** • **mem-util-next-hop-mobile:-timing-profile-allocation-count** • **mem-util-next-hop-mobile:-timing-profile-free-count** • **mem-util-next-hop-packet-reassembly-(rw)-bytes-allocated** • **mem-util-next-hop-packet-reassembly-(rw)-allocation-count** • **mem-util-next-hop-packet-reassembly-(rw)-free-count** • **mem-util-next-hop-packet-reassembly---persistent-(rw)-bytes-allocated** • **mem-util-next-hop-packet-reassembly---persistent-(rw)-allocation-count** • **mem-util-next-hop-packet-reassembly---persistent-(rw)-free-count** • **mem-util-next-hop-ml-bundle-bytes-allocated** • **mem-util-next-hop-ml-bundle-allocation-count** • **mem-util-next-hop-ml-bundle-free-count** • **mem-util-next-hop-ddos-scfd-params-bytes-allocated**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **mem-util-next-hop-ddos-scfd-params-allocation-count** • **mem-util-next-hop-ddos-scfd-params-free-count** • **mem-util-next-hop-vbf-bytes-allocated** • **mem-util-next-hop-vbf-allocation-count** • **mem-util-next-hop-vbf-free-count** • **mem-util-next-hop-ptp-ieee-1588-nhs-bytes-allocated** • **mem-util-next-hop-ptp-ieee-1588-nhs-allocation-count** • **mem-util-next-hop-ptp-ieee-1588-nhs-free-count** • **mem-util-next-hop-cos-bytes-allocated** • **mem-util-next-hop-cos-allocation-count** • **mem-util-next-hop-cos-free-count** • **mem-util-next-hop-inline-hash-sessions-bytes-allocated** • **mem-util-next-hop-inline-hash-sessions-allocation-count** • **mem-util-next-hop-inline-hash-sessions-free-count** • **mem-util-next-hop-inline-mdi-bytes-allocated** • **mem-util-next-hop-inline-mdi-allocation-count** • **mem-util-next-hop-inline-mdi-free-count** • **mem-util-next-hop-cos-enhanced-priority-bytes-allocated** • **mem-util-next-hop-cos-enhanced-priority-allocation-count** • **mem-util-next-hop-cos-enhanced-priority-free-count** • **mem-util-firewall-fw-bytes-allocated**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **mem-util-firewall-fw-allocation-count** • **mem-util-firewall-fw-free-count** • **mem-util-counters-fw-counter-bytes-allocated** • **mem-util-counters-fw-counter-allocation-count** • **mem-util-counters-fw-counter-free-count** • **mem-util-counters-fw-policer-bytes-allocated** • **mem-util-counters-fw-policer-allocation-count** • **mem-util-counters-fw-policer-free-count** • **mem-util-counters-ifd-error-cntr-bytes-allocated** • **mem-util-counters-ifd-error-cntr-allocation-count** • **mem-util-counters-ifd-error-cntr-free-count** • **mem-util-counters-nh-cntr-bytes-allocated** • **mem-util-counters-nh-cntr-allocation-count** • **mem-util-counters-nh-cntr-free-count** • **mem-util-counters-ifl-cntr-bytes-allocated** • **mem-util-counters-ifl-cntr-allocation-count** • **mem-util-counters-ifl-cntr-free-count** • **mem-util-counters-bridge-domain-counter0-bytes-allocated** • **mem-util-counters-bridge-domain-counter0-allocation-count** • **mem-util-counters-bridge-domain-counter0-free-count** • **mem-util-counters-bridge-domain-counter0-free-count**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **mem-util-counters-bridge-domain-cntr-bytes-allocated** • **mem-util-counters-bridge-domain-cntr-allocation-count** • **mem-util-counters-bridge-domain-cntr-free-count** • **mem-util-counters-sample-inline-params-bytes-allocated** • **mem-util-counters-sample-inline-params-allocation-count** • **mem-util-counters-sample-inline-params-free-count** • **mem-util-counters-services-counters-bytes-allocated** • **mem-util-counters-services-counters-allocation-count** • **mem-util-counters-services-counters-free-count** • **mem-util-counters-exception-counter-bytes-allocated** • **mem-util-counters-exception-counter-allocation-count** • **mem-util-counters-exception-counter-free-count** • **mem-util-counters-issu-policer-bytes-allocated** • **mem-util-counters-issu-policer-allocation-count** • **mem-util-counters-issu-policer-free-count** • **mem-util-counters-ddos-scfd-counters-bytes-allocated** • **mem-util-counters-ddos-scfd-counters-allocation-count** • **mem-util-counters-ddos-scfd-counters-free-count** • **mem-util-counters-ip-reassembly-counter-bytes-allocated** • **mem-util-counters-ip-reassembly-counter-allocation-count** • **mem-util-counters-ip-reassembly-counter-free-count**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **mem-util-hash-hash-edmem-overhead-bytes-allocated** • **mem-util-hash-hash-edmem-overhead-bytes-allocated** • **mem-util-hash-hash-edmem-overhead-bytes-allocated** • **mem-util-hash-hash-edmem-overhead-bytes-allocated** • **mem-util-hash-hash-edmem-overhead-bytes-allocated** • **mem-util-hash-hash-edmem-overhead-allocation-count** • **mem-util-hash-hash-edmem-overhead-free-count** • **mem-util-hash-hash-edmem-bkt-bytes-allocated** • **mem-util-hash-hash-edmem-bkt-allocation-count** • **mem-util-hash-hash-edmem-bkt-free-count** • **mem-util-hash-hash-edmem-rec-bytes-allocated** • **mem-util-hash-hash-edmem-rec-allocation-count** • **mem-util-hash-hash-edmem-rec-free-count** • **mem-util-hash-hash-edmem-sideband-bytes-allocated** • **mem-util-hash-hash-edmem-sideband-allocation-count** • **mem-util-hash-hash-edmem-sideband-free-count** • **mem-util-hash-hash-dmem-bkt-bytes-allocated** • **mem-util-hash-hash-dmem-bkt-allocation-count** • **mem-util-hash-hash-dmem-bkt-free-count** • **mem-util-hash-hash-dmem-rec-bytes-allocated** • **mem-util-hash-hash-dmem-rec-allocation-count** • **mem-util-hash-hash-dmem-rec-free-count**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **[name="mem-util-<*partition-name*>-< *app-name*>-bytes-allocated"]/value** • **[name="mem-util-<*partition-name*>-< *app-name*>-free-count"]/value** You can also add the following to the end of the path to stream specific statistics for NPU: • **[name="util-<*memory-name*>-average-util">/value** • **[name="util-<*memory-name*>-highest-util">/value** • **[name="util-<*memory-name*>-lowest-util">/value** • **[name="util-<*memory-name*>-average-cache-hit-rate">/value** • **[name="util-<*memory-name*>-lowest-cache-hit-rate">/value** • **[name="util-<*packet-identifier*>-rate">/value** You can also export the following statistics for NPU memory for PTX routers only • **pfe_name** • **combined_pool_name** • **combined_size** • **combined_usage_cnt** • **combined_utilization** • **global_pool_name** • **global_usage_cnt** • **global_alloc_cnt** • **global_free_cnt**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **local_pool_name** • **local_usage_cnt** • **local_alloc_cnt** • **local_free_cnt**
/junos/system/linecard/node-slicing/af-fab-stats/	Sensor to export abstracted fabric (AF) interface-specific load-balancing and fabric queue statistics. This sensor is only supported for in node virtualization configurations on MX routers with an AF Interface as the connecting link between guest network functions (GNFs).The sensor also reports aggregated statistics across all AF interfaces hosted on a source packet forwarding engine of local guest GNFs along with the fabric statistics for all traffic ingressing from and egressing to the fabric from that the packet forwarding engine. Supported on MX480, MX960, MX2010, MX2020, MX2008 and MX-ELM routers with Junos OS Release 18.4R1.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/cpu/memory/	Sensor for CPU memory. This sensor exports the CPU and memory utilization per process and CPU usage for threads per process. The current implementation is Linux-based; therefore, the export information and gathered output format differs significantly from this sensor's performance on previous platforms. Supported on MX Series routers with MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards starting with Junos OS Release 19.3R1 for exporting telemetry information using gRPC services. This feature provides a different level of exported statistics in comparison to previous releases because it use the OpenConfig AFT model. Supported on MX2010 and MX2020 routers with MX2K-MPC11E line cards starting with Junos OS Release 20.1R1 for streaming telemetry information using gRPC services. Supported on EX2300, EX2300-MP, and EX3400 switches starting with Junos OS Release 20.2R1 and later for streaming telemetry information using gRPC services. Supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000 routers, PTX10000 line of routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 20.2R1 and later for INITIAL_SYNC statistics using gNMI services. The statistics exported from this sensor are found in the following operational mode commands: **show system info**, **show system processes**, and **show system cpu**.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/cpu/memory/	Sensor for CPU memory. **NOTE**: On PTX Series routers, FPC1 and FPC2 are not supported. Supported on QFX10000 switches and PTX1000 routers starting with Junos OS Release 17.2R1. Supported on EX9200 switches starting with Junos OS Release 17.3R1. Supported on QFX5100, QFX5110, and QFX5200 switches starting with Junos OS Release 18.2R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. Periodic streaming is supported on on QFX10002 switches and PTX10002 routers starting with Junos OS Release 19.1R1. Starting with Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services. Supported on QFX5200 switches starting with Junos OS Release 19.2R1 for streaming telemetry information using gNMI services. Periodic streaming using gRPC services is supported on EX4300-MP switches starting with Junos OS Release 19.4R1, Periodic streaming using gRPC services is supported on EX2300, EX2300-MP, and EX3400 switches starting with Junos OS Release 20.2R1. You can also include the following to end of the resource path for CPU memory:

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• [name="mem-util-<*memory-name*>-size"]/value • [name="mem-util-<*memory-name*>-bytes-allocated"]/value • [name="mem-util-<*memory-name*>-utilization"]/value • [name="mem-util-<*memory-name*>-< *app-name*>-allocations"]/value • [name="mem-util-<*memory-name*>-< *app-name*>-frees"]/value • [name="mem-util-<*memory-name*>-< *app-name*>-allocations-failed"]/value

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/npu/memory/	Sensor for NPU Memory utilization statistics. Shown below, statistics are exported for the default FPC (**FPC0**). Multiples FPCs are supported. The component values and property values are names (like interface names). Starting in Junos OS Evolved Release 19.4R1, streaming statistics using gRPC and gNMI services on PTX10008 routers is supported. Starting in Junos OS Release 20.2R1, INITIAL_SYNC statistics using gNMI services on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000 routers, PTX10000 line of routers, and QFX5100 and QFX5200 switches are supported. The following statistics are exported: • **/components-memory/component[name='FPC0:NPU17']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-epp-mapid-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-epp-mapid-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-epp-mapid-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-l2domain-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-l2domain-allocated']/**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-l2domain-utilizationn']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-tunnell2domainhash00-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-tunnell2domainhash00-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-tunnell2domainhash00-utilization']/** • **:/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-tunnell2domainhash10-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-tunnell2domainhash10-allocatedd']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-tunnell2domainhash10-utilization']/** • **:/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-slu-my-mac-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-kht-slu-my-mac-allocated']/**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-refbits-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-refbits-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-nh-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-nh-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-nh-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-mpls-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-mpls-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name=' mem-util-jnh-mpls-utilization']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-loadbal-size']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-loadbal-allocated']/** • **/components-memory/component[name='FPC0:NPU17']/properties/property[name='mem-util-jnh-loadbal-utilization']/**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/components-utilization/ component[name='FPC0:NPU17']/properties/ property[name='util-Wan and Host inject-packet-rate']** • **/components-utilization/ component[name='FPC0:NPU17']/properties/ property[name='util-ASIC to host-packet-rate']**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/npu/utilization/	Packet Forwarding Engine sensor for NPU processor utilization. Supported on MX Series routers with MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards starting with Junos OS Release 19.3R1 for streaing telemetry information using gRPC services. This feature provides a different level of exported statistics in comparison to previous releases because it uses the OpenConfig AFT model. Supported on MX2010 and MX2020 routers with MX2K-MPC11E line cards starting with Junos OS Release 20.1R1 for streaming telemetry information using gRPC services. Supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000 routers, PTX10000 line of routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 20.2R1 and later for INITIAL_SYNC statistics using gNMI services. You can also include the following to the end of the resource path for NPU utilization: • **util-metric** • **util-Disp 0 Pkts-packet-rate** • **util-Disp 0 Pkts-average-instructions-per-packet** • **util-Disp 0 Pkts-average-wait-cycles-per-packet** • **util-Disp 0 Pkts-average-cycles-per-packet** • **util-Disp 1 Pkts-packet-rate** • **util-Disp 1 Pkts-average-instructions-per-packet** • **util-Disp 1 Pkts-average-wait-cycles-per-packet** • **util-Disp 1 Pkts-average-cycles-per-packet**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• • **util-Disp 2 Pkts-packet-rate** • **util-Disp 2 Pkts-average-instructions-per-packet** • **util-Disp 2 Pkts-average-wait-cycles-per-packet** • **util-Disp 2 Pkts-average-cycles-per-packet** • **util-Disp 3 Pkts-packet-rate** • • **util-Disp 3 Pkts-average-instructions-per-packet** • **util-Disp 3 Pkts-average-wait-cycles-per-packet** • **util-Disp 3 Pkts-average-cycles-per-packet** • **mem-util-EDMEM-average-util** • **mem-util-EDMEM-highest-util** • **mem-util-EDMEM-lowest-util** • **mem-util-EDMEM-average-cache-hit-rate** • **mem-util-EDMEM-highest-cache-hit-rate** • **mem-util-EDMEM-lowest-cache-hit-rate** • **mem-util-IDMEM-average-util** • **mem-util-IDMEM-highest-util** • **mem-util-IDMEM-lowest-util** • **mem-util-IDMEM-average-cache-hit-rate** • **mem-util-IDMEM-highest-cache-hit-rate** • **mem-util-IDMEM-lowest-cache-hit-rate**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/interface/	Packet Forwarding Engine sensor for physical interface traffic. **NOTE**: For PTX Series routers, for a specific interface, queue statistics are exported for each line card. For MX series routers, interface queue statistics are exported only from the slot on which an interface is configured. For Aggregated Ethernet interfaces, statistics are exported for the member physical interfaces. You must aggregate the counters at the destination server, or collector. If a physical interface is administratively down or operationally down, interface counters are not exported. Issuing an operational **clear** command, such as **clear interfaces statistics all**, does not reset statistics exported by the line card. Supported on PTX Series routers starting with Junos OS Release 15.1F3. Supported on MX Series routers starting with Junos OS Release 15.1F5. Supported on QFX10000 switches and PTX1000 routers starting with Junos OS Release 17.2R1. Supported on EX9200 switches and MX150 routers starting with Junos OS Release 17.3R1. Supported on QFX5100, QFX5110, and QFX5200 switches starting with Junos OS Release 18.2R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches Starting with Junos OS Release 18.4R1. Periodic streaming is supported on QFX10002 switches and PTX10002 routers starting with Junos OS Release 19.1R1. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	QFX5200 switches with Junos OS Release 19.2R1 on gRPC and gNMI services. Supported on MX240, MX480, and MX960 routers starting with Junos OS Release 19.3R1 for exporting telemetry information using gNMI services. This feature includes support to export telemetry data for integration with AFTTelemetry and LibTelemetry libraries with the OpenConfig model openconfig-aft. Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Periodic streaming using gNMI services on MX2K-MPC11E line cards on MX2010 and MX2020 routers is supported starting with Junos OS Release 20.1R1. Periodic streaming using gRPC services is supported on EX2300, EX2300-MP, and EX3400 switches starting with Junos OS Release 20.2R1. INITIAL_SYNC statistics using gNMI services is supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000 routers, PTX10000 line of routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 20.2R1. Streaming statistics using gRPC services or gNMI services is supported on PTX10008 routers starting with Junos OS Release 20.2R1.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/interface/logical/usage	Packet Forwarding Engine sensor for logical interface statistics. **NOTE**: If a logical interface is operationally down, interface statistics continue to be exported. Issuing an operational **clear** command, such as **clear interfaces statistics all**, does not reset statistics exported by the line card. **NOTE**: If a logical interface is operationally down, interface statistics continue to be exported. Issuing an operational **clear** command, such as **clear interfaces statistics all**, does not reset statistics exported by the line card. **NOTE**: Locally injected packets from the Routing Engine are not exported. **NOTE**: Locally injected packets from the Routing Engine are not exported. Supported in Junos OS Release 15.1F5. Supported QFX10000 switches starting with on Junos OS Release 17.2R1. Supported on EX9200 switches and MX150 routers starting with Junos OS Release 17.3R1. Supported on QFX5100, QFX5110, and QFX5200 switches starting with Junos OS Release 18.2R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. Starting with Junos OS Release 19.1R1, periodic streaming is supported on QFX10002 switches and PTX10002 routers.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches with Junos OS Release 19.2R1 on gRPC and gNMI services. Supported on QFX5200 switches starting with Junos OS Release 19.2R1 for streaming telemetry information using gNMI services. Supported on MX240, MX480, and MX960 routers starting with Junos OS Release 19.3R1 for exporting telemetry information using gNMI services. This feature includes support to export telemetry data for integration with AFTTelemetry and LibTelemetry libraries with the OpenConfig model openconfig-aft. Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Periodic streaming using gNMI services on MX2K-MPC11E line cards on MX2010 and MX2020 routers is supported starting with Junos OS Release 20.1R1. Periodic streaming using gRPC services is supported on EX3400 switches starting with Junos OS Release 20.2R1. INITIAL_SYNC statistics using gNMI services is supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000 routers, PTX10000 line of routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 20.2R1.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/interface/queue/	Sensor for interface queue statistics. Starting with Junos OS Release 18.3R1, when a subscription is made to **/interfaces** on MX, EX, QFX, PTX, and ACX platforms, traffic and queue statistics are delivered in two separate sensors: • **/junos/system/linecard/interface/traffic/** • **/junos/system/linecard/interface/queue/** This can reduce the reap time for non-queue data for platforms supporting Virtual Output Queues (VOQ), such as PTX Series routers. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services. Supported on MX240, MX480, and MX960 routers starting with Junos OS Release 19.3R1 for exporting telemetry information using gNMI services. This feature includes support to export telemetry data for integration with AFTTelemetry and LibTelemetry libraries with the OpenConfig model openconfig-aft. Periodic streaming using gNMI services on MX2K-MPC11E line cards on MX2010 and MX2020 routers is supported starting with Junos OS Release 20.1R1. INITIAL_SYNC statistics using gNMI services is supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000 routers, PTX10000 line of routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 20.2R1.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/interface/traffic/	Sensor for interface traffic, exporting all fields except queue statistics. Starting with Junos OS Release 18.3R1, when a subscription is made to **/interfaces** on MX, EX, QFX, PTX, and ACX platforms, traffic and queue statistics are delivered in two separate sensors: • **/junos/system/linecard/interface/traffic/** • **/junos/system/linecard/interface/queue/** This can reduce the reap time for non-queue data for platforms supporting Virtual Output Queues (VOQ), such as PTX Series routers. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services. Supported on MX240, MX480, and MX960 routers starting with Junos OS Release 19.3R1 for exporting telemetry information using gNMI services. This feature includes support to export telemetry data for integration with AFTTelemetry and LibTelemetry libraries with the OpenConfig model openconfig-aft. Periodic streaming using gNMI services on MX2K-MPC11E line cards on MX2010 and MX2020 routers is supported starting with Junos OS Release 20.1R1. INITIAL_SYNC statistics using gNMI services is supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000 routers, PTX10000 line of routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 20.2R1. Streaming statistics using gRPC services or gNMI services is supported on PTX10008 routers starting with Junos OS Release 20.2R1.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/intf-exp/	Sensor for physical interface express statistics. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services.
/junos/system/linecard/optical	Sensor for optical alarms. Configure this sensor for **et-*type-fpc/pic/port*** (100-Gigabit Ethernet) interfaces. Supported on ACX6360 Universal Metro, MX Series, and PTX Series routers with a CFP2-DCO optics module starting with Junos OS Release 18.3R1. This module provides a high-density, long-haul OTN transport solution with MACSec capability. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 19.2R1 on gRPC and gNMI services.
/junos/system/linecard/otn	Sensor for G.709 optical transport network (OTN) alarms. Configure this sensor on **ot-*type-fpc/pic/port*** interfaces. Supported on ACX6360 Universal Metro, MX Series, and PTX Series routers with a CFP2-DCO optics module starting with Junos OS Release 18.3R1. This module provides a high-density, long-haul OTN transport solution with MACSec capability. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 19.2R1 on gRPC and gNMI services.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/qmon-sw/	Sensor for congestion and latency monitoring statistics. Supported on QFX5100, QFX5110, and QFX5200 switches starting with Junos OS Release 18.2R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 19.2R1 on gRPC and gNMI services. Supported on QFX5200 switches starting with Junos OS Release 19.2R1 for streaming telemetry information using gNMI services. Periodic streaming using gRPC services with EX4300-MP switches is supported starting with Junos OS Release 19.4R1. Periodic streaming using gRPC services is supported on EX3400 switches starting with Junos OS Release 20.2R1. INITIAL_SYNC statistics using gNMI services is supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000 routers, PTX10000 line of routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 20.2R1.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/services/inline-jflow	Sensor for inline active flow monitoring services statistics. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 19.2R1 on gRPC and gNMI services. When configuring inline active flow monitoring in Junos, you can apply version 9 or IPFIX flow templates to define a flow record template suitable for IPv4 or IPv6 MPLS and bridging traffic. For more information, see *Configuring Flow Aggregation on MX, M, vMX and T Series Routers and NFX250 to Use Version 9 Flow Templates*. Supported on MX Series operating with MPC10E-15C-MRATE line-rate cards starting with Junos OS Release 19.2R1. Supported on MX240, MX480, and MX960 routers starting with Junos OS Release 19.3R1 for exporting telemetry information using gNMI services. This feature includes support to export telemetry data for integration with AFTTelemetry and LibTelemetry libraries with the OpenConfig model openconfig-aft. Periodic streaming using gNMI services on MX2K-MPC11E line cards on MX2010 and MX2020 routers is supported starting with Junos OS Release 20.1R1. Periodic streaming using gRPC services on PTX10008 routers is supported starting with Junos OS Evolved Release 20.1R1.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/local-routes/static-routes/static/ **/local-routes/local-aggregates/aggregate/**	Sensor for local routing. These sensors support OpenConfig version 1.0.0 data model **openconfig-local-routing.yang**. Starting in Junos OS Release 20.2R1, EX2300, EX3400, EX4300, EX4600, and EX9200 switches support streaming statistics with gRPC services. You can add the following end paths for static routes: • **prefix** • **state/prefix** • **state/set-tag** • **next-hops/next-hop/index** • **next-hops/next-hop/state/index** • **next-hops/next-hop/state/next-hop** • **next-hops/next-hop/state/metric** You can add the following end paths for aggregate routes: • **prefix** • **state/prefix** • **state/discard** • **state/set-tag**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance/protocols/protocol/bgp/global/	Sensor for BGP global statistics. This sensors support OpenConfig version 4.0.1 data model **openconfig-bgp-neighbor.yang** and **openconfig-bgp-policy.yang**. Starting in Junos OS Release 20.2R1, EX2300, EX3400, EX4300, EX4600, and EX9200 switches support streaming statistics with gRPC services. You can add the following end paths: • **config/as** • **config/router-id** • **confederation/config/identifier** • **confederation/config/member/as** • **graceful-restart/config/enabled** • **graceful-restart/config/restart-time** • **graceful-restart/config/stale-routes-time** • **graceful-restart/config/helper-only** • **route-selection-options/config/always-compare-med** • **route-selection-options/config/ignore-as-path-length** • **route-selection-options/config/external-compare-router-id** • **route-selection-options/config/advertise-inactive-routes** • **route-selection-options/config/enable-aigp** • **route-selection-options/config/ignore-next-hop-igp-metric** • **afi-safis/afi-safi/config/afi-safi-name**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **afi-safis/afi-safi/config/enabled** • **afi-safis/afi-safi/graceful-restart/config/enabled** • **afi-safis/afi-safi/route-selection-options/config/enable-aigp** • **afi-safis/afi-safi/add-paths/config/receive** • **afi-safis/afi-safi/add-paths/config/send** • **afi-safis/afi-safi/add-paths/config/send-max** • **afi-safis/afi-safi/add-paths/config/eligible-prefix-policy** • **afi-safis/afi-safi/ipv4-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv4-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/ipv4-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv4-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/shutdown-threshold-pct** • **ipv6-unicast/prefix-limit/config/restart-timer** • **ipv4-labeled-unicast/prefix-limit/config/max-prefixes** • **ipv4-labeled-unicast/prefix-limit/config/prevent-teardown**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safi/ipv6-labeled-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/max-prefixes** • **afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/prevent-teardown** • **afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/prevent-teardown** • **afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/shutdown-threshold-pct**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv6-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l3vpn-ipv6-unicast/prefix-limit/config/prevent-teardown** • **afi-safi/l3vpn-ipv6-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safi/l3vpn-ipv6-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv4-multicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l3vpn-ipv4-multicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l3vpn-ipv4-multicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l3vpn-ipv4-multicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv6-multicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l3vpn-ipv6-multicast/prefix-limit/config/prevent-teardown** • **afi-safi/l3vpn-ipv6-multicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l3vpn-ipv6-multicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/max-prefixes**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l2vpn-evpn/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l2vpn-evpn/prefix-limit/config/prevent-teardowns** • **afi-safis/afi-safi/l2vpn-evpn/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l2vpn-evpn/prefix-limit/config/restart-time**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance/ protocols/neighbor/neighbors/	Sensor for BGP peer statistics. This sensors support OpenConfig version 4.0.1 data model **openconfig-bgp-neighbor.yang** and **openconfig-bgp-policy.yang**. Starting in Junos OS Release 20.2R1, EX2300, EX3400, EX4300, EX4600, and EX9200 switches support streaming statistics with gRPC services. You can add the following end paths: • **config/peer-group** • **config/neighbor-address** • **config/enabled** • **config/peer-as** • **config/local-as** • **config/peer-type** • **config/auth-password** • **config/remove-private-as** • **config/route-flap-damping** • **config/description** • **timers/config/connect-retry** • **timers/config/hold-time** • **timers/config/minimum-advertisement-interval** • **transport/config/tcp-mss** • **transport/config/mtu-discovery** • **transport/config/passive-mode** • **transport/config/local-address**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **error-handling/config/treat-as-withdraw** • **graceful-restart/config/enabled** • **graceful-restart/config/restart-time** • **graceful-restart/config/stale-routes-time** • **graceful-restart/config/helper-only** • **logging-options/config/log-neighbor-state-changes** • **ebgp-multihop/config/enabled** • **ebgp-multihop/config/multihop-ttl** • **route-reflector/config/route-reflector-cluster-id** • **route-reflector/config/route-reflector-client** • **as-path-options/config/allow-own-as** • **as-path-options/config/replace-peer-as** • **as-path-options/config/disable-peer-as-filter** • **use-multiple-paths/config/enabled** • **use-multiple-paths/ebgp/config/allow-multiple-as** • **apply-policy/config/import-policy** • **apply-policy/config/export-policy** • **afi-safis/afi-safi/config/afi-safi-name** • **afi-safis/afi-safi/config/enabled** • **afi-safis/afi-safi/graceful-restart/config/enabled** • **afi-safis/afi-safi/add-paths/config/receive** • **afi-safis/afi-safi/add-paths/config/send**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **afi-safis/afi-safi/add-paths/config/send-max** • **afi-safis/afi-safi/add-paths/config/eligible-prefix-policy** • **afi-safis/afi-safi/ipv4-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv4-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/ipv4-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv4-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/restart-timer**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv6-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l3vpn-ipv6-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l3vpn-ipv6-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l3vpn-ipv6-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv4-multicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l3vpn-ipv4-multicast/prefix-limit/config/prevent-teardown**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **afi-safis/afi-safi/l3vpn-ipv4-multicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l3vpn-ipv4-multicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv6-multicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l3vpn-ipv6-multicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l3vpn-ipv6-multicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l3vpn-ipv6-multicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/retart-timer**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance/protocols/protocol/bgp/peer-groups/peer-group/	Sensor for BGP peer group statistics. This sensors support OpenConfig version 4.0.1 data model **openconfig-bgp-neighbor.yang** and **openconfig-bgp-policy.yang**. Starting in Junos OS Release 20.2R1, EX2300, EX3400, EX4300, EX4600, and EX9200 switches support streaming statistics with gRPC services. You can add the following end paths: • **config/peer-group-name** • **config/peer-as** • **config/local-as** • **config/peer-type** • **config/auth-password** • **config/remove-private-as** • **route-flap-damping** • **description** • **config/connect-retry** • **config/hold-time** • **config/minimum-advertisement-interval** • **config/tcp-mss** • **config/mtu-discovery** • **config/passive-mode** • **config/local-address** • **error-handling/config/treat-as-withdraw** • **graceful-restart/config/enabled**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **graceful-restart/config/restart-time** • **graceful-restart/config/stale-routes-time** • **graceful-restart/config/helper-only** • **logging-options/config/log-neighbor-state-changes** • **ebgp-multihop/config/enabled** • **ebgp-multihop/config/multihop-ttl** • **route-reflector/config/route-reflector-cluster-id** • **route-reflector/config/route-reflector-client** • **as-path-options/config/allow-own-as** • **as-path-options/config/replace-peer-as** • **use-multiple-paths/config/enabled** • **use-multiple-paths/ebgp/config/allow-multiple-as** • **use-multiple-paths/ebgp/config/maximum-paths** • **use-multiple-paths/ibgp/config/maximum-paths** • **apply-policy/config/import-policy** • **apply-policy/config/export-policy** • **afi-safis/afi-safi/config/afi-safi-name** • **afi-safis/afi-safi/config/enabled** • **afi-safis/afi-safi/graceful-restart/config/enabled** • **afi-safis/afi-safi/add-paths/config/receive** • **afi-safis/afi-safi/add-paths/config/send** • **afi-safis/afi-safi/add-paths/config/send-max**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **afi-safis/afi-safi/add-paths/config/eligible-prefix-policy** • **afi-safis/afi-safi/ipv4-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv4-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/ipv4-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv4-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/max-prefixes**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/prevent-teardown** • **/afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv6-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv4-labeled-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/ipv6-labeled-unicast/prefix-limit/config/restart-timer**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l3vpn-ipv4-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv6-unicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l3vpn-ipv6-unicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l3vpn-ipv6-unicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l3vpn-ipv6-unicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv4-multicast/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l3vpn-ipv4-multicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l3vpn-ipv4-multicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l3vpn-ipv4-multicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l3vpn-ipv6-multicast/prefix-limit/config/max-prefixes**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **afi-safis/afi-safi/l3vpn-ipv6-multicast/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l3vpn-ipv6-multicast/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l3vpn-ipv6-multicast/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l2vpn-vpls/prefix-limit/config/restart-timer** • **afi-safis/afi-safi/l2vpn-evpn/prefix-limit/config/max-prefixes** • **afi-safis/afi-safi/l2vpn-evpn/prefix-limit/config/prevent-teardown** • **afi-safis/afi-safi/l2vpn-evpn/prefix-limit/config/shutdown-threshold-pct** • **afi-safis/afi-safi/l2vpn-evpn/prefix-limit/config/restart-timer**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance/protocols/protocol/bgp/	Sensor for BGP peer information. Periodic streaming using gRPC services on PTX10003 routers is supported, starting with Junos OS Evolved Release 19.2R1. Periodic streaming using gRPC services is supported on any platform family that supports containerized routing protocol process (cRPD) starting with Junos OS Release 20.2R1. cRPD is Juniper's routing protocol process (rpd) decoupled from Junos OS and packaged as a Docker container to run in Linux-based environments. You can also add the following end paths: • **neighbors/neighbor/afi-safis/afi-safi/state/active** • **neighbors/neighbor/afi-safis/afi-safi/state/prefixes/installed** • **neighbors/neighbor/afi-safis/afi-safi/state/prefixes/received** • **neighbors/neighbor/afi-safis/afi-safi/state/prefixes/sent** • **neighbors/neighbor/afi-safis/afi-safi/state/prefixes/rejected** • **neighbors/neighbor/state/admin-state** • **neighbors/neighbor/state/established-transitions** • **neighbors/neighbor/state/last-established** • **neighbors/neighbor/state/messages/received/notification** • **neighbors/neighbor/state/messages/received/update** • **neighbors/neighbor/state/messages/sent/notification** • **neighbors/neighbor/state/messages/sent/update** • **neighbors/neighbor/state/session-state**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **neighbors/neighbor/state/supported-capabilities** • **transport/state/local-address** • **transport/state/remote-address** • **transport/state/remote-port**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance/ protocols/protocol/bgp/ **NOTE**: Starting with Junos OS Release 17.4R1 on MX Series and PTX Series routers, you can provision Junos Telemetry Interface sensors to export data for BGP routing tables (RIBs) for IPv4 and IPv6 routes. For BGP routing table paths, the **/network-instances/network-instance/** path is not supported. Each address family supports exporting data for five different tables, a main routing table, and four per-neighbor tables: • local-rib— main BGP routing table for the main routing instance. • adj-rib-in-pre— NLRI updates received from the neighbor before any local input policy filters have been applied. • adj-rib-in-post— routes received from the neighbor eligible for best-path selection after local input policy filters have been applied. • adj-rib-out-pre— routes eligible for advertising to the neighbor before output policy filters have been applied. • adj-rib-out-post— routes eligible for advertising to the neighbor after output policy filters have been applied. Use the following paths to export data for each BGP routing table. You can specify to export data either for IPv4 or IPv6 for each table:	Sensor for BGP peer information. Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers, EX4600 and EX9200 switches, and QFX5110 switches starting with Junos OS Release 17.3R1. Starting with Junos OS Release 18.1R1, QFX5100 switches are also supported. Starting with Junos OS Release 18.3R1, QFX5120-48Y and EX4650 switches are also supported. Starting with Junos OS Release 19.1R1, periodic streaming on QFX10002 switches and PTX10002 routers is supported. Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX are also supported. Starting with Junos OS Release 20.2R1, periodic streaming using gRPC services is supported on EX3400 switches. Starting with Junos OS Release 20.2R1, streaming pseudo interface statistics through Routing Engine sensors is supported using gRPC services or gNMI services with SRX5400, SRX5600, and SRX5800 Service Gateways. Previously, streaming statistics was only supported through gRPC services. **NOTE**: Starting with Junos OS Release 17.3R1, telemetry data streamed through gRPC for BGP peers is reported separately for each configured routing instance. If your Juniper Network device is running Junos OS Release 17.3R1 or later, you must prepend the following to the beginning of any path you specify to stream statistics for BGP, with the exception of paths for routing tables:

Table 5: gRPC Sensors *(Continued)*

resource path	Description
• **/bgp-rib/afi-safis/afi-safi/ipv4-unicast/loc-rib/** • **/bgp-rib/afi-safis/afi-safi/ipv6-unicast/loc-rib/** • **/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/neighbor/adj-rib-in-pre/** • **/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/neighbor/adj-rib-in-pre/** • **/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/neighbor/adj-rib-in-post/** • **/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/neighbor/adj-rib-in-post/** • **/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/neighbor/adj-rib-out-pre/** • **/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/neighbor/adj-rib-out-pre/** • **/bgp-rib/afi-safis/afi-safi/ipv4-unicast/neighbors/neighbor/adj-rib-out-post/** • **/bgp-rib/afi-safis/afi-safi/ipv6-unicast/neighbors/neighbor/adj-rib-out-post/**	**/network-instances/network-instance[name_'instance-name']/ protocols/protocol/** Starting with Junos OS Release 17.3R1, the following paths are also supported: • **/network-instances/network-instance/protocols/protocol/ bgp/neighbors/neighbor/afi-safis/afi-safi/state/prefixes/accepted** • **/network-instances/network-instance/protocols/protocol/ bgp/neighbors/neighbor/afi-safis/afi-safi/state/prefixes/rejected** **/network-instances/network-instance/protocols/protocol/ bgp/neighbors/neighbor/afi-safis/afi-safi/state/active** • **/network-instances/network-instance/protocols/protocol/ bgp/neighbors/neighbor/afi-safis/afi-safi/state/queues/output** • **/network-instances/network-instance/protocols/protocol/ bgp/neighbors/neighbor/afi-safis/afi-safi/state/queues/input** • **/network-instances/network-instance/protocols/protocol/ bgp/neighbors/snmp-peer-index** • **/network-instances/network-instance/protocols/protocol/ bgp/neighbors/neighbor/state/ImportEval** • **/network-instances/network-instance/protocols/protocol/ bgp/neighbors/neighbor/state/ImportEvalPending** • **/network-instances/network-instance/protocols/protocol/ bgp/neighbors/neighbor/state/messages/received/notification**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	/network-instances/network-instance/protocols/ protocol/ bgp/neighbors/neighbor/state/messages/sent/ notification **/network-instances/network-instance/protocols/ protocol/ bgp/transport/state/remote-port** **/network-instances/network-instance/protocols/ protocol/ bgp/neighbors/neighbor/state/supported-capabilities** **NOTE**: For all the following paths, with the exception of paths for routing tables, if your Juniper Networks device is running Junos OS Release 17.3R1 or later, you must prepend the following in front of the path: **/network-instances/network-instance[name_'instance-name']/protocols/protocol/** You can also include the following at the end path to **/ network-instances/network-instance[name_'instance-name']/protocols/protocol/ bgp/neighbors/neighbor/**: • **state/session-state** • **state/messages/sent/update** • **state/messages/received/update** • **transport/state/local-address** • **transport/state/remote-address** • **state/peer-as** • **afi-safis/afi-safi/state/prefix-limit/state/max-prefixes** • **afi-safis/afi-safi/state/active** • **state/session-status**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance/ protocols/protocol/bgp	Sensor for BGP peer information. ON_CHANGE BGP peer statistics export using gRPC services and gNMI services is supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000, PTX10000 routers and QFX5100 and QFX5200 switches, starting with Junos OS Release 20.2R1. • **neighbors/neighbor/afi-safis/afi-safi/ state/active** (ON_CHANGE) • **neighbors/neighbor/afi-safis/afi-safi/ state/prefixes** (ON_CHANGE) • **neighbors/neighbor/afi-safis/afi-safi/ state/prefixes/ received** (ON_CHANGE) • **neighbors/neighbor/afi-safis/afi-safi/ state/prefixes/sent** (ON_CHANGE) • **neighbors/neighbor/afi-safis/afi-safi/ state/prefixes/ rejected** (ON_CHANGE) • **neighbors/neighbor/state/admin-state** (ON_CHANGE) • **neighbors/neighbor/state/ established-transitions** (ON_CHANGE) • **neighbors/neighbor/state/last-established** (ON_CHANGE) • **neighbors/neighbor/state/messages/ received/ notification** (stream only) • **neighbors/neighbor/messages/received/ update** (stream only) • **neighbors/neighbor/state/messages/ sent/notification** (stream only) • **neighbors/neighbor/state/messages/ sent/update** (stream only)

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **neighbors/neighbor/state/session-state** (ON_CHANGE) • **neighbors/neighbor/state/supported-capabilities** (ON_CHANGE) • **transport/state/local-address** (ON_CHANGE) • **transport/state/remote-address** (ON_CHANGE) • **transport/state/remote-port** (ON_CHANGE)
/network-instances/network-instance[instance-name='name']/protocols/protocol/evpn/	Sensor for instance level statistics. Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.
/network-instances/network-instance[instance-name='name']/protocols/protocol/evpn/peer/	Route statistics per peer sensor. Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.
/network-instances/network-instance[instance-name='name']/protocols/protocol/evpn/ethernet-segment/	Ethernet segment information sensor). Statistics include EVPN designated forwarder ON_CHANGE leafs **esi** and **designated-forwarder**. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance[instance-name='name']/protocols/protocol/evpn/interfaces/	Local interface information sensor.) Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.
/network-instances/network-instance[instance-name='name']/protocols/protocol/evpn/irb-interfaces/	Local integrated routing and bridging (IRB) interface information sensor. Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.
/network-instances/network-instance[instance-name='name']/protocols/protocol/evpn/sg-db/	EVPN IGMP snooping database (type 6) sensor. Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance[instance-name='name']/protocols/protocol/evpn/sg-db/sgdb-esi	EVPN IGMP join sync (type 7) ad leave sync (type 8) sensor. Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.
/network-instances/network-instance[instance-name='name']/protocols/protocol/evpn/assisted-replication/	Sensor to relate selected replicator on AR leaf. Use the Telemetry Explorer tool to see leaves for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, and QFX5200 switches.
/network-instances/network-instance[instance-name='name']//protocols/protocol/evpn/ethernet-segment	EVPN ON_CHANGE notifications sensor. Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, and QFX5200 switches.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance[instance-name='name']/protocols/protocol/evpn/vxlan-tunnel-end-point/	Overlay VX-LAN tunnel information sensor. This sensor also delivers VTEP information ON_CHANGE leafs: • **source_ip_address** • **remote_ip_address** • **status** • **mode** • **nexthop-index** • **event-type** • **source-interface** Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.
/network-instances/network-instance[instance-name='name']/mac_db/entries/entry/	EVPN MAC table information sensor. Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance[instance-name='name']/macip_db/entries/entry/	MAC-IP or ARP-ND table sensor. Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.
/network-instances/network-instance[name='name']/macip-table-info/	MAC-IP ON_CHANGE table information sensor. Statistics include leafs: • **status** • **learning** • **aging-time** • **table-sixe** • **proxy-macip** • **num-local-entries** Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance[name='name']/macip-table/entries/entry/	MAC-IP ON_CHANGE entry information sensor. Statistics include leafs: • **ip-address** • **mac-address** • **vlan-id** • **vni** Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.
/network-instances/network-instance[instance-name='name']/bd/	Bridge domain or VLAN information sensor. Use the Telemetry Explorer tool to see leafs for this resource path. Starting with Junos OS Release 20.2R1, streaming statistics is supported using gRPC services with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance/ protocols/protocol/isis/levels/level/	Sensor for IS-IS routing protocol statistics. Statistics are exported separately for each routing instance. To specify a routing-instance name: **/network-instances/network-instance[name_'*instance-name*']/protocols/protocol/isis/levels/level/** **/network-instances/network-instance[name_'*instance-name*']/protocols/protocol/isis/interfaces/interface/levels/level/** Starting with Junos OS Release 20.1R1, streaming statistics is supported with gRPC and gNMI services, and where indicated, ON_CHANGE statistics, for MX960, PTX1000, and PTX10000 routers. The following paths are also supported: • **/network-instances/network-instance/protocols/ protocol/isis/levels/level/link-state-database/lsp/state/ lsp-id** • **/network-instances/network-instance/protocols/ protocol/isis/levels/level/link-state-database/lsp/state/ maximum-area-addresses** • **/network-instances/network-instance/protocols/ protocol/isis/levels/level/link-state-database/lsp/state/ version** • **/network-instances/network-instance/protocols/ protocol/isis/levels/level/link-state-database/lsp/state/ version2** • **/network-instances/network-instance/protocols/ protocol/isis/levels/level/link-state-database/lsp/ state/id-length**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/state/pdu-type** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/state/remaining-lifetime** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/state/lsp-install-time** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/state/sequence-number** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/state/checksum** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/state/pdu-length** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/state/is-type** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/state/flag/value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/tlv-type** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/state/tlv-type**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/area-address/state/address** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/nlpid/state/nlpid** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv4-interface-addresses/state/address** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-interface-addresses/state/address** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv4-te-router-id/state/te-router-id** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/lsp-buffer-size/state/size** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/hostname/state/hname** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/system-id** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/state/metric** • **/network-instances/network-instance/protocols/protocol/isis/instances/instance/levels/level/link-state-**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/state/system-id • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/state/type** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/admin-group/state/admin-group** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/link-id/state/local** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/link-id/state/remote** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/ipv4-interface-address/state/address** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/ipv4-neighbor-address/state/address** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/te-default-metric/state/metric**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/max-link-bandwidth/state/bandwidth** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/max-reservable-link-bandwidth/state/bandwidth** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/unreserved-bandwidth/setup-priority/priority** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/unreserved-bandwidth/setup-priority/priority** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/unreserved-bandwidth/setup-priority/state/priority** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/unreserved-bandwidth/setup-priority/state/bandwidth** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/bandwidth-constraints/bandwidth-constraint/model-id**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/bandwidth-constraints/bandwidth-constraint/state/model-id** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/bandwidth-constraints/bandwidth-constraint/constraints/constraint/constraint-id** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/bandwidth-constraints/bandwidth-constraint/constraints/constraint/state/constraint-id** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/bandwidth-constraints/bandwidth-constraint/constraints/constraint/state/bandwidth** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/adjacency-sids/adj-sid/value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/adjacency-sids/adj-sid/state/value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/adjacency-sids/adj-sid/state/flags**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/adjacency-sids/adj-sid/state/weight** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/adjacency-sids/adj-sid/state/weight** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/lan-adjacency-sids/lan-adj-sid/state/value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/lan-adjacency-sids/lan-adj-sid/state/flags** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/lan-adjacency-sids/lan-adj-sid/state/weight** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/subtlvs/subtlv/lan-adjacency-sids/lan-adj-sid/state/neighbor-id** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/undefined-subtlvs/undefined-subtlv/type** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/undefined-subtlvs/undefined-subtlv/state/type**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/undefined-subtlvs/undefined-subtlv/state/length** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-is-reachability/neighbors/neighbor/undefined-subtlvs/undefined-subtlv/state/value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv4-srlgs/ipv4-srlg/instance-number** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv4-srlgs/ipv4-srlg/state/instance-number** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv4-srlgs/ipv4-srlg/state/system-id** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv4-srlgs/ipv4-srlg/state/psn-number** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv4-srlgs/ipv4-srlg/state/flags** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv4-srlgs/ipv4-srlg/state/ipv4-interface-address** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv4-srlgs/ipv4-srlg/state/ipv4-neighbor-address**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv4-srlgs/ipv4-srlg/state/srlg-value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/prefix** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/state/prefix** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/state/up-down** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/state/s-bit** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/state/metric** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/tag/state/tag32** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sids/prefix-sid/value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sids/prefix-sid/state/value**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sids/prefix-sid/state/flags** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sids/prefix-sid/state/algorithm** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/type** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/type** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/length** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/prefix** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/prefix**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/up-down** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/s-bit** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/x-bit** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/metric** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/tag/state/tag32** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sids/prefix-sid/value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sids/prefix-sid/state/value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sids/prefix-sid/state/flags** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	ipv6-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sids/prefix-sid/state/algorithm • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/type** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/pv6-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/type** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/length** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/router-capability/subtlvs/subtlv/segment-routing-capability/state/flags** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/router-capability/subtlvs/subtlv/segment-routing-capability/srgb-descriptors/srgb-descriptor/range** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/router-capability/subtlvs/subtlv/segment-routing-capability/srgb-descriptors/srgb-descriptor/state/label**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/router-capability/subtlvs/subtlv/segment-routing-capability/srgb-descriptors/srgb-descriptor/state/range**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance/ protocols/protocol/isis/instances/instance	Sensor for IS-IS routing protocol statistics. Statistics are exported separately for each routing instance. To specify a routing-instance name: **/network-instances/network-instance[name_'*instance-name*']/protocols/protocol/isis/interfaces/interface/levels/ level/** Starting with Junos OS Release 20.1R1, streaming statistics is supported with gRPC and gNMI services, and where indicated, ON_CHANGE statistics, for MX960, PTX1000, and PTX10000 routers. The following endpoints are also supported: • **/network-instances/network-instance/protocols/ protocol/isis/instances/instance/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/capability/ instance-number** • **/network-instances/network-instance/protocols/ protocol/isis/instances/instance/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/capability/state/ instance-number** • **/network-instances/network-instance/protocols/ protocol/isis/instances/instance/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/capability/state/ flags** • **/network-instances/network-instance/protocols/ protocol/isis/instances/instance/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/capability/state/ router-id** • **/network-instances/network-instance/protocols/ protocol/isis/instances/instance/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/capability/ subtlvs/subtlv/type**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/instances/instance/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/capability/subtlvs/subtlv/state/type** • **/network-instances/network-instance/protocols/protocol/isis/instances/instance/levels/level/link-state-database/lsp/tlvs/tlv/router-capabilities/capability/subtlvs/subtlv/segment-routing-algorithms/state/algorithm**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance/ protocols/protocol/isis/interfaces/interface	Sensor for IS-IS routing protocol interface statistics. Statistics are exported separately for each routing instance. To specify a routing-instance name: **/network-instances/network-instance[name_'*instance-name*']/protocols/protocol/isis/interfaces/interface/levels/ level/** Periodic streaming using gRPC and gNMI services is supported with on MX960, PTX1000, and PTX10000 routers starting with Junos OS Release 20.1R1. ON_CHANGE statistics are also supported, where indicated. Periodic streaming using gRPC services is supported on EX2300, EX2300-MP, and EX3400 switches starting with Junos OS Release 20.2R1. The following end points are also supported: • **/network-instances/network-instance/protocols/ protocol/isis/interfaces/interface/levels/level/ adjacencies/adjacency/state/system-id** • **/network-instances/network-instance/protocols/ protocol/isis/interfaces/interface/levels/level/ adjacencies/adjacency/state/neighbor-snpa** • **/network-instances/network-instance/protocols/ protocol/isis/interfaces/interface/levels/level/ adjacencies/adjacency/state/dis-system-id** • **/network-instances/network-instance/protocols/ protocol/isis/interfaces/interface/levels/level/ adjacencies/adjacency/state/neighbor-circuit-type** • **/network-instances/network-instance/protocols/ protocol/isis/interfaces/interface/levels/level/ adjacencies/adjacency/state/local-extended-circuit-id**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/neighbor-extended-circuit-id** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/nlpid** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/area-address** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/adjacency-type** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/adjacency-state** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/lan-adjacency-state** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/multi-topo** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/restart-support** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/restart-suppress** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/restart-status**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/ipv4-neighbor-address** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/adjacencies/adjacency/state/ipv6-neighbor-address**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/task-memory-information/	Sensor for memory utilization for routing protocol task. Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers, EX4600 and EX9200 switches and QFX5110 switches starting with Junos OS Release 17.3R1. Starting with Junos OS Release 18.1R1, QFX5100 switches are also supported. Starting with Junos OS Release 18.3R1, QFX5120-48Y and EX4650 switches are also supported. Starting with Junos OS Release 19.1R1, periodic streaming is supported on QFX10002 switches and PTX10002 routers. Starting with Junos OS Release 19.2R1, periodic streaming using gRPC services on SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX Service Gateways is supported. Starting with Junos OS Release 19.2R1, streaming and ON_CHANGE statistics export using gNMI services is supported on QFX5200 switches. Starting with Junos OS Release 20.2R1, streaming pseudo interface statistics through Routing Engine sensors is supported using gRPC services or gNMI services with SRX5400, SRX5600, and SRX5800 Service Gateways. Previously, streaming statistics was only supported through gRPC services. You can also include the following at the end path to **/junos/task-memory-information/**: • **task-memory-overall-report/task-size-block-list/task-size-block/tsb-size**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **task-memory-overall-report/task-size-block-list/task-size-block/tsb-alloc-bytes** • **task-memory-overall-report/task-size-block-list/task-size-block/tsb-allocs** • **task-memory-overall-report/task-size-block-list/task-size-block/tsb-max-allocs** • **task-memory-overall-report/task-size-block-list/task-size-block/tsb-max-bytes** • **task-memory-overall-report/task-size-block-list/task-size-block/tsb-free-bytes** • **task-memory-overall-report/task-memory-total-bytes** • **task-memory-overall-report/task-memory-total-max-bytes** • **task-memory-information/task-memory-overall-report/task-memory-total-free-bytes** • **task-memory-allocator-report/task-block-list/task-block/tb-name** • **task-memory-allocator-report/task-block-list/task-block/tb-size** • **task-memory-allocator-report/task-block-list/task-block/tb-alloc-size** • **task-memory-allocator-report/task-block-list/task-block/tb-alloc-blocks** • **task-memory-allocator-report/task-block-list/task-block/tb-alloc-bytes** • **task-memory-allocator-report/task-block-list/task-block/tb-max-alloc-blocks**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **task-memory-page-data-bytes** • **task-memory-max-page-data-bytes** • **task-memory-dir-bytes** • **task-memory-max-dir-bytes** • **task-memory-total-bytes-in-use** • **task-memory-total-bytes-percent**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	Periodic streaming using gNMI services with PTX10003 routers is supported starting with Junos OS Evolved Release 19.4R1. Periodic streaming using gNMI services on MX2K-MPC11E line cards on MX2010 and MX2020 routers is supported starting with Junos OS Release 20.1R1. Periodic streaming using gRPC services is supported on EX2300, EX2300-MP, and EX3400 switches starting with Junos OS Release 20.2R1. INITIAL_SYNC statistics using gNMI services is supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000 routers, PTX10000 line of routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 20.2R1. **NOTE**: Hierarchical policer statistics are collected for MX Series routers only. Traffic-class counter statistics are collected for PTX Series routers and QFX10000 switches only. Firewall counters are exported even if the interface to which the firewall filter is attached is operationally down. The following OpenConfig paths are supported: • **junos/firewall/firewall-stats/[name='*filter-name*']/timestamp** • **/junos/firewall/firewall-stats/[name='*filter-name*']/memory-usage/[name='*memory-type*']/allocated** • **/junos/firewall/firewall-stats/[name='*filter-name*']/counter-stats/[name='*counter-name*']/packets** • **/junos/firewall/firewall-stats/[name='*filter-name*']/counter-stats/[name='*couner-name*']/bytes** • **/junos/firewall/firewall-stats/[name='*filter-name*']/policer-stats/[name='*policer-name*']/out-of-spec-packets**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/junos/firewall/firewall-stats/[name='*filter-name*']/policer-stats/[name='*policer-name*']/out-of-spec-bytes** • **/junos/firewall/firewall-stats/[name='*filter-name*']/policer-stats/[name='*policer-name*']/offered-packets** • **/junos/firewall/firewall-stats/[name='*filter-name*']/policer-stats/[name='*policer-name*']/offered-bytes** • **/junos/firewall/firewall-stats/[name='*filter-name*']/policer-stats/[name='*policer-name*']/transmitted-packets** • **/junos/firewall/firewall-stats/[name='*filter-name*']/policer-stats/[name='*policer-name*']/transmitted-bytes** • **/junos/firewall/firewall-stats/[name='*filter-name*']/hierarchical-policer-stats/[name='*hierarchical-policer-name*']/premium-packets** (MX Series only) • **/junos/firewall/firewall-stats/[name='*filter-name*']/hierarchical-policer-stats/[name='*hierarchical-policer-name*']/premium-bytes** (MX Series only) • **/junos/firewall/firewall-stats/[name='*filter-name*']/hierarchical-policer-stats/[name='*hierarchical-policer-name*']/aggregate-packets** (MX Series only) • **/junos/firewall/firewall-stats/[name='*filter-name*']/hierarchical-policer-stats/[name='*hierarchical-policer-name*']/aggregate-bytes** (MX Series only)

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	Starting with Junos OS Release 19.2R1, periodic streaming using gNMI services is supported on QFX5100, QFX5110, QFX5120, QFX5200 and QFX5210 switches. Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gRPC services with PTX10008 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. Starting with Junos OS Release 20.1R1, ON_CHANGE statistics using gNMI services with MX960, MX2020, PTX1000, and PTX5000 routers. These routers support OpenConfig model: • openconfig-interfaces.yang: oc-ext:openconfig-version 2.4.1 Starting with Junos OS Release 20.2R1, streaming revenue interface statistics through Packet Forwarding Engine sensors and pseudo interface statistics through Routing Engine sensors is supported using gRPC services or gNMI services with SRX5400, SRX5600, and SRX5800 Service Gateways. Starting with Junos OS Release 18.3R1, when a subscription is made to **/interfaces** on MX, EX, QFX, PTX, and ACX platforms, traffic and queue statistics are delivered in two separate sensors. This can reduce the reap time for non-queue data for platforms supporting Virtual Output Queues (VOQ), such as PTX Series routers. The two sensors are: • **/junos/system/linecard/interface/traffic/** exports all fields except queue statistics.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/junos/system/linecard/interface/queue/** exports queue statistics. **NOTE**: End paths supporting ON_CHANGE streaming are indicated. The following paths are also supported: • **/interfaces/interface[name='*interface-name*']/state/parent_ae_name** • **/interfaces/interface[name='*interface-name*']/state/admin-status** ON_CHANGE streaming supported for Junos OS and for Junos OS Evolved Release 19.1R1 and higher ON_CHANGE streaming supported • **/interfaces/interface[name='*interface-name*']/state/counters/carrier-transitions** • **/interfaces/interface[name='*interface-name*']/state/last-change** • **/interfaces/interface[name='*interface-name*']/state/high-speed** • **/interfaces/interface[name='*interface-name*']/state/counters/out-octets** • **/interfaces/interface[name='*interface-name*']/state/counters/out-unicast-pkts** • **/interfaces/interface[name='*interface-name*']/state/counters/out-multicast-pkts** • **/interfaces/interface[name='*interface-name*']/state/counters/out-broadcast-pkts**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• /interfaces/interface[name='*interface-name*']/state/counters/out-errors • /interfaces/interface[name='*interface-name*']/state/counters/in-octets • /interfaces/interface[name='*interface-name*']/state/counters/in-unicast-pkts • /interfaces/interface[name='*interface-name*']/state/counters/in-multicast-pkts • /interfaces/interface[name='*interface-name*']/state/ • /interfaces/interface[name='*interface-name*']/state/counters/in-broadcast-pkts • /interfaces/interface[name='*interface-name*']/state/counters/in-errors • /interfaces/interface[name='*interface-name*']/state/in-pause-pkts • /interfaces/interface[name='*interface-name*']/state/out-pause-pkts • /interfaces/interface[name='*interface-name*']/state/counters/in-queue [queue-number=*queue_number*]/ • /interfaces/interface[name='*interface-name*']/state/counters/in-queue [queue-number=*queue_number*]/ pkts • /interfaces/interface[name='*interface-name*']/state/counters/in-queue [queue-number=*queue_number*]/bytes • /interfaces/interface[name='*interface-name*']/state/counters/in-queue [queue-number=*queue_number*]/tail-drop-pkts

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/interfaces/interface[name='*interface-name*']/state/counters/out-queue [queue-number=*queue_number*]/ rl-drop-bytes** • **/interfaces/interface[name='*interface-name*']/state/counters/out-queue [queue-number=*queue_number*]/red-drop-pkts** • **/interfaces/interface[name='*interface-name*']/state/counters/out-queue [queue-number=*queue_number*]/red-drop-bytes** • **/interfaces/interface[name='*interface-name*']/state/counters/out-queue [queue-number=*queue_number*]/avg-buffer-occupancy** • **/interfaces/interface[name='*interface-name*']/state/counters/out-queue [queue-number=*queue_number*]/cur-buffer-occupancy** • **/interfaces/interface[name='*interface-name*']/state/counters/out-queue [queue-number=*queue_number*]/peak-buffer-occupancy** • **/interfaces/interface[name='*interface-name*']/state/counters/out-queue [queue-number=*queue_number*]/allocated-buffer-size** • **/interfaces/interface[name='*interface-name*']/state/description** ON_CHANGE streaming supported for Junos OS and for Junos OS Evolved Release 19.1R1 and higher • **/interfaces/interface[name='*interface-name*']/state/enabled** • **/interfaces/interface[name='*interface-name*']/state/ifindex**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **counters/in-block-errors** • **counters/out-mac-control-frames** • **counters/out-mac-pause-frames**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	Starting with Junos OS Release 20.1R1, ON_CHANGE statistics using gNMI services with MX960, MX2020, PTX1000, and PTX5000 routers. These routers support OpenConfig model: • openconfig-interfaces.yang: oc-ext:openconfig-version 2.4.1 Starting with Junos OS Release 20.2R1, streaming revenue interface statistics through Packet Forwarding Engine sensors and pseudo interface statistics through Routing Engine sensors is supported using gRPC services or gNMI services with SRX5400, SRX5600, and SRX5800 Service Gateways. **NOTE**: End paths supporting ON_CHANGE streaming are indicated. The following paths are also supported: • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/name** ON_CHANGE streaming supported. This value does not change with an event, but will be streamed on event creation and deletion. • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/ifindex** ON_CHANGE streaming supported. This value does not change with an event, but will be streamed on event creation and deletion. • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/index** ON_CHANGE streaming supported. This value does not change with an event, but will be streamed on event creation and deletion.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/snmp_index** ON_CHANGE streaming supported starting with Junos OS Evolved Release 19.1R1 • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/admin_status** ON_CHANGE streaming supported for Junos OS and Junos OS Evolved Release 19.1R1 and higher • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/oper_status** ON_CHANGE streaming supported for Junos OS and Junos OS Evolved Release 19.1R1 and higher • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/last_change** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/description** ON_CHANGE streaming supported for Junos OS and Junos OS Evolved Release 19.1R1 and higher • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/enabled** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_octets** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_unicast_pkts**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_broadcast_pkts** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_multicast_pkts** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_discards** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_errors** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/in_unknown_protos** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/out_octets** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/out_unicast_pkts** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/out_broadcast_pkts** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/out_multicast_pkts** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/out_discards**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/out_errors** • **/interfaces/interface[name='*interface-name*']/subinterfaces/subinterface[index='*unit*']state/counters/last_clear**
/interfaces/interface/	Sensor for Routing Engine logical interface statistics (re0:mgmt-0). Starting with Junos OS Evolved Release 19.4R1, gNMI streaming for PTX10003 routers is supported. Starting with Junos OS Evolved Release 20.1R1, periodic streaming using gNMI services with PTX10008 routers is supported.
/junos/system/linecard/optics/	Sensor for various optical interface performance metrics, such as transmit and receive power levels. Supported on QFX10000 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers and EX9200 switches starting with Junos OS Release 17.3R1. Supported on EX4650 switches starting with Junos OS Release 18.3R1. Supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches starting with Junos OS Release 19.2R1 on gRPC and gNMI services.

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **rsvp-interface[interface-name='ae0.100']/rsvp-telink/static-bandwidth** • **rsvp-interface[interface-name='ae0.101']/rsvp-telink/available-bandwidth**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **rsvp-interface/protect-flag** • **rsvp-interface/hello-interval** • **rsvp-interface/interface-address** • **message-statistics/rsvp-message** • **rsvp-interface/message-statistics/messages-sent** • **rsvp-interface/message-statistics/messages-received** • **rsvp-interrface/message-statistics/messages-sent-5seconds** • **rsvp-interface/message-statistics/messages-received-5seconds** • **rsvp-interface/rsvp-telink/active-reservation** • **rsvp-interface/rsvp-telink/preemption-count** • **rsvp-interface/rsvp-telink/update-threshold** • **rsvp-interface/rsvp-telink/subscription** • **rsvp-interface/rsvp-telink/static-bandwidth** • **rsvp-interface/rsvp-telink/available-bandwidth** • **rsvp-interface/rsvp-telink/reserved-bandwidth/bandwidth-priority** • **rsvp-interface/rsvp-telink/reserved-bandwidth/total-reserved-bandwidth**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/components/	Sensor for operational state of Routing Engines, power supply modules, Switch Fabric Boards, Control Boards, Switch Interface Boards, Modular Interface Cards, and Physical Interface Cards. **NOTE**: Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1. Supported on EX9200 switches and MX150 routers starting with Junos OS Release 17.3R1. Supported on QFX5100 switches starting with Junos OS Release 18.1R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with Junos OS Release 18.4R1. Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX are also supported. Starting with Junos OS Release 20.2R1, periodic streaming using gRPC services is supported on EX2300, EX2300-MP, and EX3400 switches. You can also add the following to each of the paths: • **name** • **cidx** • **version** • **part_number** • **serial_number**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **description** • **clei_code** • **model** • **vendor_name** • **properties/property/state** • **properties/property/state_offline_reason** (MX Series only) • **properties/property/power_usage** • **properties/property/power_maximum** • **properties/property/temperature_intake** • **properties/property/temperature_exhaust_a** (not supported on PTX1000 and PTX3000 routers) • **properties/property/temperature_exhaust_b** (not supported on PTX1000 and PTX3000 routers) • **properties/property/temperature_exhaust** (not supported on PTX1000 and PTX5000 routers) • **properties/property/cpu_utilization_total** • **properties/property/ memory_dram_used** • **properties/property/memory_utilization_heap** • **properties/property/memory_utilization_buffer** • **properties/property/uptime** The following paths are also supported only for Routing Engine statistics: • **properties/property/mastership-state** • **properties/property/mastership-priority**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **properties/property/temperature-cpu** • **properties/property/memory-dram-installed** • **properties/property/cpu-utilization-user** • **properties/property/cpu-utilization-background** • **properties/property/cpu-utilization-kernel** • **properties/property/cpu-utilization-idle** • **properties/property/reboot-reason** The following paths are also supported for power modules: • **properties/property/power-zone-upper-capacity** • **properties/property/power-zone-upper-maximum** • **properties/property/power-zone-upper-allocated** • **properties/property/power-zone-upper-remaining** • **properties/property/power-zone-upper-usage** • **properties/property/power-zone-lower-capacity** • **properties/property/power-zone-lower-maximum** • **properties/property/power-zone-lower-allocated** • **properties/property/power-zone-lower-remaining** • **properties/property/power-zone-lower-usage** • **properties/property/power-zone-0-capacity** • **properties/property/power-zone-0-maximum** • **properties/property/power-zone-0-allocated** • **properties/property/power-zone-0-remaining**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **properties/property/power-zone-0-usage** • **properties/property/power-zone-1-capacity** • **properties/property/power-zone-1-maximum** • **properties/property/power-zone-1-allocated** • **properties/property/power-zone-1-remaining** • **properties/property/power-zone-1-usage** • **properties/property/power-system-capacity** • **properties/property/power-system-allocated** • **properties/property/power-system-remaining** • **properties/property/power-system-usage** • **properties/property/temperature-ambient** The following paths are supported for either Switch Fabric Board or Control Boards or both: • **properties/property/temperature-zone-0-intake** (SFB only) • **properties/property/temperature-zone-0-intake-a** (both SFB and CB) • **properties/property/temperature-zone-1-intake-b** (both SFB and CB) • **properties/property/temperature-zone-0-exhaust** (SFB only) • **properties/property/temperature-zone-1-exhaust** (SFB only) • **properties/property/temperature-zone-0-intake-c** (CB only)

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/lacp/	Sensor for operational state of aggregated Ethernet interfaces configured with the Link Aggregation Control Protocol. Supported on QFX10000 switches and QFX5200 switches starting with Junos OS Release 17.2R1. Supported on PTX1000 routers and EX9200 switches starting with Junos OS Release 17.3R1. Supported on QFX5100 switches starting with Junos OS Release 18.1R1. Supported on QFX5120-48Y and EX4650 switches starting with Junos OS Release 18.3R1. Supported on EX4600 switches starting with unos OS Release 18.4R1, Supported on PTX10003 routers starting with Junos OS Evolved Release 19.1R1. Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gRPC services with PTX10008 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. Starting with Junos OS Release 20.2R1, periodic streaming using gRPC services is supported on EX2300, EX2300-MP, and EX3400 switches. You can also add the following to the end of the path for **/lacp/**: • **interfaces/interface/state**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **interfaces/interface/members/member/state/activity** • **interfaces/interface/members/member/state/timeout** • **interfaces/interface/members/member/state/system-id** • **interfaces/interface/members/member/state/partner-id** • **interfaces/interface/members/member/state/interface** • **interfaces/interface/members/member/state/synchronization** • **interfaces/interface/members/member/state/aggregatable** • **interfaces/interface/members/member/state/collecting** • **interfaces/interface/members/member/state/distributing** • **interfaces/interface/members/member/state/oper-key** • **interfaces/interface/members/member/state/partner-key** • **interfaces/interface/members/member/state/counters/lacp-in-packets** • **interfaces/interface/members/member/state/counters/lacp-out-packets** • **interfaces/interface/members/member/state/counters/lacp-rx-errors** • **interfaces/interface/members/member/state/counters/lacp-unknown-errors** • **interfaces/interface/members/member/state/counters/lacp-errors** • **state/system-priority**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **interfaces/interface[name='aggregate-interface-name']/state/** • **interfaces/interface[name='aggregate-interface-name'] / members/member[interface='interface-name']/state/** • **interfaces/interface[name='aggregate-interface-name'] / members/member[interface='interface-name']/state/counters/** • **interfaces/interface[name='aggregate-interface-name'] / members/member[interface='interface-name']/state/port-num** • **interfaces/interface[name='aggregate-interface-name'] / members/member[interface='interface-name']/state/partner-port-num** • **interfaces/interface[name='aggregate-interface-name'] / members/member[interface='interface-name']/state/mux-state**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	through gNMI services starting with Junos OS Release 19.2R1. QFX5200 switches support the LLDP statistics export and OpenConfig LLDP Model (v0.1.0). Starting with Junos OS Release 19.4R1, periodic streaming using gRPC services with EX4300-MP switches is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gRPC services with PTX10008 routers is supported. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. Starting with Junos OS Release 20.1R1, periodic streaming using gRPC services with MX240, MX480, MX960, MX10003, PTX10008, and PTX10016 routers is supported for leaf-list **suppress-tlv-advertisement** under the resource path **/lldp/state/suppress-tlv-advertisement**. The resource path **/lldp/interfaces/interface[name='name']/** is supported on EX2300, EX2300-MP, and EX3400 switches periodic streaming using gNMI services starting with Junos OS Release 20.2R1. Starting with Junos OS Release 20.2R1, streaming pseudo interface statistics through Routing Engine sensors is supported using gRPC services or gNMI services with SRX5400, SRX5600, and SRX5800 Service Gateways. Previously, streaming statistics was only supported through gRPC services. You can also add the following to the end of the path for **/lldp/**: **NOTE**: End paths supporting ON_CHANGE streaming are indicated. • **state/**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **state/enabled/** ON_CHANGE streaming supported • **state/hello-timer/** ON_CHANGE streaming supported • **state/chassis-id/** ON_CHANGE streaming supported • **state/chassis-id-type/** ON_CHANGE streaming supported • /state/suppress-tlv-advertisement gRPC streaming with MX240, MX480, MX960, MX10003, PTX10008, and PTX10016 routers is supported for this attribute. The TLVs **port-description**, **system-name**, **system-description**, **system-capabilities**, and **management address** are streamed to support operational state, notifications, and configuration change support. • **state/system-name/** ON_CHANGE streaming supported • **state/system-description/** ON_CHANGE streaming supported • **state/loc-port-id-type/** • **state/counters/frame-in/** • **state/counters/frame-out/** • **state/counters/frame-error-in/** • **state/counters/frame-discard/**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **interfaces/interface[name='interface-name']/neighbors/neighbor/capabilities/cabapility/state/enabled/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/type/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/oui/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/oui-subtype/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/state/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/state/type/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/state/oui/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/state/oui-subtype/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/custom-tlvs/tlv/state/value/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/system-name/**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	ON_CHANGE streaming supported. This resource path does not change with an event, but will be streamed on creation and deletion. • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/system-description/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/chassis-id/** ON_CHANGE streaming supported. This resource path does not change with an event, but will be streamed on creation and deletion. • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/chassis-id-type/** ON_CHANGE streaming supported. This resource path does not change with an event, but will be streamed on creation and deletion. • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/id/** • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/age/** ON_CHANGE streaming supported **NOTE**: This attribute is not sent for every LLDP PDU because it continuously changes. The **age** value is sent when another attribute learned by the neighbor is updated. • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/last-update/** ON_CHANGE streaming supported

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	This attribute is not sent for every LLDP PDU because it continuously changes. The **last-update** value is sent when another attribute learned by the neighbor is updated. • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/port-id/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/port-id-type/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/port-description/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/management-address/** ON_CHANGE streaming supported • **interfaces/interface[name='interface-name']/neighbors/neighbor/state/management-address-type/** ON_CHANGE streaming supported

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description

	• **PATHERR_RECEIVED**
	  • **ADMISSION_CONTROL_FAILURE**
	  • **SESSION_PREEMPTED**
	  • **BAD_LOOSE_ROUTE**
	  • **BAD_STRICT_ROUTE**
	  • **LABEL_ALLOCATION_FAILURE**
	  • **ROUTING_LOOP_DETECTED**
	  • **REQUESTED_BANDWIDTH_UNAVAILABLE**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/mpls/lsps-constrained-path/tunnels/tunnel[name='*foo-name*',source='*foo-source*']/p2p-tunnel-attributes/p2p-primary-paths[name='*foo-path*']/lsp-instances[index='*local-index*']/state/	Sensor to export LSP properties for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs Supported on PTX Series routers, MX Series routers, and QFX10002, QFX10008, and QFX10016 switches starting with Junos OS Release 17.2R1. The following end paths are also supported for the resource path: • **bandwidth** • **metric** • **max-average-bandwidth** • **explicit-route-objects** • **record-route-objects**
/mpls/signaling-protocols/ldp/lsp-transit-policies/lsp-transit-policy/state/counters	Sensor to export statistics for LDP LSP transit traffic. Supported on MX Series routers starting with Junos OS Release 20.2R1.
/mpls/signaling-protocols/ldp/lsp-ingress-policies/lsp-ingress-policy/state/counters	Sensor to export statistics for LDP LSP ingress traffic. Supported on MX Series routers starting with Junos OS Release 20.2R1.
/mpls/signaling-protocols/ldp/p2mp-lsps/p2mp-lsp/state/counters	Sensor to export statistics for multipoint LDP LSP traffic. Supported on MX Series routers starting with Junos OS Release 20.2R1.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/mpls/signalling-protocols/ldp/p2mp-interfaces/p2mp-interface/state/counters/	Sensor to export statistics for multipoint LDP egress traffic per interface. Supported on MX Series routers starting with Junos OS Release 20.2R1.
/mpls/signalling-protocols/ldp/p2mp-egress-interfaces/p2mp-interface/state/counters/	Sensor to export statistics for multipoint LDP egress traffic per interface. Supported only on MPC10E-10C-MRATE, MPC10E-15C-MRATE, and MX2K-MPC11E line cards line cards on MX Series routers starting with Junos OS Release 20.3R1.
/mpls/signalling-protocols/ldp/p2mp-interfaces/p2mp-interface/	Sensor to export statistics for multipoint LDP ingress traffic per interface. Supported on MX Series routers starting with Junos OS Release 20.2R1.

Table 5: gRPC Sensors *(Continued)*

resource path	Description

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/network-instances/network-instance/mpls/signaling-protocols/rsvp-te/	Sensor to export events for ingress point-to-point LSPs, point-to-multipoint LSPs, bypass LSPs, and dynamically created LSPs. Starting in Junos OS Evolved Release 19.2R1, PTX10003 routers support streaming statistics. The following end paths are also supported: • **interface-attributes/interface/bandwidth-reservations/state/active-reservations-count** • **interface-attributes/interface/bandwidth-reservations/state/available-bandwidth** • **interface-attributes/interface/bandwidth-reservations/state/highwater-mark** • **interface-attributes/interface/bandwidth-reservations/state/reserved-bandwidth** • **interface-attributes/interface/counters/in-ack-messages** • **interface-attributes/interface/counters/in-hello-messages** • **interface-attributes/interface/counters/in-path-messages** • **interface-attributes/interface/counters/in-path-tear-messages** • **interface-attributes/interface/counters/in-reservation-error-messages** • **interface-attributes/interface/counters/in-reservation-messages** • **interface-attributes/interface/counters/in-reservation-tear-messages** • **interface-attributes/interface/counters/in-srefresh-messages**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **interface-attributes/interface/counters/out-path-tear-messages** • **interface-attributes/interface/counters/out-ack-messages** • **interface-attributes/interface/counters/out-hello-messages** • **interface-attributes/interface/counters/out-path-messages** • **interface-attributes/interface/counters/out-reservation-error-messages** • **interface-attributes/interface/counters/out-reservation-messages** • **interface-attributes/interface/counters/out-reservation-tear-messages** • **interface-attributes/interface/counters/out-srefresh-messages** • **neighbors/neighbor/state/neighbor-status** • **sessions/session/record-route-objects/record-route-object** • **sessions/session/state/destination-address** • **sessions/session/state/label-in** • **sessions/session/state/label-out** • **sessions/session/state/lsp-id**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported. Starting with Junos OS Evolved Release 20.1R1, periodic streaming using gNMI services with PTX10008 routers is supported. Starting with Junos OS Release 20.2R1, periodic streaming using gRPC services with EX2300, EX2300-MP, and EX3400 switches is supported. Starting with Junos OS Release 20.2R1, streaming pseudo interface statistics through Routing Engine sensors is supported using gRPC services or gNMI services with SRX5400, SRX5600, and SRX5800 Service Gateways. Previously, streaming statistics was only supported through gRPC services. You can also add the following to the end path for **/arp-information/** • **ipv4** • **ipv4/neighbors** • **ipv4/neighbors/neighbor** • **ipv4/neighbors/neighbor/state/host-name** • **ipv4/neighbors/neighbor/state/table-id** • **ipv4/neighbors/neighbor/state/neighbor-state** • **ipv4/neighbors/neighbor/state/expiry** • **ipv4/neighbors/neighbor/state/ispublish** • **ipv4/neighbors/neighbor/state/interface-name** • **ipv4/neighbors/neighbor/state/logical-router-id**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/interfaces/interface/state/counters/in-drops** • **/interfaces/interface/state/counters/in-frame-errors** • **/interfaces/interface/state/counters/in-runts** • **/interfaces/interface/state/counters/in-lchan-errors** • **/interfaces/interface/state/counters/in-l-mismatch-errors** • **/interfaces/interface/state/counters/in-fifo-errors** • **/interfaces/interface/state/counters/in-giants** • **/interfaces/interface/state/counters/in-resource-errors** • **/interfaces/interface/state/counters/out-drops** • **/interfaces/interface/state/counters/carrier-transitions** • **/interfaces/interface/state/counters/mtu-errors** • **/interfaces/interface/state/counters/out-resource-errors** • **/interfaces/interface/subinterfaces/subinterface/index** • **/interfaces/interface/subinterfaces/subinterface/state/index** • **/interfaces/interface/subinterfaces/subinterface/state/name** • **/interfaces/interface/subinterfaces/subinterface/state/description** • **/interfaces/interface/subinterfaces/subinterface/state/enabled** • **/interfaces/interface/subinterfaces/subinterface/state/ifindex**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/interfaces/interface/subinterfaces/subinterface/state/counters/out-multicast-pkts** • **/interfaces/interface/subinterfaces/subinterface/state/counters/out-discards** • **/interfaces/interface/subinterfaces/subinterface/state/counters/out-errors** • **/interfaces/interface/subinterfaces/subinterface/state/counters/last-clear** • **/interfaces/interface/subinterfaces/subinterface/state/counters/out-pkts**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	Starting with Junos OS Evolved Release 20.1R1, periodic streaming using gNMI services with PTX10008 routers is supported. Starting with Junos OS Release 20.2R1, periodic streaming using gRPC services with EX2300, EX2300-MP, and EX3400 switches is supported. Starting with Junos OS Release 20.2R1, periodic streaming using gRPC services with PTX10001 routers is supported. Starting with Junos OS Release 20.2R1, streaming pseudo interface statistics through Routing Engine sensors is supported using gRPC services or gNMI services with SRX5400, SRX5600, and SRX5800 Service Gateways. Previously, streaming statistics was only supported through gRPC services. You can also add the following to the end path for **nd6-information/** • **ipv6/neighbors/neighbor/state/ip** ON_CHANGE streaming supported starting with Junos OS Evolved Release 19.1R1 • **ipv6/neighbors/neighbor/state/link-layer-address** ON_CHANGE streaming supported starting with Junos OS Evolved Release 19.1R1 • **ipv6/neighbors/neighbor/state/origin** • **ipv6/neighbors/neighbor/sttae/is-router** ON_CHANGE streaming supported starting with Junos OS Evolved Release 19.1R1 • **ipv6/neighbors/neighbor/state/neighbor-state** • **ipv6/neighbors/neighbor/state/table-id**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **ipv6/neighbors/neighbor/state/is-secure** • **ipv6/neighbors/neighbor/state/is-publish** • **ipv6/neighbors/neighbor/state/expiry** • **ipv6/neighbors/neighbor/state/interface-name** • **ipv6/neighbors/neighbor/state/logical-router-id**
/ipv6-ra/	Sensor for NDP router-advertisement statistics. Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX are supported. Starting with Junos OS Release 19.2R1, gNMI streaming and ON_CHANGE for QFX5200 switches is supported. Starting with Junos OS Release 19.3R1, gNMI streaming and ON_CHANGE for MX960, MX2010, MX2020, PTX5000, PTX1000, and PTX10000 routers is supported. Starting with Junos OS Evolved Release 20.2R1, periodic streaming using gRPC services with PTX10001 routers is supported. Starting with Junos OS Release 20.2R1, streaming pseudo interface statistics through Routing Engine sensors is supported using gRPC services or gNMI services with SRX5400, SRX5600, and SRX5800 Service Gateways. Previously, streaming statistics was only supported through gRPC services.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/packet/usage/	Sensor for Packet Forwarding Engine Statistics. This sensor exports statistics for counters and provides visibility into Packet Forwarding Engine error and drop statistics. This sensor is supported starting on MX Series and PTX Series routers starting with Junos OS Release 17.4R1. Starting in Junos OS Evolved Release 19.1R1, PTX10003 routers are supported. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services. Starting with Junos OS Evolved Release 19.4R1, periodic streaming using gNMI services with PTX10003 routers is supported.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/linecard/packet/usage/	Sensor for Packet Forwarding Engine Statistics. This sensor exports statistics and provides visibility into Packet Forwarding Engine error and drop statistics. Statistics include counters (CC, CPU, and NPU) for traffic data. Note that NPU statistics are different than those streamed from the sensors **/junos/system/linecard/npu/memory/** and **/junos/system/linecard/npu/utilization/** . Sensor output is comparable to the output using the operational mode command **show pfe statistics traffic**. Shown below, statistics are exported for the default FPC (**FPC0**). Multiples FPCs are supported. The component values and property values are names (like interface names). Starting in Junos OS Evolved Release 19.4R1, streaming statistics using gRPC and gNMI services on PTX10008 routers is supported. Starting in Junos OS Release 20.2R1, INITIAL_SYNC statistics using gNMI services on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000 routers, PTX10000 line of routers, and QFX5100 and QFX5200 switches are supported. The following paths are also supported: • **:/components/component[name='FPC0:CC0']/properties/property[name='ts-input-packets']/** • **/components/component[name='FPC0:CC0']/properties/property[name='ts-output-packets']/** • **//components/component[name='FPC0:CC0']/properties/property[name='ts-input-packets-pps']/** • **/components/component[name='FPC0:CC0']/properties/property[name='ts-output-packets-pps']/** • **/components/component[name='FPC0:CC0']/properties/property[name='ts-fabric-input-packets']/**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/components/component[name='FPC0:CC0']/properties/property[name='ts-fabric-input-packets-pps']/** • **/components/component[name='FPC0:CC0']/properties/property[name='ts-fabric-output-packets']/** • **/components/component[name='FPC0:CC0']/properties/property[name='ts-fabric-output-packets-pps']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-input-packets']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-output-packets']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-sw-input-control-drops']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-sw-input-high-drops']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-sw-input-medium-drops']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-sw-input-low-drops']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-sw-output-low-drops']/** • **/components/component[name='FPC0:CPU0']/properties/property[name='lts-hw-input-drops']/** • **/components/component[name='FPC0:NPU0']/properties/property[name='hwdsNormal']/** • **/components/component[name='FPC0:NPU0']/properties/property[name='hwds-data-error']/** • **/components/component[name='FPC0:NPU0']/properties/property[name='hwds-tcp-error']/**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/components/component[name='FPC0:NPU0']/properties/property[name='hwds-illegal-nh']/** • **/components/component[name='FPC0:NPU0']/properties/property[name='hwds-invalid-iif']/** **//components/component[name='FPC0:NPU0']/properties/property[name='hwds-fabric']/**

Table 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/**	Sensor for IS-IS routing protocol statistics. Statistics are exported separately for each routing instance. To specify a routing-instance name: **/network-instances/network-instance[name_'*instance-name*']/protocols/protocol/isis/levels/level/** **/network-instances/network-instance[name_'*instance-name*']/protocols/protocol/isis/interfaces/interface/levels/level/** **NOTE**: This sensor is supported on MX Series and PTX Series routers starting with Junos OS Release 17.4R1. Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800 and vSRX are also supported. Starting with Junos OS Release 20.2R1, streaming pseudo interface statistics through Routing Engine sensors is supported using gRPC services or gNMI services with SRX5400, SRX5600, and SRX5800 Service Gateways. Previously, streaming statistics was only supported through gRPC services. The following paths are also supported: • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/lsp/received** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/lsp/processed** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/lsp/dropped**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/lsp/sent** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/lsp/retransmit** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/iih/received** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/iih/processed** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/iih/dropped** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/iih/sent** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/iih/retransmit** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/psnp/received** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/psnp/processed** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interface/levels/level/packet-counters/psnp/dropped**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/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**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-extended-system-id** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/adjacency-state** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-circuit-type** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-ipv4-address** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-ipv6-address** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/neighbor-snpa** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/levels/level/adjacencies/adjacency/state/priority** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/remaining-hold-time** • **/network-instances/network-instance/protocols/protocol/isis/interfaces/interfaces/levels/level/adjacencies/adjacency/state/restart-status**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	extended-ipv4-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/type • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/length** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/undefined-subtlvs/undefined-subtlv/state/value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/prefix-sid/sid/state/value** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/flags/state/flags** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/extended-ipv4-reachability/prefixes/prefix/subtlvs/subtlv/flags/state/algorithm** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/ipv6-prefix** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/up-down** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/tlvs/tlv/ipv6-reachability/prefixes/prefix/state/s-bit**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/undefined-tlvs/undefined-tlv/state/length** • **/network-instances/network-instance/protocols/protocol/isis/levels/level/link-state-database/lsp/undefined-tlvs/undefined-tlv/state/value**

Table 5: gRPC Sensors *(Continued)*

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

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/mpls/signaling-protocols/segment-routing/interfaces/interface/state/in-octets** • **/network-instances/network-instance/mpls/signaling-protocols/segment-routing/interfaces/interface/state/out-octets** • **/network-instances/network-instance/mpls/signaling-protocols/segment-routing/interfaces/interface/state/out-pkts** • **/network-instances/network-instance/mpls/aggregate-sid-counters/aggregate-sid-counter/state/in-octets** • **/network-instances/network-instance/mpls/aggregate-sid-counters/aggregate-sid-counter/state/in-pkts** • **/network-instances/network-instance/mpls/aggregate-sid-counters/aggregate-sid-counter/state/out-octets** • **/network-instances/network-instance/mpls/aggregate-sid-counters/aggregate-sid-counter/state/out-pkts** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/state/in-octets** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/state/in-pkts** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/state/out-octets** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/state/out-pkts** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/forwarding-classes/forwarding-class/state/in-octets**

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	• **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/forwarding-classes/forwarding-class/state/in-pkts** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/forwarding-classes/forwarding-class/state/out-octets** • **/network-instances/network-instance/mpls/interfaces/interface/sid-counters/sid-counter/forwarding-classes/forwarding-class/state/out-pkts**
/junos/services/segment-routing/sid/usage/	Sensors for aggregate segment routing traffic with IS-IS. This sensor is supported on PTX3000 routers and PTX5000 routers with FPC2 starting with Junos OS Release 19.1R1. Statistics are exported separately for each routing instance. The first path exports inbound traffic. The second path exports outbound traffic. The third path exports inbound segment routing traffic for each segment identifier. **NOTE**: When you enable a sensor for segment routing statistics, you must also configure the `sensor-based-stats` statement at the **[edit protocols isis source-packet-routing]** hierarchy level.
/junos/services/segment-routing/traffic-engineering/ingress/usage	Packet Forwarding Engine sensor for ingress segment routing traffic engineering statistics. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/services/segment-routing/traffic-engineering/transit/usage	Packet Forwarding Engine sensor for ingress segment routing traffic engineering statistics. Starting in Junos OS Release 19.2R1, MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches are supported on gRPC and gNMI services.

Table 5: gRPC Sensors *(Continued)*

resource path	Description
/junos/services/segment-routing/traffic-engineering/tunnel/lsp/ingress/usage/ **/junos/services/segment-routing/traffic-engineering/tunnel/lsp/transit/usage/**	Sensor for Segment Routing Traffic Engineering (SR-TE) per Label Switched Path (LSP) route statistics. You can stream SR-TE telemetry statistics for uncolored SR-TE policies to an outside collector. Ingress statistics include statistics for all traffic steered by means of an SR-TE LSP. Transit statistics include statistics for traffic to the Binding-SID (BSID) of the SR-TE policy. To enable these statistics, include the **per-source per-segment-list** option at the [**edit protocols source-packet-routing telemetry statistics**] hierarchy level. Starting in Junos OS Release 20.1R1, MX Series and PTX Series routers support streaming statistics using gRPC services. Starting in Junos OS Release 20.2R1, MX240. MX480, MX960, MX2010, and MX2020 with MPC-10E or MPC-11E routers support streaming statistics using gRPC services. When a subscription is made to these resource paths, the following output format is displayed: • **/mpls/signaling-protocols/segment-routing/sr-te-per-lsp-ingress-policies/sr-te-ingress-lsp-policy\[tunnel-name='srtelsp1' and source='st' and origin='0' and distinguisher='f' and lsp-name='sr1'\]/state/counters\[name='.*'\]/packets** • **/mpls/signaling-protocols/segment-routing/sr-te-per-lsp-transit-policies/sr-te-transit-lsp-policy\[tunnel-name='srtelsp1' and source='st' and origin='0' and distinguisher='f' and lsp-name='sr1'\]/state/counters\[name='.*'\]/packets** For the output format above, the field **source**, values can be **ST** (static tunnel) or **PC** (PCEP tunnel). For the field **lsp-name**,

Table 5: gRPC Sensors *(Continued)*

resource path	Description
	the value is the transit output. Other fields, such as **Origin** and **Distinguisher** are fixed for uncolored tunnels.
/system/alarms/alarm	Sensor for alarms. Starting with Junos OS Release 20.1R1, ON_CHANGE statistics using gNMI services with MX960, MX2020, PTX1000, and PTX5000 routers. These routers support OpenConfig model: • openconfig-alarms.yang: oc-ext:openconfig-version 0.3.1
/system/processes/process/	Individual Routing Engine core information sensor. You can stream CPU usage statistics per Routing Engine core. Statistics are similar to output from the **show system process detail** operational mode command. This feature supports the private data model openconfig-procmon.yang. Starting in Junos OS Release 20.2R1, streaming statistics using gRPC services or gNMI services on MX960, MX2010, MX2020, PTX1000, PTX5000, and PTX10000 routers QFX5100, and QFX5200 switches is supported.

Table 5: gRPC Sensors *(Continued)*

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

Table 6: Broadband Edge gRPC Sensors

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

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

resource path	Description
/junos/system/subscriber-management/aaa/address-assignment-statistics/logical-system-routing-instances/logical-system-routing-instance/pools/pool	For Authentication, Authorization, and Accounting, this sensor tracks address pool utilization. The resource path can be refined to select a logical system routing instance by using a logical system routing instance filter: **/aaa/address-assignment-statistics/logical-system-routing-instances/logical-system-routing-instance [lsri-name=' *lsName:riName*']/pools/pool[pool-name=' *poolName*']** The resource path can be refined to select a specific pool by using a pool filter: **/junos/system/subscriber-management/aaa/address-assignment-statistics/logical-system-routing-instances/logical-system-routing-instance/pools/pool[pool-name=' *poolName*']** The resource path can be refined to select both a logical routing instance and a pool by using a logical system routing instance filter and a pool filter: **/junos/system/subscriber-management/aaa/address-assignment-statistics/logical-system-routing-instances/logical-system-routing-instance/[lsri-name=' *lsName:riName*']/pools/pool[pool-name=' *poolName*']** The following end paths are also supported for the resource path: • **pool-name** • **out-of-memory** • **out-of-address** • **address-total** • **address-in-use**

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

resource path	Description

	• **address-usage-percent**
	• **linked-pool-name**-The next address pool in the chain of linked pools. If there is no next address pool, the value is empty. This leaf is supported in Junos OS Release 18.3R1 and higher.
	• **linked-pool-head**-The first address pool in a chain of linked pools. If this pool is not part of a linked address pool, the value is empty. This leaf is supported in Junos OS Release 18.3R1 and higher. For single pools, the value of linked-pool-head should be the same as the pool-name. For example:
	key:__prefix__, str_value:/junos/system/subscriber-management/aaa/address-assignment-statistics/logical-system-routing-instances/logical-system-routing-instance[name='default:marberry']/pools/pool[pool-name='john']/}
	.
	.
	kv {
	key:linked-pool-name,
	str_value:jayne
	}
	kv {
	key:linked-pool-head,
	str_value:john

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

resource path	Description
/junos/system/subscriber-management/aaa/diameter/clients/gx	Sensor for policy and charging rules function (PCRF) statistics for subscribers. Supported on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers for streaming statistics export through gRPC services and gNMI services starting with Junos OS Release 19.3R1. You can also add the following end paths: • **ccr-initial** • **ccr-initial-retry** • **cca-initial** • **cca-initial-grant** • **cca-initial-deny** • **cca-initial-failure** • **ccr-update** • **ccr-update-retry** • **cca-update** • **cca-update-timeout** • **ccr-terminate** • **ccr-terminate-retry** • **cca-terminate** • **cca-terminate-timeout** • **cca-parse-error** • **cca-dropped-no-session-id**

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

resource path	Description
	• **cca-dropped-bad-e2e-id** • **cca-dropped-bad-origin-realm** • **cca-dropped-bad-origin-host** • **cca-dropped-no-result-code** • **cca-dropped-other** • **cca-initial-bad-result-code** • **cca-initial-bad-data** • **rar-update** • **rar-update-retry** • **rar-update-drop** • **raa-update-ack** • **raa-update-nak-no-session** • **raa-update-nak-unable-to-comply** • **raa-update-nak-other** • **rar-disconnect** • **rar-disconnect-retry** • **rar-disconnect-drop** • **raa-disconnect-ack** • **raa-disconnect-nak-no-session** • **raa-update-nak-unable-to-comply** • **raa-disconnect-nak-other** • **rar-audit**

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

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

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

resource path	Description
/junos/system/subscriber-management/aaa/diameter/clients/gy	Sensor for Online Charging System (OCS) statistics for subscribers. Supported on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers for streaming statistics export through gRPC services and gNMI services starting with Junos OS Release 19.3R1. You can also add the following end paths: • **ccr-initial** • **ccr-initial-retry** • **ccr-initial-alternate-retry** • **cca-initial** • **cca-initial-alternate** • **ccr-update** • **ccr-update-retry** • **ccr-update-alternate-retry** • **cca-update** • **cca-update-alternate** • **ccr-terminate** • **ccr-terminate-retry** • **ccr-terminate-alternate-retry** • **cca-terminate** • **cca-terminate-alternate** • **cca-terminate-timeout**

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

resource path	Description
	• **cca-se-error** • **cca-no-session-id** • **cca-bad-e2e-id** • **cca-bad-origin-realm** • **cca-bad-origin-host** • **cca-no-result-code** • **cca-drop** • **cca-initial-bad-result-code** • **cca-initial-bad-data** • **asr** • **asr-retry** • **asr-parse-error** • **asr-update-drop** • **asa-ack** • **asa-nak**

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

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

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

resource path	Description
	• **session-terminate-request-message-failures**-Termination requests processing errors • **session-terminate-request-messages-timeouts**-Termination requests timed out • **session-terminate-response-messages-failures**-Termination response processing errors • **session-terminate-response-messages-received**-Termination responses received • **abort-session-requests-received**-Terminate session requests received • **abort-session-response-ack-messages-sent**-Terminate session requests responded with ack • **abort-session-response-nack-messages-sent**-Terminate session requests responded with nack • **abort-session-response-message-failures**- • **transmit-queue-time-outs**-Total count of messages dropped from the transmit queue due to timeout • **response-parse-errors**-Response messages dropped due to parsing errors • **responses-dropped**-Total count of responses dropped • **outstanding-requests**-Outstanding request messages

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

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

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

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

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

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

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

resource path	Description	
/junos/system/subscriber-management/access-network/ancp/protocol	Sensors that track statistics associated with ANCP protocol.	
	establishing-neighbor-count	Number of neighbors in the process of establishing adjacency.
	established-neighbor-count	Number of neighbors in the process of establishing adjacency
	total-neighbor-count	Total number of neighbors in all states.
	mapped-static-subscriber-count	Number of ANCP subscribers mapped to static interfaces by ANCP protocol.
	port-up-count	Total number of port ups received.
	port-down-count	Total number of port downs received.

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

resource path	Description
/junos/system/subscriber-management/aaa/authentication-statistics/	Sensors that track authentication, authorization, and accounting (AAA) authentication, pre-authentication, and re-authentication statistics. The following end paths are also supported for the resource path: • **req-received** • **req-accepted** • **req-rejected** • **req-challenge** • **req-timeout** • **pre-authen-req-received** • **pre-authen-req-accepted** • **pre-authen-req-rejected** • **pre-authen-req-challenge** • **pre-authen-req-timeout** • **re-authen-req-received** • **re-authen-req-accepted** • **re-authen-req-rejected** • **re-authen-req-internal-errors** • **re-authen-req-challenge** • **re-authen-req_timeout**

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

resource path	Description
/junos/system/subscriber-management/aaa/dynamic-request-statistics/	Sensor tracks dynamic request statistics from AAA server-initiated requests, including Change of Authorization (CoA) and RADIUS-initiated Disconnect (RID). The following end paths are also supported for the resource path: • **dynamic-req-received** • **dynamic-req-success** • **dynamic-req-error** • **dynamic-req-silently-drop**

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

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

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

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

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

resource path	Description
	• **preauth-retransmissions** • **preauth-access-accepts** • **preauth-access-rejects** • **preauth-access-challenges** • **preauth-malformed-responses** • **preauth-bad-authenticators** • **preauth-req-pending** • **preauth-request-timeouts** • **preauth-unknown-responses** • **preauth-packets-dropped** • **acct-start-requests** • **acct-interim-requests** • **acct-stop-requests** • **acct-rollover-requests** • **acct-retransmissions** • **acct-start-responses** • **acct-interim-responses** • **acct-stop-responses** • **acct-malformed-responses** • **acct-bad-authenticators** • **acct-req-pending** • **acct-request-timeouts**

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

resource path	Description
	• **acct-unknown-responses** • **acct-packets-dropped**
/junos/system/subscriber-management/chassis **/junos/system/subscriber-management/chassis[chassis-index=*chassis-index*]** (to specify an index number for a specific Routing Engine)	Chassis role (backup or primary) sensor. Starting with Junos OS Release 20.2R1, streaming statistics from a single chassis or virtual chassis is supported using gRPC services with MX480, MX960, MX10003, MX2010, and MX2020 routers.
/junos/system/subscriber-management/chassis/routing-engines/routing-engine] **/junos/system/subscriber-management/chassis/routing-engines/routing-engine[re-index=*RoutingEngineIndex*]** (to specify an index number for a specific Routing Engine)	Routing Engine status and GRES notification sensor. This sensor provides: • Routing Engine role • Graceful Routing Engine switchover (GRES) readiness state Starting with Junos OS Release 20.2R1, streaming statistics from a single chassis or virtual chassis is supported using gRPC services with MX480, MX960, MX10003, MX2010, and MX2020 routers.

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

resource path	Description
/junos/system/subscriber-management/chassis/routing-engines/process-status/subscriber-management-processes/subscriber-management-process **/junos/system/subscriber-management/chassis/routing-engines/process-status/subscriber-management-processes/subscriber-management-process[pid=*ProcessIdentifier*]** (to specify a Process ID (PID) for a specific process)	Subscriber management process sensor. This sensor includes leaves per Routing Engine for each running process: • PID • CPU utilization (%) • Process name • Memory utilization (%) Starting with Junos OS Release 20.2R1, streaming statistics from a single chassis or virtual chassis is supported using gRPC services with MX480, MX960, MX10003, MX2010, and MX2020 routers.
/junos/system/subscriber-management/chassis/routing-engines/routing-engine/dhcp-bindings/dhcp-element[dhcp-type-name=*RelayOrServer*/v4] **/junos/system/subscriber-management/chassis/routing-engines/routing-engine/dhcp-bindings/dhcp-element[dhcp-type-name=*RelayOrServer*/v6]**	DHCP binding statistics sensor. Statistics for server or relay are streamed per Routing Engine sensor. The sensor includes statistics on the number of subscribers in the following states: • Initializing • Binding • Bound • Renewing • Restoring • Releasing Starting with Junos OS Release 20.2R1, streaming statistics from a single chassis or virtual chassis is supported using gRPC services with MX480, MX960, MX10003, MX2010, and MX2020 routers.

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

resource path	Description
/junos/system/subscriber-management/chassis/virtual-chassis-ports/virtual-chassis-port **/junos/system/subscriber-management/chassis/virtual-chassis-ports/virtual-chassis-port[vcp-interface-name=*vcp-interface-port-string*]** (to specify the interface name)	Virtual chassis port counter sensor. The sensor includes these statistics: • Input packets • Output packets • Input bytes • Output bytes Starting with Junos OS Release 20.2R1, streaming statistics from a virtual chassis is supported using gRPC services with MX480, MX960, MX10003, MX2010, and MX2020 routers.

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

resource path	Description
/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance/relay/bindings/	Sensor for DHVPv4 relay binding state statistics. The resource path can be refined to select a specific routing instance by adding a routing instance name: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[name=’ *routing-instance-name*]/relay/bindings/** The following end paths are also supported for the resource path: • **binding-state-v4relay-binding** • **binding-state-v4relay-init** • **binding-state-v4relay-bound** • **binding-state-v4relay-selecting** • **binding-state-v4relay-requesting** • **binding-state-v4relay-renew** • **binding-state-v4relay-release** • **binding-state-v4relay-restoring**

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

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

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

resource path	Description
	• **one-minute-minimum-response-time** • **one-minute-average-response-time** • **one-minute-maximum-response-time** • **one-minute-messages-sent** • **one-minute-messages-received** • **one-minute-messages-no-response**
/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance/server/bindings/	Sensor for DHVPv4 server binding state statistics. The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[name=' *routing-instance-name*]/server/bindings/** The following end paths are also supported for the resource path: • **binding-state-v4server-binding** • **binding-state-v4server-init** • **binding-state-v4server-bound** • **binding-state-v4server-selecting** • **binding-state-v4server-requesting** • **binding-state-v4server-renew** • **binding-state-v4server-release** • **binding-state-server-restoring**

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

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

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

resource path	Description
	• **dropped-v4server-no-local-address** • **dropped-v4server-short-pkt** • **dropped-v4server-no-bad-send** • **dropped-v4server-no-option60** • **dropped-v4server-no-option82** • **dropped-v4server-authentication** • **dropped-v4server-dynamic-profile** • **dropped-v4server-no-license** • **dropped-v4server-no-bad-dhcp-opcode** • **dropped-v4server-no-options** • **dropped-v4server-hop-limit** • **dropped-v4server-ttl-expired** • **dropped-v4server-bad_udp-checksum** • **dropped-v4server-inactive-vlan** • **dropped-v4server-era-start-ailed** • **dropped-v4server-client-lookup** • **dropped-v4server-lease-time-violation** • **offer-delayed** • **offer-delay-in-progress** • **offer-delay-total** • **msg-recv-v4server-boot-request** • **msg-recv-v4server-decline**

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

resource path	Description
	• **msg-recv-v4server-discover** • **msg-recv-v4server-inform** • **msg-recv-v4server-release** • **msg-recv-v4server-request** • **msg-recv-v4server-renew** • **msg-recv-v4server-rebind** • **msg-recv-v4server-lease-query** • **msg-recv-v4server-bulklease-query** • **msg-sent-v4server-boot-reply** • **msg-sent-v4server-offer** • **msg-sent-v4server-boot-ack** • **msg-sent-v4server-nak** • **msg-sent-v4server-force-renew** • **msg-sent-v4server-unassigned** • **msg-sent-v4server-unknown** • **msg-sent-v4server-active** • **msg-sent-v4server-query-done**

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

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

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

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

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

resource path	Description
	• **dropped-v4server-short-pkt** • **dropped-v4server-no-bad-send** • **dropped-v4server-no-option60** • **dropped-v4server-no-option82** • **dropped-v4server-authentication** • **dropped-v4server-dynamic-profile** • **dropped-v4server-no-license** • **dropped-v4server-no-bad-dhcp-opcode** • **dropped-v4server-no-options** • **dropped-v4server-hop-limit** • **dropped-v4server-ttl-expired** • **dropped-v4server-bad_udp-checksum** • **dropped-v4server-inactive-vlan** • **dropped-v4server-era-start-ailed** • **dropped-v4server-client-lookup** • **dropped-v4server-lease-time-violation** • **offer-delayed** • **offer-delay-in-progress** • **offer-delay-total** • **msg-recv-v4server-boot-request** • **msg-recv-v4server-decline** • **msg-recv-v4server-discover**

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

resource path	Description
	• **msg-recv-v4server-inform** • **msg-recv-v4server-release** • **msg-recv-v4server-request** • **msg-recv-v4server-renew** • **msg-recv-v4server-rebind** • **msg-recv-v4server-lease-query** • **msg-recv-v4server-bulklease-query** • **msg-sent-v4server-boot-reply** • **msg-sent-v4server-offer** • **msg-sent-v4server-boot-ack** • **msg-sent-v4server-nak** • **msg-sent-v4server-force-renew** • **msg-sent-v4server-unassigned** • **msg-sent-v4server-unknown** • **msg-sent-v4server-active** • **msg-sent-v4server-query-done**

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

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

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

resource path	Description
	• **dropped-v4relay-no-local-address** • **dropped-v4relay-short-packet** • **dropped-v4relay-bad-send** • **dropped-v4relay-option-60** • **dropped-v4relay-relay-option** • **dropped-v4relay-option-82** • **dropped-v4relay-authentication** • **dropped-v4relay-dynamic-profile** • **dropped-v4relay-dynamic-profile** • **dropped-v4relay-license** • **dropped-v4relay-bad-dhcp-opcode** • **dropped-v4relay-no-options** • **dropped-v4relay-hop-limit** • **dropped-v4relay-ttl-expired** • **dropped-v4relay-bad-udp-checksum** • **dropped-v4relay-inactive-vlan** • **dropped-v4relay-era-start-failed** • **dropped-v4relay-client-lookup** • **dropped-v4relay-proxy-no-server-addr** • **dropped-v4relay-lease-time-violation** • **dropped-v4relay-leasequery-repl-no-circuitid** • **dropped-v4relay-leasequery-repl-with-error-code**

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

resource path	Description
	• **dropped-v4relay-leasequery-repl-with-query-term** • **dropped-v4relay-older-leasequery-reply** • **dropped-v4relay-abort-leasequery-reply-proc** • **dropped-v4relay-during-leasequery-reply** • **dropped-v4relay-relay-source-no-lpbk-interface** • **v4relay-bootp-request-rcvd** • **msg-recv-v4relay-decline** • **msg-recv-v4relay-discover** • **msg-recv-v4relay-inform** • **msg-recv-v4relay-release** • **msg-recv-v4relay-request** • **msg-recv-v4relay-leaseactive** • **msg-recv-v4relay-leaseunassigned** • **msg-recv-v4relay-leaseunknown** • **msg-recv-v4relay-leasequerydone** • **v4relay-bootp-reply-rcvd** • **msg-recv-v4relay-offer** • **msg-recv-v4relay-ack** • **msg-recv-v4relay-nak** • **msg-recv-v4relay-forcerenew** • **v4relay-bootp-reply-sent** • **msg-sent-v4relay-offer**

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

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

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

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

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

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

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

resource path	Description
	• **one-minute-minimum-response-time** • **one-minute-average-response-time** • **one-minute-maximum-response-time** • **one-minute-messages-sent** • **one-minute-messages-received** • **one-minute-messages-no-response**
/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance/server/bindings/	Sensor for DHVPv6 binding state statistics. The resource path can be refined to select a specific routing instance by adding a routing instance filter to the resource path: **/junos/system/subscriber-management/client-protocols/dhcp/v6/routing-instances/routing-instance[name=' *routing-instance-name*]/server/bindings/** The following end paths are also supported for the resource path: • **binding-state-v6server-binding** • **binding-state-v6server-init** • **binding-state-v6server-bound** • **binding-state-v6server-selecting** • **binding-state-v6server-requesting** • **binding-state-v6server-renew** • **binding-state-v6server-release** • **binding-state-server-restoring**

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

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

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

resource path	Description
	• **dropped-v6server-bad-udp-checksum** • **dropped-v6server-no-client-id** • **dropped-v6server-strict-reconfigure** • **dropped-v6server-option-18** • **dropped-v6server-authentication{** • **dropped-v6server-dynamic-profile** • **dropped-v6server-license** • **dropped-v6server-inactive-vlan** • **dropped-v6server-era-start-failed** • **dropped-v6server-client-lookup** • **dropped-v6server-lease-time-violation** • **advertise-delayed** • **advertise-queued** • **advertise-total** • **msg-recv-v6server-dhcpv6-decline** • **msg-recv-v6server-dhcpv6-solicit** • **msg-recv-v6server-dhcpv6-information-request** • **msg-recv-v6server-dhcpv6-release** • **msg-recv-v6server-dhcpv6-request** • **msg-recv-v6server-dhcpv6-confirm** • **msg-recv-v6server-dhcpv6-renew** • **msg-recv-v6server-dhcpv6-rebind**

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

resource path	Description
	• **msg-recv-v6server-dhcpv6-relay-forw** • **msg-recv-v6server-dhcpv6-leasequery** • **msg-sent-v6server-advertise** • **msg-sent-v6server-reply** • **msg-sent-v6server-logical_nak** • **msg-sent-v6server-reconfigure** • **msg-sent-v6server-relay-repl** • **msg-sent-v6server-leasequery-repl** • **msg-sent-v6server-leasequery-data** • **msg-sent-v6server-leasequery-done**

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

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

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

resource path	Description
	• **dropped-v6relay-relay-hop-count** • **dropped-v6relay-bad-udp-checksum** • **dropped-v6relay-no-client-id** • **dropped-v6relay-strict-reconfigure** • **dropped-v6relay-relay-option** • **dropped-v6relay-option-18** • **dropped-v6relay-option-37** • **dropped-v6relay-authentication** • **dropped-v6relay-dynamic-profile** • **dropped-v6relay-license** • **dropped-v6relay-inactive-vlan** • **dropped-v6relay-era-start-failed** • **dropped-v6relay-client-lookup** • **dropped-v6relay-lease-time-violation** • **dropped-v6relay-leasequery-repl-no-client-data** • **dropped-v6relay-leasequery-repl-no-interfaceid** • **dropped-v6relay-leasequery-repl-with-client-link** • **dropped-v6relay-leasequery-repl-no-relay-data** • **dropped-v6relay-leasequery-repl-with-hop-cnt** • **dropped-v6relay-leasequery-repl-with-error-code** • **dropped-v6relay-leasequery-repl-with-query-term** • **dropped-v6relay-older-leasequery-reply**

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

resource path	Description
	• **dropped-v6relay-abort-leasequery-reply-proc** • **dropped-v6relay-during-leasequery-reply** • **dropped-v6relay-relay-source-no-lpbk-interface** • **msg-recv-v6relay-decline** • **msg-recv-v6relay-solicit** • **msg-recv-v6relay-information-request** • **msg-recv-v6relay-release** • **msg-recv-v6relay-request** • **msg-recv-v6relay-confirm** • **msg-recv-v6relay-renew** • **msg-recv-v6relay-rebind** • **msg-recv-v6relay-relay-forw** • **msg-recv-v6relay-leasequery-repl** • **msg-recv-v6relay-leasequery-data** • **msg-recv-v6relay-leasequery-done** • **msg-recv-v6relay-advertise** • **msg-recv-v6relay-reply** • **msg-recv-v6relay-reconfigure** • **msg-recv-v6relay-relay-repl** • **msg-recv-v6relay-leasequery** • **msg-sent-v6relay-reply** • **msg-sent-v6relay-reconfigure**

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

resource path	Description
	• **msg-sent-v6relay-relay-repl** • **msg-sent-v6relay-leasequery** • **msg-sent-v6relay-decline** • **msg-sent-v6relay-solicit** • **msg-sent-v6relay-information-request** • **msg-sent-v6relay-release** • **msg-sent-v6relay-request** • **msg-sent-v6relay-confirm** • **msg-sent-v6relay-renew** • **msg-sent-v6relay-rebind** • **msg-sent-v6relay-relay-forw** • **msg-sent-v6relay-leasequery-repl** • **msg-sent-v6relay-leasequery-data** • **msg-sent-v6relay-leasequery-done** • **v6relay-fwd-total** • **v6relay-fwd-request** • **v6relay-fwd-reply**

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

resource path	Description
/junos/system/subscriber-management/client-protocols/l2tp/summary/	Sensor for L2TP telemetry information. The following end paths are also supported for the resource path: • **l2tp-stats-total-tunnels** • **l2tp-stats-total-sessions** • **l2tp-stats-control-rx-packets** • **l2tp-stats-control-rx-bytes** • **l2tp-stats-control-tx-packets** • **l2tp-stats-control-tx-bytes** • **l2tp-era-type-icrq-inflight-count** • **l2tp-era-type-icrq-reported-successes** • **l2tp-era-type-icrq-reported-failures** • **l2tp-era-type-sccrq-inflight-count** • **l2tp-era-type-sccrq-reported-successes** • **l2tp-era-type-sccrq-reported-failures**
/junos/system/subscriber-management/client-protocols/ppp/statistics/	Sensors for PPP telemetry information. The following end paths are also supported for the resource path: • **ppp-stats-total-subscriber-sessions** • **ppp-stats-sessions-disable-phase** • **ppp-stats-sessions-establish-phase** • **ppp-stats-sessions-network-phase** • **ppp-stats-sessions-authenticate-phase**

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

resource path	Description
/junos/system/subscriber-management/client-protocols/pppoe/statistics/	Sensors for PPPoE counts. The following end paths are also supported for the resource path: • **padi-packets-sent** • **padi-packets-received** • **pado-packets-sent** • **pado-packets-received** • **padr-packets-sent** • **padr-packets-received** • **pads-packets-sent** • **pads-packets-received** • **padt-packets-sent** • **padt-packets-received** • **service-error-sent** • **service-error-received** • **ac-error-sent** • **ac-error-received** • **generic-error-sent** • **generic-error-received** • **malformed-packets-received** • **unknown-packets-received** • **era-inflight-count**

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

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

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

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

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

resource path	Description
/junos/system/subscriber_management/dynamic-interfaces/interface-sets/meta-data/interface[sid-id='*sid-value*']/	Sensor for actual accounting statistics for dynamic subscriber interfaces. The following end paths are supported: • **ip-in-packets**-The number of actual transit IPv4 & IPv6 packets received by the interface. • **ip-out-packets**-The number of actual transit IPv4 & IPv6 packets sent to the interface. • **ip-in-bytes**-The number of actual transit IPv4 & IPv6 bytes received by the interface. • **ip-out-bytes**-The number of actual transit IPv4 & IPv6 bytes received by the interface. • **ipv6-in-packets**-The number of actual transit IPv6 packets received by the interface. • **ipv6-out-packets**-The number of actual transit IPv6 packets sent to the interface. • **ipv6-in-bytes**-The number of actual transit IPv6 bytes received by the interface. • **ipv6-out-bytes**-The number of actual transit IPv6 bytes sent to the interface.

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

resource path	Description
/junos/system/subscriber_management/dynamic-interfaces/interfaces/queue-statistics/interface[sid-id='*sid-value*']/fpcs/fpc[slot='*slot-value*']/queues/queue/[queue-no='*queue-no-value*']/	Sensor for queue statistics for dynamic interfaces. The following end paths are supported: • **transmitted-packets**-The number of actual transit IPv4 & IPv6 packets received by the interface. • **transmitted-bytes**-Total bytes enqueued for this queue. • **dropped-packets**-Total packets dropped (because of RED, rate-limited, tail-drop, etc.) for the queue. • **dropped-bytes**-Total bytes dropped (because of RED, rate-limited, tail-drop, etc.) for the queue.
/junos/system/subscriber_management/dynamic-interfaces/interface-sets/queue-statistics/interface-set[container-id='*container-id-value*']/fpcs/fpc[slot='*slot-value*']/queues/queue/[queue-no='*queue-no-value*']/	Sensor for queue statistics for dynamic interface-sets. The following end paths are supported: • **transmitted-packets**-The number of actual transit IPv4 & IPv6 packets received by the interface. • **transmitted-bytes**-Total bytes enqueued for this queue. • **dropped-packets**-Total packets dropped (because of RED, rate-limited, tail-drop, etc.) for the queue. • **dropped-bytes**-Total bytes dropped (because of RED, rate-limited, tail-drop, etc.) for the queue.

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

resource path	Description
/junos/system/subscriber-management/infra/resource-monitor/chassis	Sensor for chassis resource statistics. The crossing of chassis thresholds maintained by the resource monitor can be incremented. For each threshold, a count is maintained of rising and falling threshold crossings. As the consumed resource exceeds the threshold, the threshold exceeded count is incremented. As the consumed resource drops below the threshold, the threshold nominal count is incremented. Unless limits are configured using **configured-subscriber-limit**, configured and current limit counts will not be visible. The following end paths are supported for chassis threshold crossing statistics: • **subscriber-limit-exceeded** • **subscriber-limit-nominal** • **configured-subscriber-limit** • **current-subscriber-count**

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

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

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

resource path	Description
	• **client-session-denied-count** • **service-session-denied-count** • **rtt-throttled-sub-count-client** • **rtt-throttled-sub-count-client**

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

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

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

resource path	Description
	• **pfe-no** • **filter-memory-used** • **ifl-memory-used** • **expansion-memory-used** • **nh-memory**
/junos/system/subscriber-management/infra/resource-monitor/rsmon-infra/fpcs/fpc[slot=' *slot number*']/	Sensor for FPC resource statistics. Using the slot number filter, the crossing of FPC thresholds maintained by the resource monitor can be incremented. For each threshold, a count is maintained of rising and falling threshold crossings. As the consumed resource exceeds the threshold, the threshold exceeded count is incremented. As the consumed resource drops below the threshold, the threshold nominal count is incremented. The following end paths are supported for FPC threshold crossing statistics: • **delay-round-trip-exceeded** • **delay-round-trip-nominal**

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

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

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

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

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

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

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

resource path	Description
/junos/system/subscriber-management/infra/network/dhcp/	Sensor for network stack DHCP. Periodically tracks packets processed by the BBE network stack to and from the DHCP application. The following end paths are also supported for the resource path: • **rx-packet-cnt** • **era-drops** • **rx-no-connection** • **rx-malformed-cnt** • **rx-no-if-cnt** • **rx-ifl-invalid** • **rx-send-failed** • **tx-packet-cnt** • **packets-transmitted** • **tx-malformed-cnt** • **tx-null-pkt** • **tx-no-if-cnt** • **tx-no-iff-cnt** • **tx-no-rtt-cnt** • **tx-arp-failed** • **tx_arp_failed** • **tx-if-invalid** • **tx-send-failed**

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

resource path	Description
	• **rx-while-not-connected**
/junos/system/subscriber-management/infra/network/dvlan/	Sensor for network stack dynamic VLAN. Periodically maintains a count of the number of packets received that triggered dynamic VLAN interface creations. The following end paths are also supported for the resource path: • **rx-packet-cnt**

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

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

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

resource path	Description
	• **l2-tx-no-ifd-cnt** • **l2-tx-ifl-invalid** • **l2-bbe-io-send-tx-failed** • **l2-bbe-io-send-tx-failed-partial** • **l2-tx-v4-out-error-local-intf** • **l2-tx-v6-out-error-local-intf** • **l3-rx-packet-cnt** • **l3-rx-unsupported-protocol** • **l3-tx-packet-cnt** • **l3-tx-send-failed** • **l3-tx-v4-kernel-forward** • **l3-tx-v4-kernel-forward-drops** • **l3-tx-v6-kernel-forward** • **l3-tx-v6-kernel-forward-drops**
/junos/system/subscriber-management/infra/network/dvlan/	Sensor for network stack dynamic VLAN. Periodically maintains a count of the number of packets received that triggered dynamic VLAN interface creations. The following end paths are also supported for the resource path: • **rx-packet-cnt**

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

resource path	Description
/junos/system/subscriber-management/infra/network/l2tp/	Sensor network stack L2TP. Periodically tracks L2TP packets processed by the BBE network stack to and from the L2TP application. The following end paths are also supported for the resource path: • **rx-cnt** • **rx-pkt-cnt** • **ppp-rx-pkt-cnt** • **tx-pkt-cnt** • **ppp-rx-lcp-conf-req-count** • **ppp-rx-lcp-conf-ack-count** • **ppp-rx-lcp-conf-nack-count** • **ppp-rx-lcp-term-req-count** • **ppp-rx-lcp-term-ack-count** • **ppp-rx-lcp-echo-req-count** • **ppp-rx-lcp-echo-resp-count** • **ppp-rx-pap-req-count** • **ppp-rx-pap-ack-count** • **ppp-rx-pap-nack-count** • **ppp-rx-chap-challenge-count** • **ppp-rx-chap-resp-count** • **ppp-rx-chap-success-count** • **ppp-rx-chap-fail-count**

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

resource path	Description
	• **ppp-rx-ipcp-conf-req-count** • **ppp-rx-ipcp-conf-ack-count** • **ppp-rx-ipcp-conf-nack-count** • **rx-malformed-cnt** • **ppp-rx-unknown-protocol** • **rx-msg-cnt** • **rx-msg-processd-cnt** • **rx-msg-err** • **rx-invalid-msg-cnt** • **tx-cnt** • **ppp-tx-lcp-conf-req-count** • **ppp-tx-lcp-conf-ack-count** • **ppp-tx-lcp-conf-nack-count** • **ppp-tx-lcp-echo-req-count** • **ppp-tx-lcp-echo-resp-count** • **ppp-tx-lcp-term-req-count** • **ppp-tx-lcp-term-ack-count** • **ppp-tx-pap-req-count** • **ppp-tx-pap-ack-count** • **ppp-tx-pap-nack-count** • **ppp-tx-chap-challenge-count** • **ppp-tx-chap-resp-count**

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

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

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

resource path	Description
/junos/system/subscriber-management/infra/network/ppp/	Sensor network stack PPP. Periodically tracks PPP packets processed by the BBE network stack to and from the PPP application. The following end paths are also supported for the resource path: • **rx-network-pkt-cnt** • **rx-plugin-pkt-cnt** • **rx-lcp-conf-req-cnt** • **rx-lcp-conf-ack-cnt** • **rx-lcp-conf-nack-cnt** • **rx-lcp-conf-rej-cnt** • **rx-lcp-term-req-cnt** • **rx-lcp-term-ack-cnt** • **rx-lcp-code-rej-cnt** • **rx-lcp-protocol-rej-cnt** • **rx-lcp-echo-req-cnt** • **rx-lcp-echo-reply-cnt** • **rx-pap-req-cnt** • **rx-pap-ack-cnt** • **rx-pap-nack-cnt** • **rx-chap-challenge-cnt** • **rx-chap-resp-cnt** • **rx-chap-success-cnt**

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

resource path	Description
	• **rx-chap-failure-cnt** • **rx-ipcp-req-cnt** • **rx-ipcp-ack-cnt** • **rx-ipcp-nack-cnt** • **rx-ipv6cp-req-cnt** • **rx-ipv6cp-ack-cnt** • **rx-ipv6cp-nack-cnt** • **rx-malformed-cnt** • **rx-no-if-cnt** • **rx-unsupported** • **tx-cnt** • **tx-lcp-conf-req-cnt** • **tx-lcp-conf-ack-cnt** • **tx-lcp-conf-nack-cnt** • **tx-lcp-echo-req-cnt** • **tx-lcp-echo-reply-cnt** • **tx-lcp-term-req-cnt** • **tx-lcp-term-ack-cnt** • **tx-pap-req-cnt** • **tx-pap-ack-cnt** • **tx-pap-nack-cnt** • **tx-chap-challenge-cnt**

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

resource path	Description
	• **tx-chap-resp-cnt** • **tx-chap-success-cnt** • **tx-chap-failure-cnt** • **tx-ipcp-req-cnt** • **tx-ipcp-ack-cnt** • **tx-ipcp-nack-cnt** • **tx-ipv6cp-req-cnt** • **tx-ipv6cp-ack-cnt** • **tx-ipv6cp-nack-cnt** • **tx-unknown-pkt-cnt** • **tx-send-failed** • **tx-malformed-cnt**

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

resource path	Description
/junos/system/subscriber-management/infra/network/pppoe/	Sensor for network stack PPPoE statistics. PPPoE packets processed by the BBE network stack to and from the PPPoE application are tracked. The following end paths are also supported for the resource path: • **rx-cnt** • **rx-padi-cnt** • **rx-padr-cnt** • **rx-ppp-cnt** • **rx-malformed-cnt** • **rx-no-if-cnt** • **rx-unsupported** • **rx-padi-era-discards** • **tx-cnt** • **tx-send-failed**

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

resource path	Description
/junos/system/subscriber-management/infra/sdb/statistics/client-type/	Sensor for session database resources session counts by client type. The following end paths are also supported for the resource path: • **dhcp-client-count** • **vlan-client-count** • **ppp-client-count** • **pppoe-client-count** • **l2tp-client-count** • **static-client-count** • **vpls-pw-client-count** • **mlppp-client-count** • **essm-client-count** • **total-client-count**

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

resource path	Description
/junos/system/subscriber-management/infra/sdb/statistics/state/	Sensor for session database resources tracking session counts by state. The following end paths are also supported for the resource path: • **init-state-count** • **configured-state-count** • **active-state-count** • **terminating-state-count** • **terminated-state-count** • **total-state-count**
/junos/system/linecard/ddos/	This PFE sensor exports the statistics of DDOS from MPC1, MPC2, MPC3, MPC5, MPC6, MPC7, MPC8, and MPC9 line cards.

Release History Table

Release	Description
20.3R1	Starting with Junos OS Release 20.3R1, gRPC service for exporting LDP and mLDP statistics is supported on MPC10E-10C-MRATE, MPC10E-15C-MRATE, and MX2K-MPC11E line cards.
20.2R1	Starting with Junos OS Evolved Release 20.2R1, gRPC service for streaming NDP statistics is supported on PTX10001 routers.
20.2R1	Starting with Junos OS Release 20.2R1, gRPC service for streaming Packet forwarding Engine and Routing Engine statistics is supported on EX2300, EX2300-MP, and EX3400 switches.
20.2R1	Starting with Junos OS Release 20.2R1, gRPC service for streaming BGP routing information base (RIB) and BGP peer statistics is supported on any platform family that supports containerized routing protocol process (cRPD). cRPD is Juniper's routing protocol process (rpd) decoupled from Junos OS and packaged as a Docker container to run in Linux-based environments.

20.2R1	Starting with Junos OS Release 20.2R1, ON_CHANGE BGP peer statistics export using gRPC services and gNMI services is supported on MX960, MX2008, MX2010, MX2020, PTX1000, PTX5000, PTX10000 routers and QFX5100 and QFX5200 switches.
20.2R1	Starting with Junos OS Release 20.2R1, streaming BGP global, peer and perr groups statistics using gRPC services is supported on EX2300, EX3400, EX4300, EX4600, and EX9200 switches.
20.2R1	Starting with Junos OS Release 20.2R1, streaming revenue interface statistics through Packet Forwarding Engine sensors and pseudo interface statistics through Routing Engine sensors using gRPC services and gNMI services is supported on SRX5400, SRX5600, and SRX5800 Services Gateways..
20.2R1	Starting with Junos OS Release 20.2R1, streaming revenue interface statistics through Packet Forwarding Engine sensors and pseudo interface statistics through Routing Engine sensors using gRPC services and gNMI services is supported on SRX5400, SRX5600, and SRX5800 Services Gateways.
20.2R1	Starting with Junos OS Release 20.2R1 sensors to stream standby Routing Engine statistics are supported on MX480, MX960, MX10003, MX2010, and MX2020 routers.
20.2R1	Starting with Junos OS Release 20.2R1 sensors to stream EVPN statistics using gRPC services are supported with QFX5100, QFX5110, QFX5120, QFX5200, QFX10002-60C, QFX10002, QFX10008, and QFX10016 switches.
20.2R1	Starting with Junos OS Release 20.2R1, gRPC service for exporting LDP and mLDP statistics is supported on MX Series routers.
20.1R1	Starting with Junos Release 20.R1, gNMI service for streaming telemetry sensors for Packet Forwarding Engine statistics is supported on MX2K-MPC11E line cards on MX2010 and MX2020 routers.
19.4R1	Starting with Junos OS Release 19.4R1, gRPC service for streaming Packet Forwarding Engine and Routing Engine statistics is supported on EX4300-MP switches.
19.3R1	Starting with Junos OS Release 19.3R1, gNMI services for streaming Packet Forwarding Engine statistics is supported on MX240, MX480 and MX960 routers.
19.3R1	Starting with Junos OS Release 19.3R1, gRPC service for exporting statistics is supported on MX Series routers hosting MPC10E-10C-MRATE and MPC10E-15C-MRATE line cards. The resource paths /junos/system/linecard/cpu/memory/, /junos/system/linecard/npu/memory/, and /junos/system/linecard/npu/utilization/ can be updated to call out individual sensors (leaves) and their respective paths for better clarity.

19.3R1	Starting with Junos OS Evolved Release 19.3R1, gRPC service for exporting statistics is supported on QFX5220-128C and QFX5220-32CD switches.
19.2R1	Starting with Junos OS Release 19.2R1, SRX4100, SRX4200, SRX4600, SRX5400, SRX5600, SRX5800, and vSRX Series Services Gateways.are supported.
19.2R1	Starting with Junos OS Release 19.2R1, gNMI services for streaming Packet Forwarding Engine statistics is supported on MX960, MX2008, MX2010 and MX2020 routers, PTX1000 and PTX10000 routers, and QFX5100 and QFX5200 switches.
19.2R1	Starting with Junos OS Release 19.2R1, gNMI services for streaming statistics is supported on QFX5110, QFX5120, QFX5200 and QFX5210 switches.
19.2R1	Starting with Junos OS Release 19.3R1, gNMI services for streaming and ON_CHANGE export of Routing Engine statistics is supported on MX960, MX2010, MX2020, PTX5000, PTX1000, and PTX10000 routers.
19.1R1 EVO	Starting in Junos OS Evolved Release 19.1R1, OpenConfig (OC) and Junos Telemetry Interface (JTI) are supported. Both gRPC APIs and the customer-facing CLI remain the same as for the Junos OS. As was standard for Junos OS, Network Agent (NA) and OC packages are part of the Junos OS Evolved image.
19.1R1	Starting with Junos OS Evolved 19.1R1, Packet Forwarding Engine sensors on PTX10003 routers are also supported.
18.4R1	Starting with Junos OS Release 18.4R1, MX480, MX960, MX2010, MX2020, MX2008 and MX-ELM routers are also supported.
18.3R1	Starting with Junos OS Release 18.3R1, ON_CHANGE streaming of LLDP telemetry sensor information is supported through gRPC for MX Series and PTX Series routers.
18.3R1	Starting with Junos OS Release 18.3R1, QFX5120-AY and EX4650 switches are also supported.
18.3R1	Starting with Junos OS Release 18.4R1, EX4600 switches are also supported.
18.2R1	Starting with Junos OS Release 18.2R1, PTX10002 routers are also supported.
18.1R1	Starting with Junos OS Release 18.1R1, QFX5210-64C switches and QFX5100 switches are also supported.

18.1R1	Starting with Junos OS Release 18.1R1, ON_CHANGE streaming of ARP, ND, and IP sensor information associated with interfaces is supported through gRPC for MX Series routers and PTX Series routers.
17.4R1	Starting with Junos OS Release 17.4R1, PTX10016 routers and virtual MX Series (vMX) routers are also supported.
17.3R1	Starting with Junos OS Release 17.3R1, QFX5110 switches, EX4600, EX4600-VC, and EX9200 switches and the Routing and Control Board (RCB) on PTX3000 routers are also supported.
17.3R1	Starting with Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensors are supported.
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor /junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name=' routing-instance-name'] /server/statistics/ the only value supported for routing-instance-name is default.
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor /junos/system/subscriber-management/client-ancpinstance[ri-name=' routing-instance-name'] /server/statistics/ the only value supported for routing-instance-name is default.
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor /junos/system/subscriber-management/client-protocols/dhcp/v4/routing-instances/routing-instance[ri-name=' routing-instance-name']/relay/statistics/ the only value supported for the value routing-instance-name is default.
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor /junos/system/subscriber-management/client-protocols/dhcp/v6/ routing-instances/routing-instance[ri-name=' routing-instance-name']/server/statistics the only value supported for routing-instance-name is default.
17.3R1	In Junos OS Release 17.3R1, broadband edge (BBE) gRPC sensor /junos/system/subscriber-management/client-protocols/dhcp/v6/ routing-instances/routing-instance[ri-name=' routing-instance-name']/relay/statistics the only value supported for routing-instance-name is default.
17.2R1	Starting with JunosOS Release 17.2R1, QFX10002, QFX10008, and QFX10016 switches, QFX5200 switches, and PTX1000 and PTX10008 routers are also supported.
16.1R3	Starting with Junos OS Release 16.1R3, the Junos Telemetry Interface supports gRPC remote procedure calls (gRPC) to provision sensors and to subscribe to and receive telemetry data on MX Series routers and PTX3000 and PTX5000 routers.

RELATED DOCUMENTATION

Understanding OpenConfig and gRPC on Junos Telemetry Interface | 36

NPU Utilization Properties

IN THIS SECTION

- NPU Utilization for PTX10000 and QFX1000 Series | 394
- NPU Utilization for PTX Series | 398

The following sections contain NPU utilization and memory sensor information.

NPU Utilization for PTX10000 and QFX1000 Series

The following section contains NPU utilization information for PTX10000 and QFX10000 series.

Table 7: NPU Utilization sensor (resource path /junos/system/linecard/npu/utilization/)

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
NPU Utilization	NPU Utilization	32-bit	1-100	Number on a scale of 0-100 that indicates the busyness of an NPU.
Memory load • Name	Memory load • Name	—	—	Load on a memory subsystem of the NPU
Memory load	Memory load	—	—	Load on a memory subsystem of the NPU

Table 7: NPU Utilization sensor (resource path /junos/system/linecard/npu/utilization/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
Memory load • Name	Memory load • Name	string	—	A name string to identify the particular memory subsystems (such as hmc)
Memory load • Average_util • Highest_util • Lowest_util	Memory load • Average_util • Highest_util • Lowest_util	32-bit	—	Various memory utilization metrics
Memory load • Average_cache_hit_rate • Highest_cache_hit_rate • Lowest_cache_hit_rate	Memory load • Average_cache_hit_rate • Highest_cache_hit_rate • Lowest_cache_hit_rate		—	Each memory is front ended by a cache. The following metrics indicate how these caches are working

Table 7: NPU Utilization sensor (resource path /junos/system/linecard/npu/utilization/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
Packet Load	Packet Load	—	—	Offered packet load on an internal subsystem of the NPU, like the following: • loopback_pps • recirculation_pps • wan_and_host_inject_pps • asic_to_host_pps
Packet Load: • Identifier	Packet Load: • Identifier	string	—	Each internal subsystem of the NPU has a name
Packet Load: • rate	Packet Load: • rate	64-bit	—	Rate of packets received
Packet Load: • average_instructions_per_packet • average_wait_cycles_per_packet • average_cycles_per_packet	Packet Load: • average_instructions_per_packet • average_wait_cycles_per_packet • average_cycles_per_packet	32-bit	—	Indicate the compute load on the NPU. These metrics are not valid for the PF chip on the PTX10000 routers or QFX10000 switches.

Table 8: NPU memory sensor (resource path /junos/system/linecard/npu/memory/)

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
Memory Summary	Memory Summary	—	—	NPU memory utilization summary per memory type
Memory Summary • Resource_name	Memory Summary • Resource_name	—	string	A name string to identify the particular memory blocks such as KHT (cuckoo hash tables), edf, flt, sfm, fcv. Beta-0, beta-1, policer, and pclt
Memory Summary: • size	Memory Summary: • size	64-bit	%	Size memory utilization metrics
Memory Summary: • allocated	Memory Summary: • allocated	64-bit	%	Allocated memory utilization metrics
Memory Summary: • utilization	Memory Summary: • utilization	32-bit	%	Memory utilization metrics
Application memory partition summary		—	—	Detailed statistics for NPU memory partitions per application; examples include plct-filter, plct-ingr-nh, plct-egr-nh, plct-rt, and plct-misc.

Table 8: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
Application memory partition summary: • Application_name	Application memory partition summary • Application_name	string	—	Name of the application for which NPU memory is allocated.
Application memory partition summary: • Bytes_allocated • Allocation_count • Free_count	Application memory partition summary: • Bytes_allocated • Allocation_count • Free_count	32-bit	—	Various memory values for allocation and free count.

NPU Utilization for PTX Series

The following Section contains NPU utilization sensor information PTX series routers.

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/)

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
NPU Memory • L2 domain	Exported property names: • mem-util-kht-l2domain-allocated • mem-util-kht-l2domain-size • mem-util-kht-l2domain-utilization	—	32768 (size in your table)	An equivalent of a logical interface index. Logical interfaces is a contributor.

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
NPU Memory • SLU MY-MAC	Exported property names: • mem-util-kht-slu-my-mac-size • mem-util-kht-slu-my-mac-allocated • mem-util-kht-slu-my-mac-utilization	entry	3072	Used for both VRRP MAC and MYMAC indentification. Populated during FPC intitialization
NPU Memory • Forwarding table: edb0	Exported property names: • mem-util-kht-dlu-edb0-allocated • mem-util-kht-dlu-edb0-size • mem-util-kht-dlu-edb0-utilization	entry	16777216	Used by L3 / L2 forwarding table entries, including IPv4, IPv6, MPLS. Only route entries are located in this database. Entries size vary and depends on the entry type.
NPU Memory • Forwarding table: edb1	Exported property names: • mem-util-kht-dlu-edb1-allocated • mem-util-kht-dlu-edb1-size • mem-util-kht-dlu-edb1-utilization	entry	4194304	Used by flow table. Populated only when IPFIX is enabled.

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
Firewall / Filter • Filter instances	Exported property names: not available	entry	8192	Reflects the number of filter instances (and not the number of configured filters) Regular filters, interface-specific filter creates a new instance, there is no program sharing
Firewall / Filter • Filter terms	Exported property names: • mem-util-flt-action-entries-utilization • mem-util-flt-action-entries-allocated • mem-util-flt-action-entries-size	—	65536	Reflects the number of filter terms. Regular filters, interface-specific filter creates a new instance. There is no program sharing
Firewall / Filter • Filter alpha block [0]	Exported property names: • mem-util-kht-flt0-size • mem-util-kht-flt0-allocated • mem-util-kht-flt0-utilization	—	131072	Used for longest prefix matches (source, destination addresses). Contributors are source or destination prefix lists. IPv6 prefixes with matches longer than /64 occupy two entries.

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
Firewall / Filter • Filter alpha block [1]	Exported property names: • mem-util-kht-flt1-size • mem-util-kht-flt1-allocated • mem-util-kht-flt1-utilization • mem-util-flt-alpha-1-kht-size • mem-util-flt-alpha-1-kht-allocated • mem-util-flt-alpha-1-kht-utilization • mem-util-flt-alpha-1-bft-0-size • mem-util-flt-alpha-1-bft-0-allocated • mem-util-flt-alpha-1-bft-0-utilization • mem-util-flt-alpha-1-plt-size • mem-util-flt-alpha-1-plt-allocated • mem-util-flt-alpha-1-plt-utilization	—	131072	Used for longest prefix matches (source, destination addresses). Contributors are source or destination prefix lists.

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
Firewall / Filter • Filter beta block [0]	Exported property names: • mem-util-beta-0-bank-0-size • mem-util-beta-0-bank-0-allocated • mem-util-beta-0-bank-0-utilization • mem-util-beta-0-bank-1-size • mem-util-beta-0-bank-1-allocated • mem-util-beta-0-bank-1-utilization • mem-util-beta-0-bank-2-size • mem-util-beta-0-bank-2-allocated • mem-util-beta-0-bank-2-utilization • mem-util-beta-0-bank-3-size • mem-util-beta-0-bank-3-allocated • mem-util-beta-0-bank-3-utilization • mem-util-beta-0-bank-4-size	—	65536	Used for range matches (source and destination ports). Contributors are ports, port ranges, and other match conditions. This is a tree structure. Each match condition may translate into 1 or more entries, depending on the number of ranges.

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
	• mem-util-beta-0-bank-4-allocated • mem-util-beta-0-bank-4-utilization			

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
Firewall / Filter • Filter beta block [1]	Exported property names: • mem-util-beta-1-bank-0-size • mem-util-beta-1-bank-0-allocated • mem-util-beta-1-bank-0-utilization • mem-util-beta-1-bank-1-size • mem-util-beta-1-bank-1-allocated • mem-util-beta-1-bank-1-utilization • mem-util-beta-1-bank-2-size • mem-util-beta-1-bank-2-allocated • mem-util-beta-1-bank-2-utilization • mem-util-beta-1-bank-3-size • mem-util-beta-1-bank-3-allocated • mem-util-beta-1-bank-3-utilization • mem-util-beta-1-bank-4-size	—	65536	Used for range matches (source and destination ports). Contributors are ports, port ranges, and other match conditions. This is a tree structure. Each match condition may translate into 1 or more entries, depending on the number of ranges.

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
	• mem-util-beta-1-bank-4-allocated • mem-util-beta-1-bank-4-utilization • mem-util-flt-beta-1-bank-5-size • mem-util-flt-beta-1-bank-5-allocated • mem-util-flt-beta-1-bank-5-utilization			
Firewall / Filter • Secondary Facet Match	Exported property names: • mem-util-sfm-entries-size • mem-util-sfm-entries-allocated • mem-util-sfm-entries-utilization	—	8192	Used by other match conditions, such as tcp-flags.

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
Firewall / Filter • Special Cover Vector	Exported property names: • mem-util-flt-scv-size • mem-util-flt-scv-allocated • mem-util-flt-scv-utilization	—	256 rows 4 pages each	An auxiliary data structure used to optimize for direction indifference matches (source or destination addresses ports), excepts and ranges (plus wildcards). Contributors are filters with irregular patterns (direction indifference matches, excepts, ranges, wildcards) will contribute to the utilization.
Firewall / Filter • FCV block [1]	Exported property names: • mem-util-fcv-blk-1-size • mem-util-fcv-blk-1-allocated • mem-util-fcv-blk-1-utilization	B	65536	Cover vector FCV block 1.
Firewall / Filter • FCV block [2]	Exported property names: • mem-util-fcv-blk-2-size • mem-util-fcv-blk-21allocated • mem-util-fcv-blk-2-utilization	B	65536	Cover vector FCV block 2.

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
Firewall / Filter • FCV block [3]	Exported property names: • mem-util-fcv-blk-3-size • mem-util-fcv-blk-3-allocated • mem-util-fcv-blk-3-utilization	B	65536	Special cover vector FCV block 3.
NPU Memory • Forwarding table: edb0	Exported property names: • mem-util-kht-dlu-edb0-allocated • mem-util-kht-dlu-edb0-size • mem-util-kht-dlu-edb0-utilization	entry	16777216	Used by L3 / L2 forwarding table entries, including IPv4, IPv6, MPLS. Only route entries are located in this database. Entries size vary and depends on the entry type.
NPU Memory • Forwarding table: edb1	Exported property names: • mem-util-kht-dlu-edb1-allocated • mem-util-kht-dlu-edb1-size • mem-util-kht-dlu-edb1-utilization	entry	4194304	Used by flow table. Populated only when IPFIX is enabled.

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
NPU Memory • Forwarding table: edb0	Exported property names: • mem-util-kht-dlu-edb0-allocated • mem-util-kht-dlu-edb0-size • mem-util-kht-dlu-edb0-utilization	entry	16777216	Used by L3 / L2 forwarding table entries, including IPv4, IPv6, MPLS. Only route entries are located in this database. Entries size vary and depends on the entry type.
NPU Memory • Forwarding table: edb1	Exported property names: • mem-util-kht-dlu-edb1-allocated • mem-util-kht-dlu-edb1-size • mem-util-kht-dlu-edb1-utilization	entry	4194304	Used by flow table. Populated only when IPFIX is enabled.
Firewall / Filter • Policer IDs	Exported property names: • mem-util-policer-id-size • mem-util-policer-id-allocated • mem-util-policer-id-utilization	B	16384	Contributors are firewall policers, and interface policers

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
Firewall / Filter • Policer/Counter space	Exported property names: • mem-util-plct-size • mem-util-plct-allocated • mem-util-plct-utilization • mem-util-plct-filter-bytes-allocated • mem-util-plct-filter-allocation-count • mem-util-plct-filter-free-count • mem-util-plct-ing-nh-bytes-allocated • mem-util-plct-ing-nh-allocation-count • mem-util-plct-ing-nh-free-count • mem-util-plct-egr-nh-bytes-allocated • mem-util-plct-egr-nh-allocation-count • mem-util-plct-egr-nh-free-count • mem-util-plct-misc-bytes-allocated	B	131072	Issues 1 word per counter, 3 words per single rate policer, and 5 words for tricolor policers.

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
	• mem-util-plct-misc-allocation-count • mem-util-plct-misc-free-count • mem-util-plct-memory-size • mem-util-plct-memory-allocated • mem-util-plct-memory-utilization			
Next-hops and encapsulation • IRP Memory: Load-balancing partition	Exported property names: • mem-util-jnh-loadbal-allocated • mem-util-jnh-loadbal-size • mem-util-jnh-loadbal-utilization	KWords	128	Load-balancing data structures. Contributors are aggregated Ethernet and multipath.

Table 9: NPU memory sensor (resource path /junos/system/linecard/npu/memory/) *(Continued)*

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
Next-hops and encapsulation • IRP Memory: Next-hop partition	Exported property names: • mem-util-jnh-loadbal-allocated • mem-util-jnh-loadbal-size • mem-util-jnh-loadbal-utilization • mem-util-jnh-loadbal-utilization	KWords	256	Used for next-hops. Contributors are next-hops.
Next-hops and encapsulation • IRP Memory: EDF partition	Exported property names: • mem-util-edf-public-words-allocated • mem-util-edf-public-words-size • mem-util-edf-public-words-utilization	KWords	320	Encapsulation data structures. Contributors are forwarding next-hops.
Next-hops and encapsulation • IRP Memory: MPLS label memory	Exported property names: • mem-util-jnh-mpls-allocated • mem-util-jnh-mpls-size • mem-util-jnh-mpls-utilization	KWords	128	MPLS Label structures. Contributors are MPLS Labels.

Table 10: NPU utilization sensor (resource path /junos/system/linecard/npu/utilization/)

Native Sensor Property Name	gRPC Sensor Property Name	Unit Type	Range	Description
NPU Utilization • Utilization	Exported property names: • util-metric	percent	—	Current PE chip utilization. Contributor is traffic stream.
NPU Utilization • Packet Load	Exported property names: • util-loopback-pps-rate • util-recirculation-pps-rate • util-asic-to-host-pps-rate • util-wan-and-host-inject-pps-rate	pps	—	Traffic load on the chip which includes loopback, recirculated, WAN, and host-injected and ASIC-to-host traffic. Contributors are traffic stream pps.
NPU Utilization • Memory Load	Exported property names: • util-hmc-average-util • util-hmc-highest-util • util-hmc-lowest-util • util-hmc-average-cache-hit-rate • util-hmc-highest-cache-hit-rate • util-hmc-lowest-cache-hit-rate	percent/per-sec	—	HMC memory utilization and memory cache hit rate

Understanding YANG on Devices Running Junos OS

YANG is a standards-based, extensible data modeling language that is used to model the configuration and operational state data, remote procedure calls (RPCs), and server event notifications of network devices. The NETMOD working group in the IETF originally designed YANG to model network management data and to provide a standard for the content layer of the Network Configuration Protocol (NETCONF) model. However, YANG is protocol independent, and YANG data models can be used independent of the transport or RPC protocol and can be converted into any encoding format supported by the network configuration protocol.

Juniper Networks provides YANG modules that define the Junos OS configuration hierarchy and operational commands and Junos OS YANG extensions. You can download the YANG modules from the Juniper Networks website or the Juniper Networks GitHub repository for YANG, or you can generate the modules on the device running Junos OS.

YANG uses a C-like syntax, a hierarchical organization of data, and provides a set of built-in types as well as the capability to define derived types. YANG stresses readability, and it provides modularity and flexibility through the use of modules and submodules and reusable types and node groups.

A YANG module defines a single data model and determines the encoding for that data. A YANG module defines a data model through its data, and the hierarchical organization of and constraints on that data. A module can be a complete, standalone entity, or it can reference definitions in other modules and submodules as well as augment other data models with additional nodes.

A YANG module defines not only the syntax but also the semantics of the data. It explicitly defines relationships between and constraints on the data. This enables you to create syntactically correct configuration data that meets constraint requirements and enables you to validate the data against the model before uploading it and committing it on a device.

YANG uses modules to define configuration and state data, notifications, and RPCs for network operations in a manner similar to how the Structure of Management Information (SMI) uses MIBs to model data for SNMP operations. However, YANG has the benefit of being able to distinguish between operational and configuration data. YANG maintains compatibility with SNMP's SMI version 2 (SMIv2), and you can use libsmi to translate SMIv2 MIB modules into YANG modules and vice versa. Additionally, when you cannot use a YANG parser, you can translate YANG modules into YANG Independent Notation (YIN), which is an equivalent XML syntax that can be read by XML parsers and XSLT scripts.

You can use existing YANG-based tools or develop custom network management applications to utilize YANG modules for faster and more accurate network programmability. For example, a client application could leverage YANG modules to generate vendor-specific configuration data for different devices and validate that data before uploading it to the device. The application could also handle and troubleshoot unexpected RPC responses and errors.

For information about YANG, see RFC 6020, *YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)*, and related RFCs.

RELATED DOCUMENTATION

YANG Modules Overview

Using Juniper Networks YANG Modules

show system schema

Configure a NETCONF Proxy Telemetry Sensor in Junos

IN THIS SECTION

- Create a User-Defined YANG File | **418**
- Load the Yang File in Junos | **423**
- Collect Sensor Data | **424**
- Installing a User-Defined YANG File | **427**
- Troubleshoot Telemetry Sensors | **428**

Using Junos telemetry streaming, you can turn any available state information into a telemetry sensor by means of the XML Proxy functionality. The NETCONF XML management protocol and Junos XML API fully document all options for every supported Junos OS operational request. After you configure XML proxy sensors, you can access data over NETCONF “get” remote procedure calls (RPCs).

This task shows you how to stream the output of a Junos OS operational mode command.

BEST PRACTICE: We recommend not to use YANG files that map to a Junos OS operational command with extensive or verbose output. The output from some operational mode commands is dynamic and the level of their verbosity depends on factors such as the configuration and hardware. Examples of such commands include any variation of **show interfaces**, **show route**, **show arp**, **show bfd**, **show bgp**, and **show ddos-protection**. To check the verbosity level of a command, issue the ***command-name*| display xml | count** command. If the line count exceeds a value of 4000 lines, then the command is not recommended for XML proxy streaming. This value is more of an approximation based on internal base-lining. It can be less depending upon various factors such as device type, processing power of the device, and the existing CPU load. Consequently, this feature needs to be used judiciously based on how the device is performing. Using a YANG file that maps to a verbose command results in one or more of following::

- The xmlproxyd process CPU utilization remains high. If xmlproxyd has tracing enabled, the CPU utilization is even higher.
- An increase in the xmlproxyd process memory utilization.
- The xmlproxyd process state may show **sbwait**, indicating that the command output is verbose and that xmlproxyd is spending significant time reading the command's remote procedure call's (RPC's) output.
- The xmlproxyd sensor data does not complete the wrap.
- The xmlproxyd streams partial or no data for the sensors.
- The xmlproxyd misses reporting-interval cycles. The intervals start to overlap because of a command's verbose output, resulting in the xmlproxyd's sensor streaming data that is slow or delayed.
- The process or application that serves the verbose command's RPC may show high CPU numbers or delays in performing main tasks. This behavior is caused when the process or application is busy serving the RPC that has verbose output.

This task requires the following:

- An MX Series, vMX Series, or PTX Series router operating Junos OS Release 17.3R2 or later.
- Installation of the required Network Agent package (network-agent-x86–32–17.4R1.16-C1.tgz or later).
- A telemetry data receiver, such as OpenNTI, to verify proper operation of your telemetry sensor.

In this task, you will stream the contents of the Junos OS command **show system users**.

show system users (vMX Series)

```
user@switch> show system users
USER     TTY      FROM                              LOGIN@  IDLE WHAT
user1    pts/0       172.31.12.36                   12:40PM     39 -cli (cli)
user2    pts/1       172,16.03.25                    3:01AM      - -cli (cli)
```

In addition to the expected list of currently logged-in users, the **show system users** output also provides the average system load as 1, 5 and 15 minutes. You can find the load averages by using the **show**

system users | display xml command to view the XML tagging for the output fields. See **<load-average-1>**, **<load-average-5>**, and **<load-average-15>** in the XML tagging output below.

```
user@switch> show system users | display xml

<rpc-reply xmlns:junos="http://xml.juniper.net/junos/17.4R1/junos">
    <system-users-information xmlns="http://xml.juniper.net/junos/17.4R1/junos">
        <uptime-information>
            <date-time junos:seconds="1520170982">1:43PM</date-time>
            <up-time junos:seconds="86460">1 day, 40 mins</up-time>
            <active-user-count junos:format="2 users">2</active-user-count>
            <load-average-1>0.70</load-average-1>
            <load-average-5>0.58</load-average-5>
            <load-average-15>0.55</load-average-15>
            <user-table>
                <user-entry>
                    <user>root</user>
                    <tty>pts/0</tty>
                    <from>172.21.0.1</from>
                    <login-time junos:seconds="1520167202">12:40PM</login-time>
                    <idle-time junos:seconds="0">-</idle-time>
                    <command>cli</command>
                </user-entry>
                <user-entry>
                    <user>mwiget</user>
                    <tty>pts/1</tty>
                    <from>66.129.241.10</from>
                    <login-time junos:seconds="1520170862">1:41PM</login-time>
                    <idle-time junos:seconds="60">1</idle-time>
                    <command>cli</command>
                </user-entry>
            </user-table>
        </uptime-information>
    </system-users-information>
    <cli>
        <banner></banner>
    </cli>
</rpc-reply>
```

TIP: The **uptime-information** tag shown in the preceding output is a container that contains leafs, such as **date-time**, **up-time**, **active-user-count**. and **load-average-1**. Below is a sample YANG file for this container:

```
container uptime-information {
      dr:source "uptime-information"; // Exact name of the XML tag
      leaf date-time { // YANG model leaf
        type string; // Type of value
        dr:source date-time; // Exact name of the XML tag
      }
      leaf up-time { // YANG model leaf
        type string; // Type of value
        dr:source up-time; // Exact name of the XML tag
      }
      leaf active-user-count { // YANG model leaf
        type int32; // Type of value
        dr:source active-user-count; // Exact name of the XML tag
      }
      leaf load-average-1 { // YANG model leaf
        type string; // Type of value
        dr:source load-average-1; // Exact name of the XML tag
      }
      ...
```

TIP: The **uptime-information** tag also has another container named **user-table** that contains a list of user entries.

Below is a sample YANG file for this container:

```
container user-table { // "user-table" container which contains list of user-
entry
        dr:source "user-table"; // Exact name of the XML tag
        list user-entry { // "user-entry" list which contains the users' details
in form of leafs
          key "user"; // Key for the list "user-entry" which is a leaf in the
list "user-entry"
          dr:source "user-entry"; // Source of the list "user-entry" which is
```

```
the exact name of the XML tag
          leaf user { // YANG model leaf
            dr:source user; // A leaf in the list "user-entry", exact name of
the XML tag
            type string; // Type of value
          }
          leaf tty { // YANG model leaf
            dr:source tty; // A leaf in the list "user-entry", exact name of the
XML tag
            type string; // Type of value
          }
          leaf from { // YANG model leaf
            dr:source from; // A leaf in the list "user-entry", exact name of
the XML tag
            type string; // Type of value
          }
          leaf login-time { // YANG model leaf
            dr:source login-time; // A leaf in the list "user-entry", exact name
of the XML tag
            type string; // Type of value
          }
          leaf idle-time { // YANG model leaf
            dr:source idle-time; // A leaf in the list "user-entry", exact name
of the XML tag
            type string; // Type of value
          }
          leaf command { // YANG model leaf
            dr:source command; // A leaf in the list "user-entry", exact name of
the XML tag
            type string; // Type of value
          }
        }
      }
```

Create a User-Defined YANG File

The YANG file defines the Junos CLI command to be executed, the resource path the sensors are placed under, and the key value pairs taken from the matching XML tags.

Custom YANG files for Junos OS conform to the YANG language syntax defined in RFC 6020 YANG 1.0 *YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)* and RFC 7950

The YANG 1.1 Data Modeling Language. Certain directives need to be present in the file that configure XML proxy.

To use the **xmlproxyd** (daemon) process to translate telemetry data, create a ***render*.yang** file. In this file, the **dr:command-app** is set to **xmlproxyd**.

The XML proxy YANG filename and module name must start with **xmlproxyd_**:

- For the XML proxy YANG filename, add the extension **.yang**, for example, **xmlproxyd_sysusers.yang**
- For the module name, use the filename without the extension **.yang**, for example, **xmlproxyd_sysusers**

To simplify creating a YANG file, it's easiest to start by modifying a working example.

1. Provide a name for the module. The module name must start with **xmlproxyd_** and be the same name as the XML proxy YANG file name.

   For example, for an XML proxy YANG file called **sysusers.yang**, drop the **.yang** extension and name the module **xmlproxyd_sysusers**:

   module xmlproxyd_sysusers {

2. For the Junos telemetry interface, include the process (daemon) name **xmlproxyd**:

   dr:command-app "xmlproxyd";
3. Include the following RPC for the NETCONF get request:

   rpc juniper-netconf-get {
4. Specify the location of the output of the RPC, where *company-name* is the name you give to the location:

   dr:command-top-of-output "/company-name";
5. Include the following command to execute the RPC:

   dr:command-full-name "drend juniper-netconf-get";
6. Specify the CLI command from which to retrieve data. The Junos OS CLI command that gets executed at the requested sample frequency is defined under **dr:cli-command** and executed by the **xmlproxyd** daemon.

   To retrieve command output for the Junos OS command **show system users**:

   dr:cli-command "show system users";
7. Escalate privileges, logon as "root", connect to the internal management socket via Telnet, and specify help for an RPC:

   dr: command-help "default <get> rpc";

When this is included in the YANG file, output that is helpful for debugging is displayed in the **help drend** output on the internal management socket:

```
telnet /var/run/xmlproxyd_mgmt
Trying /var/run/xmlproxyd_mgmt...
Connected to /var/run/xmlproxyd_mgmt.
Escape character is '^]'.
220 XMLPROXYD release 18.2I20180412_0904_bijchand built by bijchand on
2018-04-12 14:48:48 UTC
help drend
```

200-juniper-netconf-get-0 system users <get> RPC

8. Specify the hierarchy and use the **dr:source** command to map to a container, a list, or a specific leaf. The absolute path under which the sensors will be reported is built from the output group **junos** plus **system-users-information**, concatenated by **/'**. The path **/junos/system-users-information/** is the path to query for information about this custom sensor.

WARNING: You should not create a custom YANG model that conflicts or overlaps with predefined native paths (Juniper defined paths) and OpenConfig paths (resources). Doing so can result in undefined behavior.

For example, do not create a model that defines new leafs at or augments nodes for resource paths such as **/junos/system/linecard/firewall**or **/interfaces**.

A one-to-one mapping between container, leafs and the XML tag or value from the CLI command output is defined in the grouping referenced by **uses** within the output container. A *grouping* can be referred to multiple times in different container outputs. The container **system-users-information** below uses the grouping system-users-information. However, it is defined without the aforementioned one-to-one mapping for every container, list and leaf to an output XML tag from the CLI command XML output.

```
output {
    container junos {
        container system-users-information {
            dr:source "/system-users-information";
            uses system-users-information-grouping;
        }
    }
}
```

9. The following YANG file shows how to include these commands to enable the **xmlproxyd** process to retrieve the full operational state and map it to the leafs in Juniper's own data model:

```
*/


/*
 * Example yang for generating OpenConfig equivalent of show system users
 */

module xmlproxyd_sysusers {
  yang-version 1;

  namespace "http://juniper.net/yang/software";

  import drend {
    prefix dr;
  }

  grouping system-users-information-grouping {
    container uptime-information {
      dr:source "uptime-information";
      leaf date-time {
        type string;
        dr:source date-time;
      }
      leaf up-time {
        type string;
        dr:source up-time;
      }
      leaf active-user-count {
        type int32;
        dr:source active-user-count;
      }
      leaf load-average-1 {
        type string;
        dr:source load-average-1;
      }
      leaf load-average-5 {
        type string;
        dr:source load-average-5;
      }
```

```
      leaf load-average-15 {
        type string;
        dr:source load-average-15;
      }
      container user-table {
        dr:source "user-table";
        list user-entry {
          key "user";
          dr:source "user-entry";
          leaf user {
            dr:source user;
            type string;
          }
          leaf tty {
            dr:source tty;
            type string;
          }
          leaf from {
            dr:source from;
            type string;
          }
          leaf login-time {
            dr:source login-time;
            type string;
          }
          leaf idle-time {
            dr:source idle-time;
            type string;
          }
          leaf command {
            dr:source command;
            type string;
          }
        }
      }
    }
  }

  dr:command-app "xmlproxyd";
  rpc juniper-netconf-get {
    dr:command-top-of-output "/company-name";
    dr:command-full-name "drend juniper-netconf-get";
    dr:cli-command "show system users";
```

```
    dr:command-help "default <get> rpc”;
output {
      container company-name {
        container system-users-information {
          dr:source "/system-users-information";
          uses system-users-information-grouping;
        }
      }
    }
  }
}
```

Load the Yang File in Junos

After the YANG file is complete, upload the YANG file and verify that the module is created.

1. Upload the YANG file to the router.
2. Register the YANG file using the **request system yang add package** command.

```
user@switch> request system yang add package sysusers proxy-xml module xmlproxyd_sysusers.yang
XML proxy YANG module validation for xmlproxyd_sysusers.yang : START
XML proxy YANG module validation for xmlproxyd_sysusers.yang : SUCCESS
JSON generation for xmlproxyd_sysusers.yang : START
JSON generation for xmlproxyd_sysusers.yang: SUCCESS
```

NOTE: Starting in Junos OS Release 18.3R1, adding, deleting, or updating YANG packages in configuration mode with the **run** command is not supported.

3. Verify that the module (sensor) is registered using the **show system yang package sysusers** command, where **sysusers** is the name of the package:

```
user@switch> show system yang package sysusers
Package ID               :sysusers
XML Proxy YANG Module(s) :xmlproxyd_sysusers.yang
```

4. Enable gRPC in the Junos OS configuration:

```
user@switch> set system services extension-service request-response grpc port 32767
```

Collect Sensor Data

Use your favorite collector to pull the newly created telemetry sensor data from the device.

Consider resource constraints before initiating sensors:

- Avoid specifying the same reporting interval for multiple XML proxy sensors.
- Because xmlproxyd performs XML and text processing, a device should only contain XML proxy sensors that execute within the CPU utilization range.

The following instructions use the collector *jtimon*. For information about jtimon setup, see Junos Telemetry Interface client.

1. Create a simple configuration file, here named **vmx1.json**. Adjust the host IP address and the port, as needed. The path **/junos/system-users-information** is specified. The **freq** field is defined in MicroSoft, streaming a new set of key value pairs every 5 seconds. Optionally, you can add multiple paths.

```
$ cat vmx1.json
{
  "host": "172.16.122.182
  "port": 32767
  "cid": "my-client-id",
  "grpc" : {
    "ws" : 524289
  },
  "paths": {
     {
       "path": "/junos/system-users-information/",
       "freq": 5000
     },
     {
       "path": "/junos/additional-path/",  <-OPTIONAL
       "freq": 5000
     }
   }
}
```

2. Launch the collector, using either your own compiled file or an automatically built image from Docker Hub. The sample query output below shows the sensor report by path. Every key is sent in human-readable form as an absolute path. In case of lists, the absolute path contains an index in the form of XPATH which is ideal to group values from a (time series) database, such as InfluxDB. For example, the output below shows the path **/junos/system-users-information/uptime-information/user-table/user-entry[user='ab']/**.

   You can terminate the stream of sensor data using Ctrl-C.

```
$ docker run -tu --rm -v $(PWD):/u mw/jtimon --config vmx1.json --print
gRPC headers from Junos:
  init-response: [response { subscription_id 1} path_list {path: "junos/
system-users-information/" sample-frequency: 5000 } ]
  content-type: [application/grpc]
  grpc-accept-encoding: [identity,deflate,gzip]
2018/03/04 17:13:19 system-id vmxdockerlight_vmx1_1
2018/03/04 17:13:19 component_id 65535
2018/03/04 17:13:19 sub_component_id: 0
2018/03/04 17:13:19 path: sensor_1000:/junos/system-users-information/:/junos/
system-users-information/
2018/03/04 17:13:19 sequence_number: 16689
2018/03/04 17:13:19 timestamp: 1520183589391
2018/03/04 17:13:19 sync_response: %!d(bool=false)
2018/03/04 17:13:19 key: __timestamp__
2018/03/04 17:13:19 uint_value: 1520183589391
2018/03/04 17:13:19 key: __junos_re_stream_creation_timestamp--
2018/03/04 17:13:19 uint value: 1520183589372
2018/03/04 17:13:19 key: __junos_re_payload-get_timestamp__
2018/03/04 17:13:19 uint_value: 1520183589390
2018/03/04 17:13:19 key: /junos/system-users-information/uptime-information/
date-time
2018/03/04 17:13:19 str-value: 5:13PM
2018/03/04 17:13:19 key: /junos/system-users-inforamtion/uptime-
information/up-time
2018/03/04 17:13:19 str-value: 1 day, 4:10
2018/03/04 17:13:19 key: /junos/system-users-information/uptime-information/
active-user-count
2018/03/04 17:13:19 int_value: 2
2018/03/04 17:13:19 key: /junos/system-users-inforamtion/uptime-information/
load-average-1
2018/03/04 17:13:19 str_value: 0.62
2018/03/04 17:13:19 key: /junos/system-users-information/uptime-information/
load-average-5
```

```
2018/03/04 17:13:19 str_value: 0.56
2018/03/04 17:13:19 key: /junos/system-users-inforamtion/uptime-information/
load-average-15
2018/03/04 17:13:19 str_value: 0.53
2018/03/04 17:13:19 key: __prefix__
2018/03/04 17:13:19 str_value: /junos/system-users-information/uptime-
information/user-table/user-entry[user='ab']/
2018/03/04 17:13:19 key: tty
2018/03/04 17:13:19 str_value: pts/1
2018/03/04 17:13:19 key: from
2018/03/04 17:13:19 str-value: 172,16.04.25
2018/03/04 17:13:19 key: login-time
2018/03/04 17:13:19 str_value: 5:12PM
2018/03/04 17:13:19 key: idle-time
2018/03/04 17:13:19 str-value: -
2018/03/04 17:13:19 key: command
2018/03/04 17:13:19 str_value: -cl
2018/03/04 17:13:19 system_id: vmxdockerlight_vmx1_1
2018/03/04 17:13:19 component_id: 65535
2018/03/04 17:13:19 sub_component_id: 0
2018/03/04 17:13:19 <output truncated>
```

The sample query shown below shows two sensor reports per path, then I terminated it with Ctrl-C. Every key is sent in human readable form as an absolute path and in case of lists, contains an index in form of XPATH, ideal to group values from a (time series) database like InfluxDB e.g. /junos/system-users-information/uptime-information/user-table/user-entry[user='ab']/

3. Verify that the module (sensor) is loaded using the **show system yang package sysusers** command, where **sysusers** is the name of the package:

```
user@switch> show system yang package sysusers
Package ID               :sysusers
XML Proxy YANG Module(s) :xmlproxyd_sysusers.yang
```

4. Enable gRPC in the Junos OS configuration:

```
user@switch> set system services extension-service request-response grpc port 32767
```

Installing a User-Defined YANG File

To add, validate, modify, or delete a user-defined YANG file for XML proxy for the Junos telemetry interface, use the **request system yang** set of commands from the operational mode:

1. Specify the name of the XML proxy YANG file and the file path to install it. This command creates a **.json** file in the **/opt/lib/render** directory.

```
user@switch> request system yang add package package-name proxy-xml module file-path-name
```

> **NOTE**: This command can be performed only on the current routing engine.
>
> To add multiple YANG modules with the **request system yang add package *package-name* proxy-xml module** command, enclose the ***file-path-name*** in brackets: **[*file-path-name 1 file-path-name 2*]**

2. (Optional) Validate an module before adding it to the router using the **request system yang validate proxy-xml module *module-name*** command. .

```
user@switch> request system yang validate proxy-xml module module-name
```

The output **XML proxy YANG module validation for xmlproxyd_<module-name> : SUCCESS** indicates successful module validation.

Mismatch error sometimes occur. If the command returns the error below, you can eliminate the error by using Junos OS Release 17.3R2 or later:

```
user@switch> request system yang validate proxy-xml module xmlproxyd_sysusers.yang
error: illegal identifier <identifier> , must not start with [xX][mM][lL]
```

3. (Optional) Update an existing XML proxy YANG file that was previously added.

```
user@switch> request system yang update package-name proxy-xml module file-path-name
```

4. Delete an existing XML proxy YANG file.

```
user@switch> request system yang delete package-name
```

5. Verify that the YANG file has been installed by entering the `show system yang package` command.

```
user@switch> show system yang package package-name
```

SEE ALSO

Understanding YANG on Devices Running Junos OS

Installing the Network Agent Package (Junos Telemetry Interface)

Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface)

Sending Requests to the NETCONF Server

Troubleshoot Telemetry Sensors

IN THIS SECTION

- Problem | 428

Problem

Description

Use the following methods to troubleshoot user-define telemetry sensors:

- Execute a tcpdump for the interface your gRPC requests came from (for this task, interface **fxp0** was used).

```
user@switch>monitor traffic interface fxp0 no-resolve matching "tcp port 32767"
```

- Enable traceoptions using the **set services analytics traceoptions flag xmlproxy** command. Check the **xmlproxyd** log file for confirmation of whether the CLI command's RPC was sent and if a response was received:

1. Issue the **show log xmlproxyd** command to show the xmlproxyd log. The value for the field **xmlproxy_execute_cli_command:** indicates if the RPC was sent or not. The value for the field **xmlproxy_build_context** indicates the command.

```
user@switch>show log xmlproxyd
Mar 4 18:52:46 vmxdockerlight_vmx1_1 clear-log[52495]: logfile cleared
Mar  4 18:52:51 xmlproxy_telemetry_start_streaming: sensor /junos/system-users-
information/
Mar  4 18:52:51 xmlproxy_build_context: command show system users merge-tag:
Mar  4 18:52:51 <command format="xml">show system users</command>
Mar  4 18:52:51 xmlproxy_execute_cli_command: Sent RPC..
Mar  4 18:52:51 <system-users-information xmlns="http://xml.juniper.net/junos/
17.4R1/junos" xmlns:junos="http://xml.juniper.net/junos/*/junos">
<uptime-information>
<date-time junos:seconds="1520189571">
6:52PM
</date-time>
<up-time junos:seconds="107400">
1 day,  5:50
</up-time>
<active-user-count junos:format="1 users">
1
</active-user-count>
<load-average-1>
0.94
</load-average-1>
<load-average-5>
0.73
</load-average-5>
<load-average-15>
0.65
```

SEE ALSO

Understanding YANG on Devices Running Junos OS

Installing the Network Agent Package (Junos Telemetry Interface)

Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface)

Sending Requests to the NETCONF Server

Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets

IN THIS SECTION

- Understanding Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | 430
- Enable Export of Subscriber Statistics and Queue Statistics | 432
- Guidelines for Exporting Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | 434
- gRPC Sensors for Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets (Junos Telemetry Interface) | 435

Understanding Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets

IN THIS SECTION

- About Subscriber and Queue Statistics | 430
- Enabling Export of Statistics | 431

You can use subscriber statistics and queue statistics for dynamic interfaces and interface-sets to support remote analytics and monitor Juniper devices that operate as a Broadband Network Gateway (BNG). Using these statistics, you can model and condition traffic flows in a subscriber access network.

About Subscriber and Queue Statistics

Subscriber statistics include the per-IP protocol family (IPv4 or IPv6) packet information (receive and transmitted packets and bytes) for a subscriber interface. They will only include subscriber data forwarded by the system. Filtered and dropped packets and control traffic are factored out and not delivered.

ON-CHANGE subscription support for interface meta-data sends asynchronous notifications when interfaces are created and deleted. After an initial baseline of delivering **create** notifications for all

existing interfaces, only notifications for interfaces that are being created or deleted are sent to an external collector.

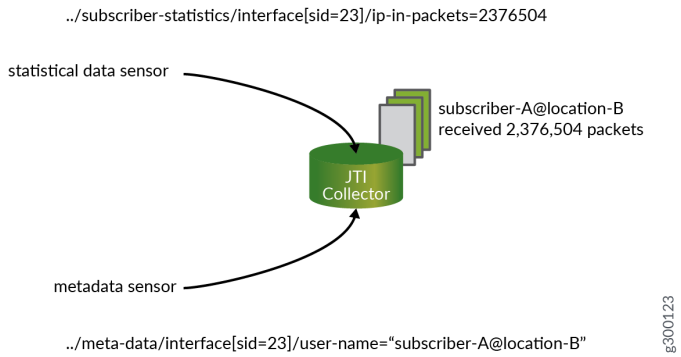
Use queue statistics to determine oversubscription levels, the mix of forwarding-class traffic, or traffic rates for a given CoS-enabled interface or interface-set.

Enabling Export of Statistics

To receive statistics, you enable both meta-data and statistical data for export on your Juniper device through the Junos CLI. Meta-data for the interface is provided because the interface key is a dynamic integer, a session identifier (SID), which conveys no context to an external server. The meta-data provides more tangible context (such as the user name, a profile name VLAN tags, etc.) to the SID. An external collector associates the statistical data to a persistent reference.

A subscription for both statistical data and meta-data can be made from the external collector (in Figure 2 on page 431, the JTI collector). In this way, the two streams are “merged” and a correlation is made between the statistical data and the meta-data. The dynamic SID is matched with the more permanent attributes such as user name and location.

Figure 2: JTI Collector “Merging” Sensor Data



SEE ALSO

gRPC Sensors for Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets (Junos Telemetry Interface) | 435

Guidelines for Exporting Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | 458

Enable Export of Subscriber Statistics and Queue Statistics | 446

telemetry | 578

Enable Export of Subscriber Statistics and Queue Statistics

You can enable the telemetry export of subscriber statistics and queue statistics for dynamic interfaces and interface-sets. After you enable telemetry for these statistics, they are eligible for export to one or more collectors using a remote procedure call (gRPC) subscription.

Use these statistics to model and condition traffic flows in a subscriber access network and to provide subscriber statistics information (accurate accounting).

To enable the export of subscriber statistics and associated interface meta-data:

1. Enable export of interface meta-data and subscriber statistics:

```
[edit dynamic-profiles profile-name]
user@host# set telemetry subscriber-statistics
```

2. Enable the logical demultiplexing (demux) interface in a dynamic profile to export subscriber accurate statistics:

```
[edit dynamic-profiles interfaces demux0]
user@host# unit $junos-interface-unit actual-transit-statistics
```

To enable export of interface meta-data and queue statistics for dynamic interfaces:

1. Enable export of interface meta-data and interface queue statistics. Use the profile variable **$junos-interface-name**.

> **NOTE**: the profile variables **$junos-interface-name** and **$junos-interface-set-name** are generated from the corresponding device, unit and interface-set elements in the interfaces stanza at profile instantiation time. Using these derived variables is a convenient way to configure telemetry behavior for the interface or interface-set without the need to mimic the specific configuration in the interfaces stanza.

```
[edit dynamic-profiles profile-name]
user@host# set telemetry queue-statistics interface $junos-interface-name
```

2. To override the default internal queue-stats collection interval of 900 seconds or the default queue export filter (all queues, 0-7), add the **rate** and **queues** statements.

```
[edit dynamic-profiles profile-name telemetry queue-statistics interface
$junos-interface-name]
user@host# set rate 300
user@host# set queues “0,1,2”
```

To enable export of interface-set meta-data and queue statistics for dynamic interface-sets:

1. Enable export of interface-set meta-data and interface-set queue statistics. Use the profile variable **$junos-interface-set-name**.

> **NOTE**: the profile variables **$junos-interface-name** and **$junos-interface-set-name** are generated from the corresponding device, unit and interface-set elements in the interfaces stanza at profile instantiation time. Using these derived variables is a convenient way to configure telemetry behavior for the interface or interface-set without the need to mimic the specific configuration in the interfaces stanza.

```
[edit dynamic-profiles profile-name]
user@host# set telemetry queue-statistics interface-set $junos-interface-set-name
```

2. To override the default internal queue-stats collection interval of 900 seconds or the default queue export filter (all queues, 0-7), add the **rate** and **queues** statements.

```
[edit dynamic-profiles profile-name telemetry queue-statistics interface-set
$junos-interface-set-name]
user@host# set rate 300
user@host# set queues “0,1,2”
```

After telemetry export is enabled, meta-data and statistics can be streamed to external collectors subscribing to the available resource paths.

Use the resource paths from "gRPC Sensors for Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets (Junos Telemetry Interface)" on page 435 for your gRPC subscription.

SEE ALSO

Understanding Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | 444

Guidelines for Exporting Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | 458

gRPC Sensors for Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets (Junos Telemetry Interface) | 435

Configure a NETCONF Proxy Telemetry Sensor in Junos | 414

Guidelines for Exporting Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets

You can use subscriber statistics and queue statistics for dynamic interfaces and interface-sets to support remote analytics and monitoring on MX Series routers that operate as a Broadband Network Gateway (BNG).

Before enabling export of subscriber statistics and queue statistics for dynamic interfaces and interface-sets, consider the following limitations:

- On MX Series routers supporting the Modular Port Concentrator 2 (MPC2), a slow internal refresh cycle for queue statistics can occur. This cycle can be lengthy at full line card scale. If the subscription frequency is higher than the internal refresh cycle, exported data may appear stale across reporting intervals.

- The unified in-service software upgrade (ISSU) feature enables you to upgrade your device between two different Junos OS releases with no disruption on the control plane and with minimal disruption of traffic. Dynamic interfaces and Interface-sets created prior to ISSU and prior to Junos OS Release 18.4R1 do not support telemetry for subscriber and queue statistics.

- The subscription frequency should be larger than the time to export telemetry. If the volume of data cannot be exported before the next reporting interval, the export continues to completion and the next reporting interval will immediately start. in such instances, continuous streaming results–behavior that may not be wanted.

- Multiple sensors from the dynamic-interfces sub-tree may be subscribed to simultaneously. As streaming of these sensors for the sub-tree is supported by a single Junos component, you should expect the time to export the sensor data for each subscription to extend.

- Juniper advises to enable export only for active queues. To do this, include the **queues** statement at the [**[edit** `dynamic-profiles` ***profile-name*** `telemetry`**queue-statistics $junos-interface-name]** or [**[edit dynamic-profiles *profile-name* telemetry queue-statistics $junos-interface-set-name]** hierarchy level. Exporting data for active queues only reduces the amount of data to export for each reporting interval.

SEE ALSO

Understanding Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | 444

Enable Export of Subscriber Statistics and Queue Statistics | 446

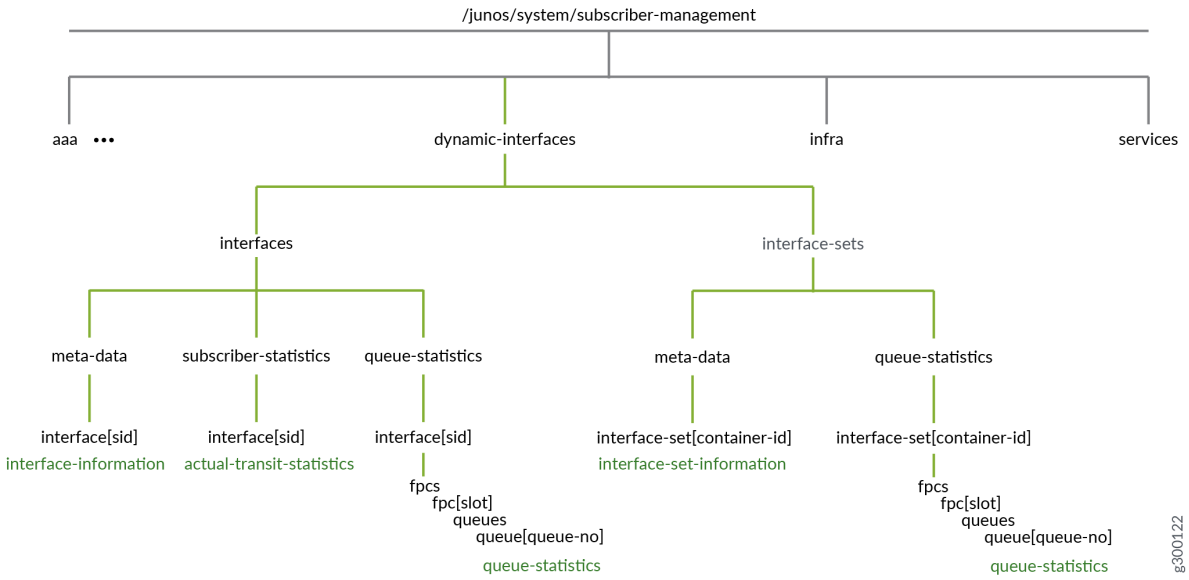
gRPC Sensors for Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets (Junos Telemetry Interface)

Starting with Junos OS Release 18.4R1, MX Series routers are supported.

You can use subscriber statistics and queue statistics for dynamic interfaces and interface-sets to support remote analytics and monitoring on Juniper devices that operate as a Broadband Network Gateway (BNG). Using these statistics, you can model and condition traffic flows in a subscriber access network.

Figure 3 on page 435 shows the structure of the sensors or resource paths used for subscription to the external collector. The resource paths are a combination of both meta-data and statistical data.

Figure 3: Structure of Sensors



For statistics delivery through a gRPC subscription, include one or more resource paths from Table 11 on page 436 in the subscription. For statistics delivered through gRPC, you will also need to install some additional software enable statistics to be exported on your Juniper device through the Junos CLI. For more information, see "Enable Export of Subscriber Statistics and Queue Statistics" on page 446. For more information about creating a subscription, see "Configure a NETCONF Proxy Telemetry Sensor in Junos" on page 414.

Table 11: gRPC Sensors

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

Table 11: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/subscriber-management/dynamic-interfaces/interfaces/meta-data/interface[sid='*sid-value*']/	Sensor for subscriber interface information. ON-CHANGE streaming is supported. The following end paths are supported: • **interface-index**-The system assigned interface index for the interface. • **session-type**-The type of client session (e.g VLAN, DHCP, PPPoE). • **user-name**-The login name for this interface and session. • **profile-name**-The name of the client profile used to create the interface. • **underlying-interface-name**-The name of the associated underlying interface. • **cvlan-tag**-The innermost VLAN tag value associated with the interface. • **svlan-tag**-The outermost VLAN tag value associated with the interface.

Table 11: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/subscriber-management/dynamic-interfaces/interfaces/subscriber-statistics/interface[sid='*sid-value*']/	Sensor for actual accounting statistics for dynamic subscriber interfaces. The following end paths are supported: • **ip-in-packets**-The number of actual transit IPv4 & IPv6 packets received by the interface. • **ip-out-packets**-The number of actual transit IPv4 & IPv6 packets sent to the interface. • **ip-in-bytes**-The number of actual transit IPv4 & IPv6 bytes received by the interface. • **ip-out-bytes**-The number of actual transit IPv4 & IPv6 bytes received by the interface. • **ipv6-in-packets**-The number of actual transit IPv6 packets received by the interface. • **ipv6-out-packets**-The number of actual transit IPv6 packets sent to the interface. • **ipv6-in-bytes**-The number of actual transit IPv6 bytes received by the interface. • **ipv6-out-bytes**-The number of actual transit IPv6 bytes sent to the interface.

Table 11: gRPC Sensors *(Continued)*

resource path	Description
/junos/system/subscriber-management/dynamic-interfaces/interfaces/queue-statistics/interface[sid='*sid-value*']/fpcs/fpc[slot='*slot-value*']/queues/queue/[queue-no='*queue-no-value*']/	Sensor for queue statistics for dynamic interfaces. The following end paths are supported: • **transmitted-packets**-The number of actual transit IPv4 & IPv6 packets received by the interface. • **transmitted-bytes**-Total bytes enqueued for this queue. • **dropped-packets**-Total packets dropped (because of RED, rate-limited, tail-drop, etc.) for the queue. • **dropped-bytes**-Total bytes dropped (because of RED, rate-limited, tail-drop, etc.) for the queue.
/junos/system/subscriber-management/dynamic-interfaces/interface-sets/queue-statistics/interface-set[container-id='*container-id-value*']/fpcs/fpc[slot='*slot-value*']/queues/queue/[queue-no='*queue-no-value*']/	Sensor for queue statistics for dynamic interface-sets. The following end paths are supported: • **transmitted-packets**-The number of actual transit IPv4 & IPv6 packets received by the interface. • **transmitted-bytes**-Total bytes enqueued for this queue. • **dropped-packets**-Total packets dropped (because of RED, rate-limited, tail-drop, etc.) for the queue. • **dropped-bytes**-Total bytes dropped (because of RED, rate-limited, tail-drop, etc.) for the queue.

SEE ALSO

Understanding OpenConfig and gRPC on Junos Telemetry Interface | 36

Release History Table

Release	Description
18.4R1	Starting with Junos OS Release 18.4R1, MX Series routers are supported.

Enabling Export of Transit SPRING Statistics

IN THIS SECTION

- Understanding Enabling Export of Transit SPRING Statistics | 440
- Enabling Collection of SPRING Statistics and Exporting Them | 442

Understanding Enabling Export of Transit SPRING Statistics

IN THIS SECTION

- About Transit Spring Statistics | 440
- Use a Valid SPRING Configuration | 440
- Enabling Export of Statistics | 442
- Exporting Statistics | 442

Source Packet Routing in Networking (SPRING), also known as segment routing, is a control-plane architecture that enables an ingress router to steer a packet through a specific set of nodes and links in the network. Starting in Junos OS Release 19.1R1, Junos telemetry interface (JTI) supports the export of transit SPRING statistics on PTX3000 routers and PTX5000 routers with FPC2. Use these statistics to monitor traffic, model engineering, and plan capacity.

About Transit Spring Statistics

Exported statistics are for SPRING traffic and exclude RSVP and LDP-signaled traffic. Family MPLS statistics per interface is accounted for separately. The segment routing statistics also include SPRING traffic statistics per link aggregation group (LAG) member and per segment identifier (SID).

Use a Valid SPRING Configuration

Statistics are not collected without the appropriate SPRING configuration in place. Before you enable SPRING statistics, verify your SPRING configuration on the device from which you will export statistics. Below is a sample Junos OS SPRING configuration.

Ingress Device

```
user@host# set groups isis protocols isis traffic-engineering family inet
shortcuts
user@host# set groups isis protocols isis source-packet-routing sensor-based-
stats per-sid ingress
user@host# set groups isis protocols isis source-packet-routing srgb start-label
400
user@host# set groups isis protocols isis source-packet-routing srgb index-range
20000
user@host# set groups isis protocols isis source-packet-routing node-segment
ipv4-index 1
user@host# set groups isis protocols mpls traffic-engineering bgp-igp-both-ribs
user@host# set groups isis protocols isis traffic-engineering family inet
shortcuts
user@host# set groups isis protocols isis traffic-engineering family inet-mpls
shortcuts
```

Transit Device

```
user@host# set groups isis protocols isis traffic-engineering family inet
shortcuts
user@host# set groups isis protocols isis source-packet-routing sensor-based-
stats per-sid ingress
user@host# set groups isis protocols isis source-packet-routing srgb start-label
400
user@host# set groups isis protocols isis source-packet-routing srgb index-range
20000
user@host# set groups isis protocols isis source-packet-routing node-segment
ipv4-index 2
user@host# set groups isis system services extension-service request-response
grpc clear-text port 50051
user@host# set groups isis system services extension-service request-response
grpc max-connections 8
user@host# set groups isis system services extension-service request-response
grpc skip-authentication
```

Egress Device

```
user@host# set groups isis protocols isis traffic-engineering family inet
shortcuts
```

```
user@host# set groups isis protocols isis source-packet-routing sensor-based-
stats per-sid ingress
user@host# set groups isis protocols isis source-packet-routing srgb start-label
400
user@host# set groups isis protocols isis source-packet-routing srgb index-range
20000
user@host# set groups isis protocols isis source-packet-routing node-segment
ipv4-index 3
```

For more information about configuring SPRING, see *Understanding Source Packet Routing in Networking (SPRING)*.

Enabling Export of Statistics

To receive statistics, you enable statistical data for export on your Juniper device through the Junos OS. To enable export, configure **per-sid-ingress** at the [**edit protocols isis source-packet-routing**] hierarchy level. For an example of how to configure this, see *Enabling Collection of SPRING Statistics and Exporting Them*.

Exporting Statistics

After you enable telemetry export for transit SPRING statistics, you can stream statistics to an outside collector using either remote procedure call (gRPC) services or a native sensor that exports statistics in UDP-format and requires a Junos OS configuration on the device.

SEE ALSO

> *Understanding Source Packet Routing in Networking (SPRING)*
>
> *Enabling Collection of SPRING Statistics and Exporting Them*

Enabling Collection of SPRING Statistics and Exporting Them

You can export through Junos telemetry interface (JTI) transit Source Packet Routing in Networking (SPRING) statistics, also known as segment routing statistics.

Before statistics can be exported, they need to be enabled for collection. After statistics are enabled for collection, you choose how they should be exported to an outside collector: gRPC services or a UDP-format using a native sensor.

To enable the export of transit SPRING statistics:

Enable sensor-based statistics per segment identifier for the ingress direction:

```
[edit protocols isis source-packet-routing]
user@host# set sensor-based-stats per-sid ingress
```

To export transit SPRING statistics using gRPC services:

1. Start gRPC services for the device by including the configuration below:

```
system {
    services {
        extension-service {
            request-response {
                grpc {
                    clear-text {
                        port 50051;
                    }
                    skip-authentication;
                }
            }
        }
    }
}
```

2. Create a subscription using the telemetrySubcribe remote procedure call. The subscription must contain telemetry parameters, including the resource path **/junos/services/segment-routing/sid/usage/**. For more information about configuring gRPC streaming and creating a subscription for statistics to be delivered to an outside collector, see *Understanding OpenConfig and gRPC on Junos Telemetry Interface*, *gRPC Services for Junos Telemetry Interface*, and *Configure a NETCONF Proxy Telemetry Sensor in Junos*.

3.

To export transit SPRING statistics in UDP-format using a native sensor:

1. Configure the *sensor* statement at the [**edit services analytics**] hierarchy level on the device. Include the sensor path (**/junos/services/segment-routing/sid/usage/**), an export profile name, a resource identifier string that enables monitoring and streaming of data for the specified system resource, and a server name to collect the data.

For more information about configuring a native sensor, see *Configuring a Junos Telemetry Interface Sensor (CLI Procedure)*.

SEE ALSO

Understanding Source Packet Routing in Networking (SPRING)

Release History Table

Release	Description
19.1R1	Starting in Junos OS Release 19.1R1, Junos telemetry interface (JTI) supports the export of transit SPRING statistics on PTX3000 routers and PTX5000 routers with FPC2

Understanding Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets

IN THIS SECTION

- About Subscriber and Queue Statistics | 444
- Enabling Export of Statistics | 445

You can use subscriber statistics and queue statistics for dynamic interfaces and interface-sets to support remote analytics and monitor Juniper devices that operate as a Broadband Network Gateway (BNG). Using these statistics, you can model and condition traffic flows in a subscriber access network.

About Subscriber and Queue Statistics

Subscriber statistics include the per-IP protocol family (IPv4 or IPv6) packet information (receive and transmitted packets and bytes) for a subscriber interface. They will only include subscriber data forwarded by the system. Filtered and dropped packets and control traffic are factored out and not delivered.

ON-CHANGE subscription support for interface meta-data sends asynchronous notifications when interfaces are created and deleted. After an initial baseline of delivering **create** notifications for all

existing interfaces, only notifications for interfaces that are being created or deleted are sent to an external collector.

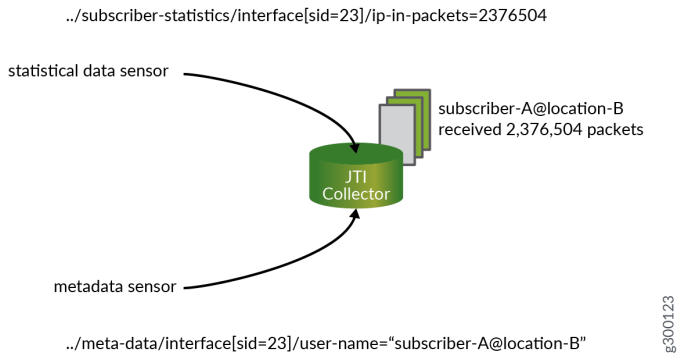
Use queue statistics to determine oversubscription levels, the mix of forwarding-class traffic, or traffic rates for a given CoS-enabled interface or interface-set.

Enabling Export of Statistics

To receive statistics, you enable both meta-data and statistical data for export on your Juniper device through the Junos CLI. Meta-data for the interface is provided because the interface key is a dynamic integer, a session identifier (SID), which conveys no context to an external server. The meta-data provides more tangible context (such as the user name, a profile name VLAN tags, etc.) to the SID. An external collector associates the statistical data to a persistent reference.

A subscription for both statistical data and meta-data can be made from the external collector (in Figure 4 on page 445, the JTI collector). In this way, the two streams are “merged” and a correlation is made between the statistical data and the meta-data. The dynamic SID is matched with the more permanent attributes such as user name and location.

Figure 4: JTI Collector “Merging” Sensor Data



RELATED DOCUMENTATION

gRPC Sensors for Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets (Junos Telemetry Interface) | 435

Guidelines for Exporting Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | 458

Enable Export of Subscriber Statistics and Queue Statistics | 446

telemetry | 578

Enable Export of Subscriber Statistics and Queue Statistics

You can enable the telemetry export of subscriber statistics and queue statistics for dynamic interfaces and interface-sets. After you enable telemetry for these statistics, they are eligible for export to one or more collectors using a remote procedure call (gRPC) subscription.

Use these statistics to model and condition traffic flows in a subscriber access network and to provide subscriber statistics information (accurate accounting).

To enable the export of subscriber statistics and associated interface meta-data:

1. Enable export of interface meta-data and subscriber statistics:

```
[edit dynamic-profiles profile-name]
user@host# set telemetry subscriber-statistics
```

2. Enable the logical demultiplexing (demux) interface in a dynamic profile to export subscriber accurate statistics:

```
[edit dynamic-profiles interfaces demux0]
user@host# unit $junos-interface-unit actual-transit-statistics
```

To enable export of interface meta-data and queue statistics for dynamic interfaces:

1. Enable export of interface meta-data and interface queue statistics. Use the profile variable **$junos-interface-name**.

> **NOTE**: the profile variables **$junos-interface-name** and **$junos-interface-set-name** are generated from the corresponding device, unit and interface-set elements in the interfaces stanza at profile instantiation time. Using these derived variables is a convenient way to configure telemetry behavior for the interface or interface-set without the need to mimic the specific configuration in the interfaces stanza.

```
[edit dynamic-profiles profile-name]
user@host# set telemetry queue-statistics interface $junos-interface-name
```

2. To override the default internal queue-stats collection interval of 900 seconds or the default queue export filter (all queues, 0-7), add the **rate** and **queues** statements.

```
[edit dynamic-profiles profile-name telemetry queue-statistics interface
$junos-interface-name]
user@host# set rate 300
user@host# set queues “0,1,2”
```

To enable export of interface-set meta-data and queue statistics for dynamic interface-sets:

1. Enable export of interface-set meta-data and interface-set queue statistics. Use the profile variable **$junos-interface-set-name**.

> **NOTE**: the profile variables **$junos-interface-name** and **$junos-interface-set-name** are generated from the corresponding device, unit and interface-set elements in the interfaces stanza at profile instantiation time. Using these derived variables is a convenient way to configure telemetry behavior for the interface or interface-set without the need to mimic the specific configuration in the interfaces stanza.

```
[edit dynamic-profiles profile-name]
user@host# set telemetry queue-statistics interface-set $junos-interface-set-name
```

2. To override the default internal queue-stats collection interval of 900 seconds or the default queue export filter (all queues, 0-7), add the **rate** and **queues** statements.

```
[edit dynamic-profiles profile-name telemetry queue-statistics interface-set
$junos-interface-set-name]
user@host# set rate 300
user@host# set queues “0,1,2”
```

After telemetry export is enabled, meta-data and statistics can be streamed to external collectors subscribing to the available resource paths.

Use the resource paths from "gRPC Sensors for Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets (Junos Telemetry Interface)" on page 435 for your gRPC subscription.

RELATED DOCUMENTATION

Understanding Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | 444

Guidelines for Exporting Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | 458

gRPC Sensors for Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets (Junos Telemetry Interface) | 435

Configure a NETCONF Proxy Telemetry Sensor in Junos | 414

Using gRPC Dial-Out for Secure Telemetry Collection

IN THIS SECTION

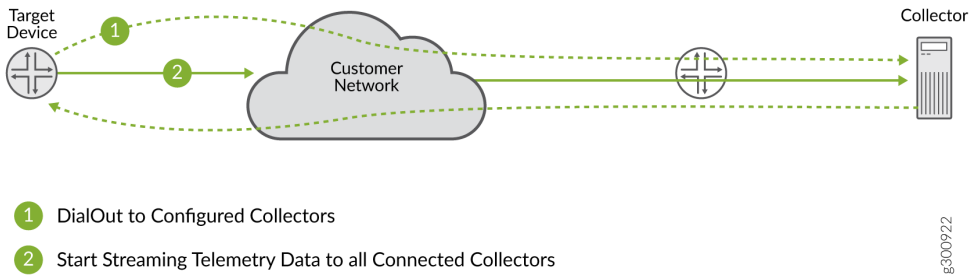
- Understanding gRPC Dial-Out | 448

Understanding gRPC Dial-Out

Starting with Junos OS Release 20.2R1, JTI supports remote gRPC dial-out support on ACX Series routers, MX Series routers, PTX Series routers, and QFX Series switches. With gRPC dialout, the target device (server) initiates a gRPC session with the collector (client). When the session is established, the target streams the telemetry data that is specified by the sensor-group subscription to the collector. This is in contrast to the gRPC network management interface (gNMI) dial-in method, in which the collector initiates a connection to the target device.

gRPC dial-out simplifies streaming telemetry statistics. Configuring the target device to stream statistics and export them to a collector IP address removes the burden of access being placed on the collector (client). (see Figure 5 on page 449).

Figure 5: gRPC Dial-Out with



gRPC dial-out provides several benefits as compared to gRPC dial-in:

- Reduces target device exposure to threats outside of their topology.
- Simplifies access to a target device. The gRPC Dial-In method requires a collector to overcome a series of complex firewall configurations to gain access to the target device. gRPC Dial-Out does not.
- Collectors can be stateless; without the need to initiate a session, they simply listen, subscribe, and store collected data.
- Support mutual encryption for heightened security.

To enable export of statistics, include the **export-profile** and **sensor** statements at the [**edit services analytics**] hierarchy level. The export profile must include the reporting rate, the transport service (for example, gRPC), and the format (for example, gbp-gnmi). The sensor configuration should include the name of the collector (the server's name), the name of the export profile, and the resource path. An example of a resource path is **/interfaces/interface[name='fxp0'**.

Starting with Junos OS Evolved Release 20.2R1, gRPC dialout is supported on PTX Series routers.

Release History Table

Release	Description
20.2R1	Starting with Junos OS Release 20.2R1, JTI supports remote gRPC dial-out support on ACX Series routers, MX Series routers, PTX Series routers, and QFX Series switches.
20.2R1	

20.2R1	Starting with Junos OS Evolved Release 20.2R1, gRPC dialout is supported on PTX Series routers.

CHAPTER 4

Best Practices for Implementing Junos Telemetry Interface

IN THIS CHAPTER

- Guidelines for Specifying Data Reporting Intervals Junos Telemetry Interface | 451
- Guidelines for Aggregating Junos Telemetry Interface Data | 452
- Guidelines for Exporting Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | 458

Guidelines for Specifying Data Reporting Intervals Junos Telemetry Interface

IN THIS SECTION

- How to Determine the Reporting Interval for a System Resource | 452

The Junos telemetry interface enables you to provision sensors to collect and export data for various system resources without involving polling. A request to send data is sent once by a management station to stream periodic updates.

You can configure telemetry sensors to report data at a specified interval either through the command-line interface (CLI) or through the OpenConfig for Junos **telemetrySubscribe** remote procedure call (RPC). To configure using the CLI, include the **reporting-rate** ***seconds*** statement at the **[edit services analytics** `export-profile` ***profile-name***] hierarchy level. For the **telemetrySubscribe** RPC, specify the sampling interval parameter, in milliseconds. In both cases, the interval specifies the amount of time between each subsequent export of data.

How to Determine the Reporting Interval for a System Resource

To determine the appropriate reporting interval for a specific system resource, follow these guidelines:

- Identify the required export interval for a given object, such as an interface.
- Identify the maximum number of objects reported by the sensor, such as the number of physical interfaces configured on a line card.
- Identify the minimum number of objects reported on each interval for a given sensor.
- Use the following formula to determine the best reporting interval:
  - Reporting interval = Required Export Interval Per Object * Minimum Number of objects reported on each Interval / Maximum Number of Objects.

Consider this example. There is a business requirement to report interface statistics every 30 seconds. At every interval, 10 interface records are reported, and the total number of interfaces is 96 for each line card. Using the reporting-interval formula, the reporting interval should be 3.125 seconds. Currently, the reporting interval can be configured only as a multiple of 2, in seconds. Therefore, for this example, configure the reporting interval as 2 seconds in the CLI or 2000 milliseconds in the OpenConfig RPC.

TIP: The same metric might be reported more than once over a 30-second interval. For the purposes of effective visualization and data manipulation, it is quite common to aggregate data over fixed time spans.

RELATED DOCUMENTATION

Overview of the Junos Telemetry Interface | 2

Guidelines for Aggregating Junos Telemetry Interface Data

IN THIS SECTION

- Aggregating Data Over Fixed Time Spans | 453
- Aggregating Data From Multiple Sources | 456
- Aggregating Data for Multiple Metrics | 457

One important feature of the Junos telemetry interface is that data processing occurs at the collector that streams data, rather than the device. Data is not automatically aggregated, but it can be aggregated for analysis.

Data aggregation is useful in the following scenarios:

- Data for the same metric over fixed spans of time, such as, the average number physical interface ingress errors over a 30-second interval.
- Data from different sources (such as multiple line cards) for the same metric, such as label-switched path (LSP) statistics or filter counter statistics.
- Data from multiple sources, such as input and output statistics for aggregated Ethernet interfaces.

The follow sections describe how to perform data aggregation for various scenarios. The examples in these sections use the InfluxDB time-series database to accept queries on telemetry data. InfluxDB is an open source database written in Go specifically to handle time-series data.

Aggregating Data Over Fixed Time Spans

Aggregating data for the same metric over fixed spans of time is a common and useful way to detect trends. Metrics can include gauges, that is, single values, or cumulative counters. You might also want to aggregate data continuously.

Example: Aggregating Data for Gauge Metrics

In this example, data for **JuniperNetworksSensors.jnpr_interface_ext.interface_stats.egress_queue_info.current_buffer_occupancy** from **port.proto** is written to the InfluxDB database with tags that identify the host name, an interface name and corresponding queue number and measurement called **current_buffer_occupancy**. See Table 12 on page 453 for the specific values used in this example.

Table 12: Telemetry Data Values

Time Stamp (seconds)	Value	Tags
1458704133	1547	queue_number=0,interface_name='xe-1/0/0',host='sjc-a'
1458704143	3221	queue_number=0,interface_name='xe-1/0/0',host='sjc-a'

Table 12: Telemetry Data Values *(Continued)*

Time Stamp (seconds)	Value	Tags
1458704155	4860	queue_number=0,interface_name='xe-1/0/0',host='sjc-a'
1458704166	6550	queue_number=0,interface_name='xe-1/0/0',host='sjc-a'

Each measurement data point has a timestamp and recorded value. In this example, the tag **queue_number** is the numerical identifier of the interface queue.

To aggregate this data over 30-second intervals, use the following influxDB query:

```
select mean(value) from current_buffer_occupancy
          where  time >= $time_start and time <= $time_end and
                           queue_number='0' and interface_name='xe-1/0/0' and
host='sjc-a'
                   group by time(30s)
```

For **$time_start** and **$time_end**, specify the actual range of time.

Example: Aggregating Data for Cumulative Statistics

Some Junos telemetry interface sensors report cumulative counter values, such as the number of ingress packets, defined as **JuniperNetworksSensors.jnpr_interface_ext.interface_stats.ingress_stats.packets**.

It is common to derive traffic rates from packet or byte counters. Unlike with gauge metrics, the initial data point in the series for cumulative counters is used only to set the baseline.

Use the following guidelines to create a database query for cumulative statistics:

- Calculate the cumulative value for a specific time interval. You can calculate either an average among several data points recorded during the time interval, or you can interpolate a value. All data points should belong to the same series. If a counter reset has occurred between the two data points reported at different times, do not use both data points.
- Determine the appropriate value for the previous time interval. If a counter has been reset since the last update, declare that value as unavailable.

- If the previous interval is available, calculate the difference between the data points and the traffic rate.

These guidelines are summarized in the following influxDB query. This query assumes that data is stored in the measurement **ingress_packets**. The query uses the same tags as the gauge metric example as well as the tag for counter initialization time, **init_time**. The query uses average values over a 30-second time interval. It calculates the rate for the metrics that have the same counter initialization.

```
select non_negative_derivative(mean(value)) from ingress_packets
        where  time >= $time_start and time <= $time_end and
               interface_name='xe-1/0/0' and host='sjc-a'
        group by time(30s), init_time
```

Use the following query to calculate the number of packets received over an interval of time, without deriving the rate.

```
select difference(mean(value)) from ingress_packets
           where  time >= $time_start and time <= $time_end and
                  interface_name='xe-1/0/0' and host='sjc-a'
           group by time(30s), init_time
```

In some cases, more than one aggregated data point is returned by the query for a particular time interval. For example, four data points are available for a time interval. Two data points have **init_time t0**, and the other two have **init_time t1**. You can run a query that uses the last change timestamp tag, **last_change**, instead of **init_time**, to calculate the difference and to derive the rate between the two data points with the same last change timestamp.

```
select difference(mean(value)) from ingress_packets
                   where  time >= $time_start and time <= $time_end and
                             interface_name='xe-1/0/0' and host='sjc-a'
       group by time(30s), last_change
```

TIP: These queries can all be run as continuous queries and can periodically populate new time-series measurements.

Aggregating Data From Multiple Sources

Certain metrics are reported from multiple line cards or packet forwarding engines. It is useful to aggregate data derived from different sources in the following scenarios:

- Packet and byte counts for label-switched paths (LSPs) are reported separately by each line card. However, a view of LSP paths for the entire device is required for path computation element controllers.
- For Juniper Networks devices that support virtual output queues, the tail drop or random early detection drop statistics for each queue are reported separately by each line card for every physical interface. It is useful to be able to aggregate the statistics for all the line cards for an interface.
- Filter counters for a firewall filter attached to a forwarding table or to an aggregated Ethernet interface are reported separately by each line card. It is useful to aggregate the statistics for all the line cards.

To aggregate data from multiple sources, perform the following:

1. Aggregate data for a specific period of time for each source, for example, each line card.
2. Aggregate the data you derive for each source in *step 1*.

For data stored in an InfluxDB database, you can complete *step 1* in the procedure by running a continuous query and populating a new measurement. We strongly recommend that you group the data points according to each source. For example, for LSP statistics, the **component_id** in the the gpb message identifies the line card sending the data. Group the data points based on each unique **component_id**.

Example: Aggregating Data from Multiple Sources

In this example, you run two queries to derive the LSP packet rate for data from all line cards.

First, you run the following continuous query on the measurement named **lsp_packet_count** for each **component_id** tag and the **counter_name** tag. Each unique **component_id** tag corresponds to a different line card. This query populates a new measurement, **lsp_packet_rate.**

```
select non_negative_derivative(mean(value)) as value from lsp_packet_count
          into lsp_packet_rate
          group by time(30s), component_id, counter_name, host
```

NOTE: The LSP statistics sensor does not report counter initialization time.

Use the new measurement derived from this continuous query—**lsp_packet_count**—to run the following query, which aggregates data from all line cards for packet rates for an LSP named **lsp-sjc-den-1**.

```
select sum(value) from lsp_packet_rate
          where counter_name='lsp-sjc-den-1', host='sjc-a'
```

NOTE: Because this query does not group data according to the **component_id** tag, or line card, the LSP packet rates from all components, or line cards, are returned.

Aggregating Data for Multiple Metrics

It can be useful to aggregate metrics for multiple values. For example, for aggregated Ethernet interfaces, you would typically want to track packet and byte rates for each interface member as well as interface utilization for the aggregated link.

Example: Aggregating Multiple Metric Values

In this example, you run the following two queries:

- Continuous query to derive ingress packet counts for each member link in an aggregated Ethernet interface
- Query to aggregate packet count data for all the member links that belong to the same aggregated Ethernet interface

The following continuous query derives a measurement, **ingress_packets**, for each member link in an aggregated Ethernet interface. The **interface_name** tag identifies each member interface. You also use the **parent_ae_name** tag to identify membership in a specific aggregated Ethernet interface. Grouping each member link with the **parent_ae_name** tag ensures that data is collected only for current member links. For example, an interface might change its membership during the reporting interval. Grouping member interfaces with the specific aggregated Ethernet interface means that data for the member link will not be transferred to the new aggregated Ethernet interface of which it is now a member.

```
select difference(mean(value)) as value from ingress_packets
       into ingress_packets_difference
       group by time(30s), component_id, interface_name, host, parent_ae_name
```

The following query aggregates data for the ingress packets for the aggregated Ethernet interface, that is all member links.

```
select sum(value) from ingress_packets_difference
       where parent_ae_name='ae0' and host='sjc-a'
```

NOTE: This query aggregates data for aggregated Ethernet interface **ae0**. The **parent_ae_name** tag does not verify the actual member links.

RELATED DOCUMENTATION

Overview of the Junos Telemetry Interface | 2

Guidelines for Exporting Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets

You can use subscriber statistics and queue statistics for dynamic interfaces and interface-sets to support remote analytics and monitoring on MX Series routers that operate as a Broadband Network Gateway (BNG).

Before enabling export of subscriber statistics and queue statistics for dynamic interfaces and interface-sets, consider the following limitations:

- On MX Series routers supporting the Modular Port Concentrator 2 (MPC2), a slow internal refresh cycle for queue statistics can occur. This cycle can be lengthy at full line card scale. If the subscription frequency is higher than the internal refresh cycle, exported data may appear stale across reporting intervals.
- The unified in-service software upgrade (ISSU) feature enables you to upgrade your device between two different Junos OS releases with no disruption on the control plane and with minimal disruption of traffic. Dynamic interfaces and Interface-sets created prior to ISSU and prior to Junos OS Release 18.4R1 do not support telemetry for subscriber and queue statistics.
- The subscription frequency should be larger than the time to export telemetry. If the volume of data cannot be exported before the next reporting interval, the export continues to completion and the next reporting interval will immediately start. in such instances, continuous streaming results–behavior that may not be wanted.

- Multiple sensors from the dynamic-interfces sub-tree may be subscribed to simultaneously. As streaming of these sensors for the sub-tree is supported by a single Junos component, you should expect the time to export the sensor data for each subscription to extend.
- Juniper advises to enable export only for active queues. To do this, include the **queues** statement at the [**[edit** `dynamic-profiles` ***profile-name*** `telemetry`**queue-statistics $junos-interface-name]** or [**[edit dynamic-profiles *profile-name* telemetry queue-statistics $junos-interface-set-name]** hierarchy level. Exporting data for active queues only reduces the amount of data to export for each reporting interval.

RELATED DOCUMENTATION

Understanding Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | **444**

Enable Export of Subscriber Statistics and Queue Statistics | **446**

PART 2

Junos Telemetry Interface Plug-ins

Network Telemetry Framework (NTF) Agent | 461

Open Source Plug-ins | 465

CHAPTER 5

Network Telemetry Framework (NTF) Agent

IN THIS CHAPTER

- NTF Agent Overview | 461
- Configuring NTF Agent | 462

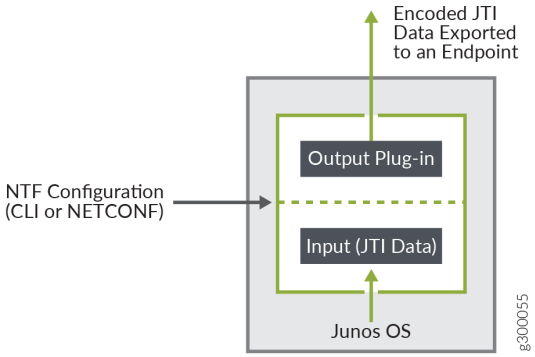
NTF Agent Overview

Junos OS exposes telemetry data over gRPC and UDP as part of the Junos telemetry interface (JTI). One way to stream JTI data into your existing telemetry and analytics infrastructure requires managing an external entity to convert the data into a compatible format. Starting in Junos OS Release 18.4R1, the Network Telemetry Framework (NTF) agent feature provides an on-box solution that allows you to configure and customize to which endpoint (such as IPFIX and Kafka) the JTI data is delivered and in which format (such as AVRO, JSON, and MessagePack) the data is encoded.

NTF agent uses an output plug-in to translate JTI data into a format that is suitable for a particular endpoint. NTF agent subscribes to JTI data with user-defined sensor information. On receiving data, NTF agent uses the output plug-in to encode the data in the format that is required by the endpoint and

then exports the translated data to the endpoint (see Figure 6 on page 462). NTF agent can be configured using Junos OS CLI or NETCONF.

Figure 6: NTF Agent Architecture



RELATED DOCUMENTATION

Configuring NTF Agent | 462

Configuring NTF Agent

To configure a Network Telemetry Framework (NTF) agent instance to send telemetry data to a single endpoint:

1. Create a service agent instance.

```
[edit services analytics agent]
user@host# edit service-agents agent-name
```

2. Configure parameters for the service agent input plug-in. The input plug-in options include **analytics**, **input-ipfix**, and **input-jti-ipfix**. See the "inputs" on page 591 configuration statement for a description of the syntax.

NOTE: When you modify the input plug-in configuration of a service agent instance, the associated service agent daemon is restarted.

```
[edit services analytics agent service-agents agent-name]
user@host# edit inputs input-plugin-name parameters key-value-pairs
```

3. Configure parameters for the service agent output plug-in. Parameters are based on the key/value pair requirements of the output plug-in. For each service agent instance, you can configure only one endpoint to which to export data. The output plug-in options include **ouput-ipfix**, **kafka**, and **file**. See the "outputs" on page 595 configuration statement for a description of the syntax.

NOTE: When you modify the output plug-in configuration of a service agent instance, the associated service agent daemon is restarted.

```
[edit services analytics agent service-agents agent-name]
user@host# set outputs ouput-plugin-name parameters key-value-pairs
```

4. (Optional) For each service agent instance, you can configure more than one input plug-in to push data to the output plug-in. To illustrate, the basic format of the configuration looks like:

```
[edit services analytics agent service-agents agent1]
    inputs {
    input-plugin1 {
        parameters {
            input-plugin1-key-value-pairs;
        }
    }
    input-plugin2 {
        parameters {
            input-plugin2-key-value-pairs;
        }
    }
}
    outputs {
        output-plugin {
            parameters {
                output-plugin-key-value-pairs;
```

```
            }
        }
    }
```

5. (Optional) Delete a service agent instance.

```
user@host# delete services analytics agent service-agents agent-name
```

To configure tracing operations for NTF agent:

1. Specify the name of the file to receive the output of the tracing operation. The file is stored in the /var/log/ directory of your device.

```
[edit services analytics agent]
user@host# edit traceoptions filename filename
```

2. Specify the severity level for messages to be logged.

```
[edit services analytics agent]
user@host# edit traceoptions flag {debug | error | info | trace}
```

SHOW COMMANDS and LOG FILES

1. Display the running service agent instances of the NTF agent.

```
user@host> show services analytics agent [brief | detail]
```

2. Additionally, view information about service agent instances, such as whether the input and output plug-ins have been initialized, in the service agent log file: /var/log/*agent-name*.log.

RELATED DOCUMENTATION

Configuring the BNG as an IPFIX Mediator to Collect and Export IPFIX Data

Configuring the Collection and Export of Local Telemetry Data on the IPFIX Mediator

IPFIX Mediation on the BNG

NTF Agent Overview | **461**

Telemetry Data Collection on the IPFIX Mediator for Export to an IPFIX Collector

CHAPTER 6

Open Source Plug-ins

IN THIS CHAPTER

- JTI Plug-ins for Open Source Data Collectors | 465

JTI Plug-ins for Open Source Data Collectors

Well-known open source data collectors, such as Telegraf, Fluentd, and Logstash, have a plug-in-based architecture, where Junos Telemetry Interface (JTI) plug-ins can be written to translate JTI data into a format that can be easily understood by the collector. The following table provides links to the public JTI plug-in files for transporting JTI data over UDP and gRPC.

Open Source Data Collector	JTI Plug-ins for Protobuf Encoding over UDP	JTI Plug-ins for OpenConfig key-value Pairs over gRPC
Telegraf	telegraf-jti-plugins	jti_openconfig_telemetry
Fluentd	fluent-plugin-udp-native-sensors	fluent-plugin-grpc-oc-keyvalue
Logstash	logstash-plugin-udp-native-sensors	logstash-plugin-grpc-oc-keyvalue

3

PART

J-Insight Device Monitor

Understanding J-Insight Device Monitor | 467

CHAPTER 7

Understanding J-Insight Device Monitor

IN THIS CHAPTER

- J-Insight Device Monitor Overview | 467
- J-Insight Device Monitor Basic Configuration | 470

J-Insight Device Monitor Overview

IN THIS SECTION

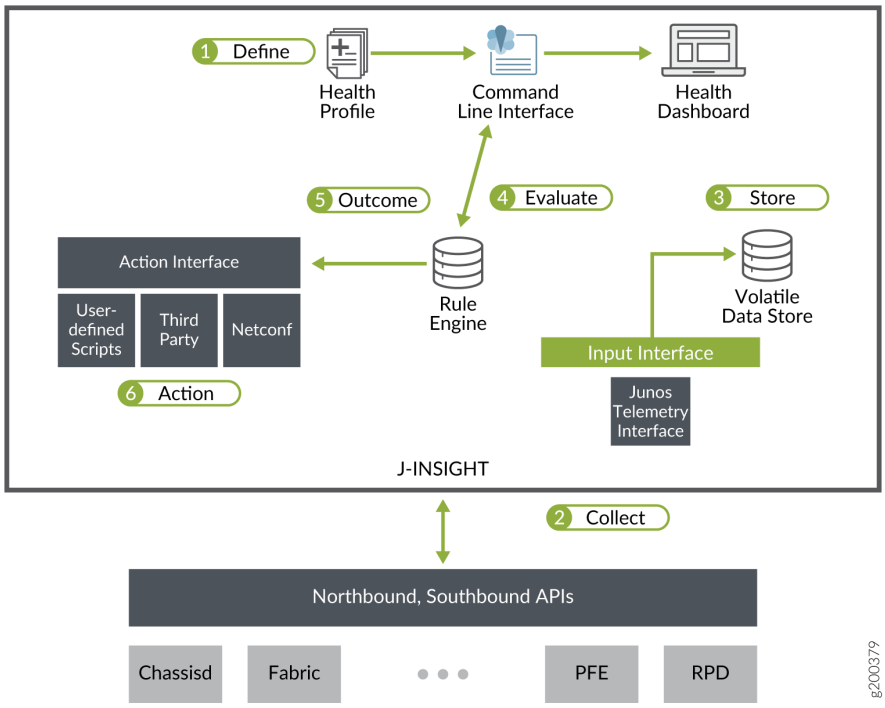
- Understanding How J-Insight Health Monitoring Works | 468
- Understanding How J-Insight Fault Monitoring Works | 469

As networks become increasingly complex, the need to adopt features that simplify the process of monitoring, maintaining, and improving the overall health of your networking devices becomes increasingly critical to delivering services in a more predictable and manageable way.

J-Insight is a data-driven device monitoring solution that provides visibility and insight into the health of a running system. Starting with Junos OS Release 18.2R1, the J-Insight framework facilitates real-time monitoring of system resources for FPC FRUs. It also has been integrated with the existing connectivity

error management infrastructure to normalize error detection, monitoring, and reporting. The long-term goal for the architectural design of the J-Insight device monitor is depicted in Figure 7 on page 468.

Figure 7: Long-term High-level Architecture for J-Insight



J-Insight is an on-premise system application that uses the Junos Telemetry Interface to continuously collect data that is reflective of the current state and health of the device component being monitored.

Understanding How J-Insight Health Monitoring Works

Starting in Junos OS Release 18.2R1, J-Insight provides health monitoring capabilities for FPC FRUs on the MX series routers. As part of this initial release, the J-Insight health monitor supports the following process flow (see Figure 7 on page 468):

1. Consumes a pre-defined static health profile. The health profile is not user-configurable through the Junos OS CLI.

2. Using the Junos Telemetry Interface (JTI) framework, subscribes to health KPIs specified in the default health profile. J-Insight health monitor subscribes to JTI sensors using a standard interface. Health monitor subscription and reporting is disabled, by default, and can be enabled through the Junos OS CLI. Starting with Junos OS Release 18.2R1, the following health KPIs are supported for MX-based FPCs:

- CPU utilization
- Temperature sensors
- PFE memory utilization
- Fabric reachability

3. Collates the JTI data streams collected from various sub-systems.
4. Evaluates the health data against configured thresholds and reports the health status.

Understanding How J-Insight Fault Monitoring Works

Starting with Junos OS Release 18.2R1, J-Insight utilizes the connectivity error management infrastructure to normalize error detection, monitoring, and reporting. Through this infrastructure, J-Insight also provides the capability to define data-driven fault policies. Each module can define error properties by reading a DST/capability file. The fault monitoring capability is available by default in Junos OS and cannot be enabled or disabled through the CLI.

Each error is defined by the following properties:

- **URI**—Error identifier. Each error is uniquely identified with an error ID that is represented as a Uniform Resource Identifier (URI).
- **Error**—Error name.
- **Scope**—Error scope. An error scope provides a level of classification above the error category. Examples of error scope values include: pfe and board.
- **Category**—Error category. An error category categories errors into various subgroups under a specific error scope level. Examples of error category values include: memory, processing, and storage.
- **Details**—Description for the error.
- **Count**—The number of times error instances have occurred.
- **Clear count**—The number of times error instances have been cleared.
- **Support**—Support details for the error type.

RELATED DOCUMENTATION

J-Insight Device Monitor Basic Configuration | 470

J-Insight Device Monitor Basic Configuration

IN THIS SECTION

- Before you Begin | 470
- J-Insight Health Monitoring | 473
- J-Insight Fault Monitoring | 474

Before you Begin

NOTE: If you're running Junos OS Evolved software, you do not need to perform the procedures in this "Before you Begin" section.

J-Insight requires that your Junos OS device supports the Junos Telemetry Interface (JTI). For information about JTI, see the Junos Telemetry Interface User Guide. To use J-Insight, you must first complete the following steps:

1. Install the Junos OS Release 18.2R1 or later Junos Network Agent software package. For information on how to install Junos Network Agent, see "Installing the Network Agent Package (Junos Telemetry Interface)" on page 65.

2. Use 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
[18.2|20180508_0022_builder]
```

3. Install the Junos OS Release 18.2R1 or later OpenConfig for Junos OS software package. For information on how to install OpenConfig for Junos OS, see *Installing the OpenConfig Package*.

4. Use the **show version | grep "opencpnfig"** command to verify that the OpenConfig package was successfully installed.

```
user@host> show version | grep "opencpnfig"
JUNOS Openconfig
[0.0.0|20180503_1001_rbu-builder]
```

5. Use the **show agent sensors** command to verify whether or not J-Insight has successfully subscribed to sensors on which it is dependent.

```
user@host> show agent sensors
.
.
.
Sensor Information :

    Name                                    : sensor_1000
    Resource                                : /junos/events/
event[id='CHASSISD_SNMP_TRAP7']/
    Version                                 : 1.0
    Sensor-id                               : 539528115
    Subscription-ID                         : 1000
    Parent-Sensor-Name                      : Not applicable
    Component(s)                            : eventd

    Profile Information :

        Name                                : export_1000
        Reporting-interval                  : 0
        Payload-size                        : 5000
        Format                              : GPB

Sensor Information :

    Name                                    : sensor_1001
    Resource                                : /junos/system/cmerror/
configuration/
    Version                                 : 1.0
    Sensor-id                               : 539528114
    Subscription-ID                         : 1001
    Parent-Sensor-Name                      : Not applicable
```

```
    Component(s)                            : PFE

    Profile Information :

        Name                                : export_1001
        Reporting-interval                  : 6
        Payload-size                        : 5000
        Format                              : GPB

Sensor Information :

    Name                                    : sensor_1002
    Resource                                : /junos/system/cmerror/counters/
    Version                                 : 1.0
    Sensor-id                               : 539528113
    Subscription-ID                         : 1002
    Parent-Sensor-Name                      : Not applicable
    Component(s)                            : PFE

    Profile Information :

        Name                                : export_1002
        Reporting-interval                  : 6
        Payload-size                        : 5000
        Format                              : GPB

Sensor Information :

    Name                                    : sensor_1003
    Resource                                : /components/
    Version                                 : 1.0
    Sensor-id                               : 539528112
    Subscription-ID                         : 1003
    Parent-Sensor-Name                      : Not applicable
    Component(s)                            : chassisd

    Profile Information :

        Name                                : export_1003
        Reporting-interval                  : 6
        Payload-size                        : 5000
        Format                              : GPB
```

```
Sensor Information :

    Name                                    : sensor_1004
    Resource                                : /junos/services/health-monitor/
config/
    Version                                 : 1.0
    Sensor-id                               : 539528119
    Subscription-ID                         : 1004
    Parent-Sensor-Name                      : Not applicable
    Component(s)                            : PFE

    Profile Information :

        Name                                : export_1004
        Reporting-interval                  : 7
        Payload-size                        : 5000
        Format                              : GPB

Sensor Information :

    Name                                    : sensor_1005
    Resource                                : /junos/services/health-monitor/
data/
    Version                                 : 1.0
    Sensor-id                               : 539528118
    Subscription-ID                         : 1005
    Parent-Sensor-Name                      : Not applicable
    Component(s)                            : PFE

    Profile Information :

        Name                                : export_1005
        Reporting-interval                  : 7
        Payload-size                        : 5000
        Format                              : GPB
```

J-Insight Health Monitoring

Starting with Junos OS Release 18.2R1, J-Insight supports health monitoring for FPC FRUs on the MX Series routers. The J-Insight health monitor is disabled by default.

- To enable the J-Insight health monitor:

```
user@host# set services jinsightd subscribe health-monitor
```

- To disable the J-Insight health monitor:

```
user@host# delete services jinsightd subscribe health-monitor
```

- To display the J-Insight health monitor results:

```
user@host> show system health-monitor [fpc fpc-slot slot-number]
```

J-Insight Fault Monitoring

IN THIS SECTION

- Chassis-level Configuration Commands | 474
- Trace Commands | 475
- Clear & Show Commands | 475

Starting with Junos OS Release 18.2R1, J-Insight supports fault monitoring for FPC FRUs on MX Series and PTX Series. Starting with Junos OS Evolved Release 19.1R1, J-Insight fault monitoring support is added for CB, chassis, fan, FPC, FPM, PDU, PIC, PSM, RE and SIB FRUs.

Chassis-level Configuration Commands

The Junos OS resiliency feature provides debugging capabilities in the case of device component failure. You can configure Packet Forwarding Engine (PFE)-related error levels on FRUs such as FPCs. Using the "error" on page 613 configuration statement, you can set an automatic recovery action for each severity and configure the actions to perform when a specified threshold is reached.

For more information, see the Chassis-Level User Guide.

Trace Commands

- (Junos OS only) To enable J-Insight trace options for debugging:

```
user@host# set services jinsightd traceoptions flag trace-option
```

- (Junos OS Evolved only) You can view collected J-Insight traces with the **show trace application jinsightd** command, and remove inactive J-Insight tracing sessions with the **clear trace application jinsightd** command.

Clear & Show Commands

- To clear all system errors or a specific error denoted by the error ID Uniform Resource Identifier (URI) for a specific FPC:

```
user@host> clear chassis fpc errors fpc-slot  slot-number [ all | error-id error-id- uri]
```

- To display information on alarms that have been triggered by faults:

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

- To display summary or detailed information about the active errors based on FRU, error scope, or error category:

```
user@host> show system errors active  [[fru slot-number] | [detail [fru slot-number
[scope error-scope ] [category error-category ]]]
```

- To display a summary of the number of detected errors and recovery actions taken based on severity level:

```
user@host> show system errors count
```

- To display information about a detected error based on its error ID URI:

```
user@host> show system errors error-id error-id-uri
```

- To display detailed information about the detected errors based on the FRU:

```
user@host> show system errors fru detail [fru slot-number]
```

RELATED DOCUMENTATION

J-Insight Device Monitor Overview | 467

PART 4

Configuration Statements and Operational Commands

Native Sensors Configuration Statements and Operational Commands | 478

gRPC Services Configuration Statements and Operational Commands | 533

Network Telemetry Framework (NTF) Configuration Statements and Operational Commands | 582

J-Insight Device Monitor Configuration Statements and Operational Commands | 607

CHAPTER 8

Native Sensors Configuration Statements and Operational Commands

IN THIS CHAPTER

- show configuration services analytics sensor ddos | 478
- export-profile (Junos Telemetry Interface) | 480
- sensor (Junos Telemetry Interface) | 484
- sensor-based-stats (Junos Telemetry Interface) | 517
- source-packet-routing | 518
- streaming-server (Junos Telemetry Interface) | 521
- show agent sensors | 524

show configuration services analytics sensor ddos

IN THIS SECTION

- Syntax | 478
- Description | 479
- Sample Output | 479
- Release Information | 479

Syntax

```
show configuration services analytics sensor ddos
```

Description

This command shows the DDOS configuration.

Sample Output

show configuration services analytics sensor ddos

```
user@host> show configuration services analytics sensor ddos
server-name sserver;
        export-name eprofile;
        resource /junos/system/linecard/ddos/;
    streaming-server sserver {
        remote-address 10.0.0.1;
        remote-port 2000;
    }
    export-profile eprofile {
        local-address 10.0.0.10;
        local-port 21111;
        reporting-rate 3000;
        format gpb;
    }
```

Release Information

Command introduced in Junos OS Release 21.1R1.

RELATED DOCUMENTATION

export-profile (Junos Telemetry Interface) | 480

sensor (Junos Telemetry Interface) | 484

streaming-server (Junos Telemetry Interface) | 521

export-profile (Junos Telemetry Interface)

IN THIS SECTION

- Syntax | 480
- Hierarchy Level | 480
- Description | 480
- Options | 481
- Required Privilege Level | 483
- Release Information | 483

Syntax

```
export-profile name {
    dscp value;
    format file-format;
    forwarding-class (assured-forwarding |  best-effort |  expedited-forwarding
| network-control);
    local-address ip-address;
    local-port source-port-number;
    loss-priority (high | low | medium-high | medium-low);
    <payload-size bytes>;
    reporting-rate seconds;
    transport protocol-name;
}
```

Hierarchy Level

```
[edit services analytics]
```

Description

Configure the parameters of the export process for data generated through Junos Telemetry Interface sensors. You can create one or more export profiles. Each profile can be associated with one or more

sensors that define the system resource to monitor and stream data. You can associate only one export profile with a specific sensor configuration.

The IP layer delivers the exported data to the remote server. The export profile configuration allows you to specify a format for exported data, a transport protocol, the rate which the system generates data, and the local source port and IP address that are used to define the transport headers in the exported packets.

To enable Junos Telemetry Interface, you must also configure a sensor that defines the parameters of the system resource to monitor and stream data, and a server to collect the data. To configure a sensor, include the `sensor` ***sensor-name*** statement at the **[edit services analytics]** hierarchy level. To configure the server that functions as a data collector, include `streaming-server` ***server-name*** statement at the **[edit services analytics]** hierarchy level.

> **NOTE**: Junos Telemetry Interface was introduced in Junos OS Release 15.1F3 on MX Series routers with interfaces configured on MPC1 through MPC6E and on PTX Series routers with interfaces configured on FPC3. Starting in Junos OS Release 15.1F5, Junos Telemetry Interface is also supported on MPC7E, MPC8E, and MPC9E on MX Series routers.
>
> Starting with Junos OS Release 16.1R3, FPC1 and FPC2 on PTX Series routers are also supported.
>
> Starting with Junos OS Release 17.2R1, QFX10000 switches and PTX1000 routers are also supported.

Options

name Name of export profile.

> **NOTE**: To associate this export profile with a configured sensor, include the **name** you configure for the **export-profile** statement at the **[edit services analytics sensor *sensor-name* export-name]** hierarchy level.

dscp *value* Specify the DSCP value for the exported packets.

- **Range:** 0 through 63.
- **Default:** 0

> **NOTE**: Any interface-level DSCP rewrite rules you have configured override the DSCP value you specify for the export profile. You need to specify a DSCP value for the export profile only if you do not configure DSCP rewrite rules on the outgoing interface. For more information, see *Configuring Rewrite Rules*.

format

Specify the format to define the structure of exported data.

- **gpb** — Google protocol buffers format.
- **json-gnmi** — JavaScript Object Notation (JSON) encoding. JSON is an open standard file format and data interchange format that provides a good balance of usability and performance. It uses human-readable text to store and transmit data objects consisting of attribute–value pairs and array data types.

forwarding-class (assured-forwarding | best-effort | expedited-forwarding | network-control)

(Packet Forwarding Engine sensors only) Specify the forwarding class for exported packets.

- **Default: best-effort**

loss-priority (high | low | medium-high | medium-low) (MX Series only)

Specify the loss priority for exported packets. Loss priority settings help determine which packets are dropped from the network during periods of congestion.

local-address *ip-address*

Specify the source address of exported packets.

local-port *number*

Specify the source port for the exported packets.

payload-size *bytes* (Optional)

Specify the maximum size of exported packets.

> **NOTE**: The **payload-size** option is supported only on the following sensors:
>
> - /junos/system/linecard/interface/
> - /junos/system/linecard/interface/logical/usage/
> - /junos/system/linecard/firewall/

- **Default:** 5000 bytes.
- **Range:** For the QFX5100 line of switches, 3000 through 9192 bytes. For all other supported platforms, 1400 through 9192 bytes

> **NOTE**: Junos Telemetry Interface does not export packets larger than 9192 bytes.

reporting-rate *seconds*

Specify the interval at which the Junos Telemetry Interface sensor generates data to export to the collector.

As the configured interval expires, the most recent sample collected by the sensor is gathered and forwarded to the server configured to collect data.

> **NOTE**: For Packet Forwarding Engine sensors, the minimum reporting rate is 2 seconds.

- **Range:** 1 through 3600 (1 hour)

transport *protocol-name*

Specify the transport protocol to use to carry the telemetry data in the IP packets.

udp User Datagram Protocol.

Required Privilege Level

interface—To view this statement in the configuration.

interface-control—To add this statement to the configuration.

Release Information

Statement introduced in Junos OS Release 15.1F3.

payload-size ***bytes*** option introduced in Junos OS Release 16.1R3.

loss-priority option introduced in Junos OS Release 17.3R1 for MX Series routers only.

Statement introduced in Junos OS Release 17.4R1 for virtual MX Series (vMX) routers.

RELATED DOCUMENTATION

sensor (Junos Telemetry Interface) | 484

sensor (Junos Telemetry Interface)

IN THIS SECTION

- Syntax | 484
- Hierarchy Level | 484
- Description | 484
- Options | 485
- Required Privilege Level | 516
- Release Information | 516

Syntax

```
sensor sensor-name {
    export-name export-profile-name;
    polling-interval seconds;
    resource resource-string;
    <resource-filter regular expression>;
    server-name [ streaming-server-names ];
}
```

Hierarchy Level

```
[edit services analytics]
```

Description

Configure a Junos telemetry interface sensor, which defines the parameters of a system resource to monitor and stream data. You can use regular expressions to filter the data collected. Examples include

filters for logical and physical interfaces and LSP messages. To apply different filters to the same system resource, you configure multiple sensors. For example, you can configure multiple logical interface sensors and apply a different interface filter to each one.

Options

Each sensor configuration requires you to specify the following: sensor name, an export profile name, a resource identifier string that enables monitoring and streaming of data for the specified system resource, and a server name to collect data. A regular expression to filter data for the specified resource is optional.

sensor-name Specify a name that defines the sensor configuration. For example, for a sensor configuration that monitors all LSP events, you might choose the name **lsp-mon-global**. For a sensor configuration that monitors events only for an LSP named A2B, you might choose the name **lsp-mon-A2B**.

export-name *export-profile-name* Specify the name of an export profile that you configured at the **[edit services analytics** `export-profile` ***name***] hierarchy level to associate with the sensor. This export profile defines the parameters for exporting telemetry data, such as a format for exported data and the rate at which data is generated for export.

> **NOTE**: You can apply only one export profile to each sensor configuration.
>
> The only supported transport protocol when you configure a sensor through the CLI is UDP.

polling-interval *seconds* Specify the interval at which the Junos Telemetry Interface sensor generates data to export to the collector.

As the configured interval expires, the most recent sample collected by the sensor is gathered and forwarded to the server configured to collect data.

> **NOTE**: For Packet Forwarding Engine sensors, the minimum reporting rate is 2 seconds.

- **Range:** 1 through 3600 (1 hour)

resource *resource-string* Enable the system resource to monitor and stream data. Each string corresponds to a specific system resource. The format is a file path and must be entered exactly. You can associate only one ***resource-string*** with a ***sensor-name***. Configure a separate sensor for

each system resource you want to monitor. The resource string to enable LSP monitoring can be modified to specify a specific LSP.

> **NOTE**: You can configure more than one sensor to monitor the same system resource. Configuring different sensors for the same system resource allows you configure different parameters for monitoring that resource.

Table 13 on page 486 lists each supported ***resource-identifier-string***, a description of the system resource monitored, and additional configuration information.

You can also use the Telemetry Explorer tool to search for and view information about ***resource-identifier-string***.

Table 13: resource statement Options

resource string	Description	Release Information
/junos/events	System events sensor. Starting with Junos OS Release 18.1R1, this sensor corresponds to system log messages (syslog). The sensor must be used with an **export-profile** that has a **reporting-rate** of 0, To subscribe for specific events, you can subscribe for /junos/events/ event[id='EVENT_NAME'] where event EVENT_NAME is the event id that you are interested in. Alternatively, you can subscribe to any XPATH Many event names can be found in the messages log file.	Junos OS 18.1R1 and later on all JTI platforms.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/services/ip-tunnel/usage/	Packet Forwarding Engine packet statistics sensor. The statistics are used to report various network element performance metrics in a scalable and efficient way, providing visibility into Packet Forwarding Engine errors and drops. A timestamp indicating when the counters were last reset is included with all the exported data to allow collectors to determine if and when a reset event happened; for example, if the Packet Forwarding Engine hardware restarted. Exported statistics are similar to the output of the operational mode command **show nhdb hw dynamic-ip-tunnels**.	Junos OS 17.4R1 and later on MX Series devices.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/services/label-switched-path/usage/	Packet Forwarding Engine sensor for LSP statistics. 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. For bypass LSPs, the following are exported: • Bypass LSP originating at the ingress router of the protected LSP • Bypass LSP originating at the transit router of the protected LSP • Bypass LSP protecting the transit LSP as well as the locally originated LSP When the bypass LSP is active, traffic is exported both on the bypass LSP and the ingress (protected) LSP. On MX Series routers only, bidirectional LSPs for ultimate-hop popping (UHP) are also supported. **NOTE**: You can modify **/junos/services/label-switched-path/usage/** to specify a specific LSP. Add **__instance__/*lsp-name*** to the end of the resource string identifier. For example, to monitor and stream data for LSP statistics for an LSP named mirror-to-murano-1, enter the following: **/junos/services/label-switched-path/usage/ __instance__/mirror-to-murano-1**. If you do not specify a specific LSP name, the system resource monitors and streams data for all LSPs.	Junos OS Release 15.1F6 and later. Junos OS Release 17.2R1 and later on QFX10000 switches and PTX1000 routers. Junos OS Release 17.3 and later on EX9200 and QFX5110 switches. Junos OS Release 18.2R1 and later on QFX5100, QFX5110, and QFX5200 switches Junos OS Release 18.3R1 and later on QFX5120-48Y and EX4650 switches Junos OS Release 18.4R1 and later on EX4600 switches Junos OS Release 19.1R1 and later on QFX10002 switches and

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
	When you enable a sensor for LSP statistics, you must also configure the `sensor-based-stats` statement at the **[edit protocols mpls]** hierarchy level. MX Series routers must also operate in enhanced mode. If not enabled by default, configure either the **enhanced-ip** statement or the **enhanced-ethernet** statement at the **[edit chassis network-services]** hierarchy level.	PTX10002 routers
/junos/services/ldp/label-switched-path/ingress/usage/	Packet Forwarding Engine sensor for LDP LSP ingress statistics. When you enable a sensor for LDP statistics, you must also configure the `sensor-based-stats` statement at the **[edit protocols ldp traffic-statistics]** hierarchy level. On PTX Series routers, this feature is not supported for the following variants: • PTX3000 and PTX5000 with the RE-DUO-C2600-16G Routing Engine • PTX10003 • PTX10008 with the PTX10K-LC1201-36CD line card	Junos OS Release 20.2R1 for MX series and PTX series routers. Junos OS Release 20.3R1 on MPC10E-10C-MRATE, MPC10E-15C-MRATE, and MX2K-MPC11E line cards.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/services/ldp/label-switched-path/transit/usage/	Packet Forwarding Engine sensor for LDP LSP transit statistics. On PTX Series routers, this feature is not supported for the following variants: • PTX3000 and PTX5000 with the RE-DUO-C2600-16G Routing Engine • PTX10003 • PTX10008 with the PTX10K-LC1201-36CD line card	Junos OS Release 20.2R1 for MX series and PTX series routers. Junos OS Release 20.3R1 on MPC10E-10C-MRATE, MPC10E-15C-MRATE, and MX2K-MPC11E line cards.
/junos/services/ldp/p2mp/interface/receive/usage/	Packet Forwarding Engine sensor for LDP P2MP receive statistics. On PTX Series routers, this feature is not supported for the following variants: • PTX3000 and PTX5000 with the RE-DUO-C2600-16G Routing Engine • PTX10003 • PTX10008 with the PTX10K-LC1201-36CD line card	Junos OS Release 20.2R1 for MX series and PTX series routers. Junos OS Release 20.3R1 on MPC10E-10C-MRATE, MPC10E-15C-MRATE, and MX2K-MPC11E line cards.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/services/ldp/p2mp/interface/transmit/usage/	Packet Forwarding Engine sensor for LDP P2MP transmit statistics. On PTX Series routers, this feature is not supported for the following variants: • PTX3000 and PTX5000 with the RE-DUO-C2600-16G Routing Engine • PTX10003 • PTX10008 with the PTX10K-LC1201-36CD line card	Junos OS Release 20.2R1 for MX series and PTX series routers. Junos OS Release 20.3R1 on MPC10E-10C-MRATE, MPC10E-15C-MRATE, and MX2K-MPC11E line cards.
/junos/services/ldp/p2mp/label-switched-path/usage/	Packet Forwarding Engine sensor for LDP P2MP LSP statistics. On PTX Series routers, this feature is not supported for the following variants: • PTX3000 and PTX5000 with the RE-DUO-C2600-16G Routing Engine • PTX10003 • PTX10008 with the PTX10K-LC1201-36CD line card	Junos OS Release 20.2R1 for MX series and PTX series routers. Junos OS Release 20.3R1 on MPC10E-10C-MRATE, MPC10E-15C-MRATE, and MX2K-MPC11E line cards.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/services/segment-routing/sid/usage/	Source Packet Routing in Networking (SPRING) sensorSfor transit statistics. SPRING is also known as segment routing. Before statistics can be exported, you must first enable them by including the `sensor-based-stats` statement at the **[edit protocols isis source-packet-routing]** hierarchy level. For more information, see "Enabling Export of Transit SPRING Statistics" on page 440.	Junos OS Release 19.1R1 and later on PTX3000 routers and PTX5000 with FPC2

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/services/spu/delegated-rpm/	Delegated Realtime Performance Monitoring (RPM) service sensor. Delegated RPM is a mode where RPM probe generation and measurement calculation are done by MS-MIC and MS-MPC cards. This hardware assistance allows a very high scale of concurrent RPM probes. You can use the resulting data from this sensor to improve network design and optimize traffic engineering. Data can also be used to detect problems in individual devices as well as in the overall network and the traffic carried by it. JTI sensor support for other RPM modes was added in Junos OS Release 18.3R1. This sensor has the following limitations: • Configuring multiple export profiles for the same resource for delegated RPM may not provide expected results. • Multiple sensors for single resource-path (such as delegated RPM) is not supported. • Due to an egress packet-size limitation, history outputs are limited to 5 per RPM test. • The sensor exports one RPM test record per export packet.	Junos OS Release 19.1R1 and later on MX Series routers operating with MS-MIC and MS-MPC

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/services/spu/ipsec-vpn	UDP-based PIC sensors. Starting with Junos OS Release 18.1R1, this sensor provides visibility for IPSec services on different service complexes and nodes. Exported data is defined using an IP address and a UDP port. When an export interval expires, the most recent statistics collected by the sensors are gathered, placed in the payload of a UDP packet, and forwarded to a collector. A timestamp indicating when counters are read is included with the exported data to allow collectors to collate data. The timestamp also can determine if and when an event happened, such as a PIC hardware restart or if counters were cleared by means of the CLI.	Junos OS 18.1R1 on MX Series with MS-MICs and MS-MPCs
/junos/services/spu/servicesets	Sensor to export service set statistics. These sensors provide visibility for services on different service complexes and nodes (for example, IPSec services). Exported data is defined using an IP address and a UDP port. When an export interval expires, the most recent statistics collected by the sensors are gathered, placed in the payload of a UDP packet, and forwarded to a collector. A timestamp indicating when counters are read is included with the exported data to allow collectors to collate data. The timestamp also can determine if and when an event happened, such as a PIC hardware restart or if counters were cleared by means of the CLI.	Junos OS 18.2R1 on MX Series with MS-MICs and MS-MPCs

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/services/spu/sessions	Sensor to export session statistics. These sensors provide visibility for services on different service complexes and nodes (for example, IPSec services). Exported data is defined using an IP address and a UDP port. When an export interval expires, the most recent statistics collected by the sensors are gathered, placed in the payload of a UDP packet, and forwarded to a collector. A timestamp indicating when counters are read is included with the exported data to allow collectors to collate data. The timestamp also can determine if and when an event happened, such as a PIC hardware restart or if counters were cleared by means of the CLI.	Junos OS 18.2R1 on MX Series with MS-MICs and MS-MPCs
/junos/system/linecard/node-slicing/af-fab-stats/	Sensor to export abstracted fabric (AF) interface specific load-balancing and fabric queue statistics. This sensor is only supported for a node virtualization configuration on MX series routers with an AF Interface as the connecting link between guest network functions (GNFs). The sensor also reports aggregated statistics across all AF interfaces hosted on a source packet forwarding engine of local GNFs along with the fabric statistics for all traffic ingressing from and egressing to the fabric from that the packet forwarding engine.	Junos OS Release 18.4R1 and later on MX480, MX960, MX2008, MX2010, MX2020, and MX-ELM routers

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/linecard/cpu/memory/	Packet Forwarding Engine sensor for CPU memory.	Junos OS Release 16.1R3 and later. Junos OS Release 17.2R1 and later on QFX10000 switches and PTX1000 routers. Junos OS Release 17.3R1 and later on EX9200 and QFX5110 switches. Junos OS Release 18.2R1 and later on QFX5100, QFX5110, and QFX5200 witches Junos OS Release 18.3R1 and later on QFX5120-48Y and EX4650 switches Junos OS Release 18.4R1 and later on EX4600 switches Junos OS Release 19.1R1 and later on QFX10002 switches and PTX10002 Routers

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
		Junos OS Release 20.2R1 and later on EX2300, EX2300-MP, and EX3400 switches

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/linecard/firewall/	Packet Forwarding Engine sensor for firewall filter counters and policer counters. Each line card reports counters separately. **NOTE**: Hierarchical policer statistics are collected for MX Series routers only. Traffic-class counter statistics are collected for PTX Series routers and QFX10000 switches only. Firewall counters are exported even if the interface to which the firewall filer is attached is down.	Junos OS Release 15.1F5 and later. Junos OS Release 17.2R1 and later on QFX10000 switches. Junos OS Release 17.3R1 and later on PTX1000 routers and EX9200 switches and QFX5110 switches. Junos OS Release 18.2R1 and later on QFX5100, QFX5110, and QFX5200 switches Junos OS Release 18.3R1 and later on QFX5120-48Y and EX4650 switches Junos OS Release 18.4R1 and later on EX4600 switches Junos OS Release 20.2R1 and later on EX2300,

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
		EX2300-MP, and EX3400 switches.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/linecard/interface/	Packet Forwarding Engine sensor for physical interface traffic. **NOTE**: For PTX Series routers, for a specific interface, queue statistics are exported for each line card. For MX series routers, interface queue statistics are exported only from the slot on which an interface is configured. For Aggregated Ethernet interfaces, statistics are exported for the member physical interfaces. You must aggregate the counters at the destination server, or collector. If a physical interface is administratively down or operationally down, interface counters are not exported. Issuing an operational **clear** command, such as **clear interfaces statistics all**, does not reset statistics exported by the line card.	Junos OS Release 15.1F3 and later on PTX Series routers only. Support introduced for MX Series routers in Junos OS Release 15.1F5. Junos OS Release 17.2R1 and later on QFX10000 switches and PTX1000 routers. Junos OS Release 17.3R1 and later on EX9200 switches, QFX5110 switches and MX150 routers. Junos OS Release 18.2R1 and later on QFX5100, QFX5110, and QFX5200 switches Junos OS Release 18.3R1 and later on QFX5120-48Y and EX4650 switches

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
		Junos OS Release 18.4R1 and later on EX4600 switches Junos OS Release 19.1R1 and later on QFX10002 Switches and PTX10002 routers Junos OS Release 20.2R1 and later on EX2300, EX2300-MP, and EX3400 switches Junos OS Evolved Release 20.2R1 and later on PTX10008 routers. UDP streaming is not supported over the management interface.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/linecard/interface/logical/usage/	Packet Forwarding Engine sensor for logical interface statistics. **NOTE**: If a logical interface is operationally down, interface statistics continue to be exported. Issuing an operational **clear** command, such as **clear interfaces statistics all**, does not reset statistics exported by the line card. **NOTE**: Locally injected packets from the Routing Engine are not exported.	Junos OS Release 15.1F5 and later. Junos OS Release 17.2R1 and later on QFX10000 switches. Junos OS Release 17.3R1 and later on EX9200 and QFX5110 switches Junos OS Release 18.2R1 and later on QFX5100, QFX5110, and QFX5200 switches Junos OS Release 18.3R1 and later on QFX5120-48Y and EX4650 switches Junos OS Release 18.4R1 and later on EX4600 switches Junos OS Release 20.2R1 and later on EX3400 switches Junos OS Evolved Release 20.2R1

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
		and later on PTX10008 routers. UDP streaming is not supported over the management interface.
/junos/system/linecard/interface/traffic/	Packet Forwarding Engine sensor for physical interface traffic. Exports all fields from **/junos/system/linecard/interface/** *except* queue statistics This additional sensor can reduce the reap time for non-queue data for platforms supporting VoQ architecture. To export traffic and queue data for physical interfaces, use **/junos/system/linecard/interface/**. To export queue fields only, use **/junos/system/linecard/interface/queue/**.	Junos OS Release 18.3R1 and later on PTX Series and ACX Series routers and EX Series, MX Series, and QFX Series switches.
/junos/system/linecard/interface/queue/	Packet Forwarding Engine sensor for physical interface traffic. Exports all queue fields from **/junos/system/linecard/interface/**. To export traffic and queue data for physical interfaces, use **/junos/system/linecard/interface/**. To export traffic fields only, use **/junos/system/linecard/interface/traffic/**.	Junos OS Release 18.3R1 and later on PTX Series and ACX Series routers and EX Series, MX Series, and QFX Series switches.

Table 13: resource statement Options *(Continued)*

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

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/linecard/npu/memory/	Packet Forwarding Engine sensor for network processing unit (NPU) memory.	Junos OS Release 16.1R3 and later. Junos OS Release 17.2R1 and later on QFX10000 switches. Junos OS Release 17.3R1 and later on EX9200 switches. Junos OS Release 19.1R1 and later on PTX10002 routers. Junos OS Evolved Release 20.2R1 and later on PTX10008 routers. UDP streaming is not supported over the management interface.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/linecard/npu/utilization/	Packet Forwarding Engine sensor for NPU processor utilization.	Junos OS Release 16.1R3 and later. Junos OS Release 17.2R1 and later on QFX10000 switches. Junos OS Release 17.3R1 and later on EX9200 switches. Junos OS Release 19.1R1 and later on PTX10002 routers. Junos OS Evolved Release 20.2R1 and later on PTX10008 routers. UDP streaming is not supported over the management interface.
/junos/npu-memory/	Sensor that exports both NPU memory statistics from the Packet Forwarding Engine and flow-label statistics from the Routing Engine. To export only flow-label statistics, include the **junos/npu-memory/flabel-memory/** resource string.	Junos OS Release 16.1R3 and later on PTX Series routers only. **NOTE**: Junos OS Release 17.2R1 and later on PTX1000 routers.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/linecard/services/inline-jflow/	Packet Forwarding Engine sensor for performance metrics of the inline flow sampling process, such as the number of active flows and the number of exported flows.	Junos OS Release 16.1R3 and later on MX series and PTX series routers only. Junos OS Release and later on EX9200 switches, PTX1000 routers, and MX150 routers.
/junos/system/linecard/optics/	Packet Forwarding Engine sensor for various optical performance metrics, such as transmit and receive power levels.	Junos OS Release 17.1R1 and later. Junos OS Release and later 17.2R1 on QFX10000 switches. Junos OS Release 17.3R1 and later on EX9200 switches and PTX1000 routers.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information

/junos/system/linecard/qmon/	Sensor for queue depth statistics for ingress and egress queue traffic. Statistics are exported directly from the line card.
	
	This sensor only supports single -streaming. Configuring this sensor to stream to multiple servers is not supported. If multiple servers are configured, no data is sent to any of the configured servers.
	
	The following example shows a configuration for single-streaming that will send data:
	
	`sensor qmon {`
	`server-name TEMP;`
	`export-name export-common;`
	`resource /junos/system/linecard/qmon/;`
	`}`
	
	The following example shows a multiple-server configuration that will not send data:
	
	`sensor qmon {`
	`server-name TEMP;`
	`server-name digi1;`
	`server-name digi2;`
	`export-name export-common;`
	`resource /junos/system/linecard/qmon/;`
	`}`
	
	NOTE: Issuing an operational **clear** command, such as **clear interfaces statistics all**, does not reset the statistics exported by the line card.
		Junos OS Release 17.1R1 and later on MX Series routers on MPC7E, MPC8E, and MPC9E only.
		
		Junos OS 17.3R1 and later on EX9200 switches.
		
		NOTE: virtual MX Series (vMX) routers are not supported.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/linecard/qmon-sw/	Sensor for congestion and latency monitoring statistics.	Junos OS Release 18.2R1 and later on QFX5100, QFX5110, and QFX5200 Switches Junos OS Release 18.3R1 and later on QFX5120-48Y and EX4650 Switches Junos OS Release 18.4R1 and later on EX4600 switches Junos OS Release 20.2R1 and later on EX3400 switches

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/linecard/fabric/	Sensor for fabric statistics. The following types of statistics can be exported: • Fabric statistics for Packet Forwarding Engine pairs (**resource-filter** option is not supported) • FPC fabric statistics • Control Board and Switch Fabric Board fabric statistics.	Junos OS Release 17.2R1 and later on MX Series routers only. Junos OS Evolved Release 20.2R1 and later on PTX10008 routers. UDP streaming is not supported over the management interface. **NOTE**: virtual MX Series (vMX) routers are not supported.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/linecard/packet/usage/	Sensor for Packet Forwarding Engine Statistics. This sensor exports statistics for counters and provides visibility into Packet Forwarding Engine error and drop statistics.	Junos OS Release 17.4R1 and later on MX Series and PTX Series routers Junos OS Evolved Release 19.1R1 on PTX10003 routers and QFX10003 switches Junos OS Evolved Release 20.2R1 on PTX10003 routers and QFX10003 switches

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/services/segment-routing/interface/ingress/usage/ /junos/services/segment-routing/interface/egress/usage/ /junos/services/segment-routing/sid/usage/	Sensors for aggregate segment routing traffic with IS-IS. The first path exports inbound traffic. The second path exports outbound traffic. The third path exports inbound segment routing traffic for each segment identifier. **NOTE**: When you enable a sensor for segment routing statistics, you must also configure the `sensor-based-stats` statement at the **[edit protocols isis source-packet-routing]** hierarchy level. MX Series and PTX Series routers must also operate in enhanced mode. On MX Series routers, If not enabled by default, configure either the **enhanced-ip** statement or the **enhanced-ethernet** statement at the **[edit chassis network-services]** hierarchy level. On PTX Series routers, configure the **enhanced-mode** statement at the **[edit chassis network-services]** hierarchy level.	Junos OS Release 17.4 and later on MX Series and PTX5000 routers.
/junos/system/subscriber-management/aaa/diameter/clients/gx	Sensor for policy and charging rules function (PCRF) statistics for subscribers.	Junos OS Release 19.3R1 on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/subscriber-management/aaa/diameter/clients/gy	Sensor for Online Charging System (OCS) statistics for subscribers.	Junos OS Release 19.3R1 on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers.
/junos/system/subscriber-management/aaa/diameter/clients/nasreq	Sensor for Network Access Server Application (NASREQ) statistics for subscribers.	Junos OS Release 19.3R1 on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/subscriber-management/aaa/diameter/peers/peer[peer_address='*peer-address*']/gx/response-time	Diameter peer sensor that provides response time measurements for messages exchanged between an MX router and the peer for PCRF statistics. This sensor includes response-time and delay measurements in milliseconds. **NOTE**: The delay measurements are made over a 60-second measurement interval. As the reporting interval may be as much as 59 seconds out of phase with the measurement interval, the response time values may not be aligned with the reporting interval.	Junos OS Release 19.3R1 on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers.
/junos/system/subscriber-management/aaa/diameter/peers/peer[peer_address='*peer-address*']/gy/response-time	Diameter peer sensor that provides response time measurements for messages exchanged between an MX router and the peer for OCS statistics. This sensor includes response-time and delay measurements in milliseconds. **NOTE**: The delay measurements are made over a 60-second measurement interval. As the reporting interval may be as much as 59 seconds out of phase with the measurement interval, the response time values may not be aligned with the reporting interval.	Junos OS Release 19.3R1 on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers.

Table 13: resource statement Options *(Continued)*

resource string	Description	Release Information
/junos/system/subscriber-management/aaa/diameter/peers/peer[peer_address='*peer-address*']/nasreq/response-time	Diameter peer sensor that provides response time measurements for messages exchanged between an MX router and the peer for NASREQ statistics. This sensor includes response-time and delay measurements in milliseconds. **NOTE**: The delay measurements are made over a 60-second measurement interval. As the reporting interval may be as much as 59 seconds out of phase with the measurement interval, the response time values may not be aligned with the reporting interval.	Junos OS Release 19.3R1 on MX5, MX10, MX40, MX150, MX204, MX240, MX480, MX960, MX2008, MX2010, MX2020, MX10003, MX10008, and MX100016 routers.
/junos/system/linecard/ddos/	This PFE sensor exports the statistics of DDOS from MPC1, MPC2, MPC3, MPC5, MPC6, MPC7, MPC8, and MPC9 line cards.	Junos OS Release 21.1R1 on MX Series routers.

resource-filter *regular-expression*

(Optional) Specify a regular expression to filter data for a specific resource. For example, you can filter for a specific set of logical or physical interfaces, firewall filters, or LSP messages. When you configure a system resource to monitor and stream data globally—that is, systemwide—you do not need to include a regular expression.

Examples of regular expressions to filter data exported through sensor configuration:

- Logical interface statistics sensor—et-2/0/7:1*
- LSP events sensor—lsp-from-A-to-B*
- Firewall filter counters sensor—f_testl*

server-name [*streaming-server-names*]

Specify one or more servers to transport data for collection. Include at least one server-name configured at the **[edit services analytics** `streaming-server` ***server-name***] hierarchy level.

NOTE: Starting in Junos OS Release 15.1F6, you can configure as many as four streaming servers for a single sensor configuration. In previous releases, you can specify only one streaming server for each configured sensor. To specify more than one streaming server for a sensor, you must enclose the names in brackets.

Required Privilege Level

interface—To view this statement in the configuration.

interface-control—To add this statement to the configuration.

Release Information

Statement introduced in Junos OS Release 15.1F3.

Support for MPC7E, MPC8E, and MPC9E on MX Series routers added in Junos OS Release 15.1F5.

Support for FPC1 and FPC2 on PTX Series routers added in Junos OS Release 16.1R3.

Statement introduced in Junos OS Release 19.1R1 for PTX3000 routers and PTX5000 routers with FPC2.

Release History Table

Release	Description
19.1R1	Statement introduced in Junos OS Release 19.1R1 for PTX3000 routers and PTX5000 routers with FPC2.

RELATED DOCUMENTATION

export-profile (Junos Telemetry Interface) | 480

sensor-based-stats (Junos Telemetry Interface)

IN THIS SECTION

- Syntax | 517
- Hierarchy Level | 517
- Description | 517
- Required Privilege Level | 518
- Release Information | 518

Syntax

```
sensor-based-stats;
```

Hierarchy Level

```
[edit protocols ldp traffic-statistics],
[edit protocols mpls]
```

Description

Enable the collection of certain statistics for the Junos telemetry interface. You must configure this statement when you configure a sensor to monitor and stream data for the following statistics:

- LDP—Enable the collection of LDP traffic statistics. Use the **resource** option at the **[edit services analytics** `sensor` ***sensor-name***] hierarchy level to configure one of the LDP statistics sensors to stream data through UDP.
- MPLS—Enable the collection of LSP statistics. To enable a sensor to stream data for LSP statistics through UDP, include the **resource /junos/services/label-switched-path/usage/** statement at the **[edit services analytics** `sensor` ***sensor-name***] hierarchy level.

NOTE: This statement is also available for IS-IS statistics on MX Series, PTX3000, and PTX5000 routers. For more information, see *Understanding Source Packet Routing in Networking (SPRING)* and *sensor-based-stats (Protocols IS-IS)*.

For additional information about configuring these statistics sensors to stream data through gRPC, see "Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface)" on page 73.

Required Privilege Level

routing—To view this statement in the configuration.

routing-control—To add this statement to the configuration.

Release Information

Statement introduced in Junos OS Release 15.1F6.

Support at the **[edit protocols mpls]** hierarchy level introduced in Junos OS Release 19.2R1 for ACX6360 routers.

Statement supported in Junos OS Evolved Release 19.1R1 on PTX10003 routers and QFX 10003 switches.

Support at the **[edit protocols ldp traffic-statistics]** hierarchy level introduced in Junos OS Release 20.2R1 for MX Series routers and PTX Series routers.

RELATED DOCUMENTATION

Understanding the Junos Telemetry Interface Export Format of Collected Data | 6

source-packet-routing

IN THIS SECTION

Syntax | 519
Hierarchy Level | 519

- Description | 519
- Default | 520
- Options | 520
- Required Privilege Level | 521
- Release Information | 521

Syntax

```
source-packet-routing {
    telemetry {
        statistics {
            per-source per-segment-list
            no-transit;
            no-ingress;
            }
        }
     source-routing-path {
         use-for-shortcut;
         }
    }
```

Hierarchy Level

```
[edit protocols]
```

Description

Enable BGP and statically configured Segment Routing Traffic Engineering (SR-TE) traffic statistics sensor support for Junos telemetry interface (JTI).

Export JTI statistics using either remote procedure call (gRPC) services or UDP native sensors to stream statistics. The following resource paths are supported. For UDP native sensors:

- **/junos/services/segment-routing/traffic-engineering/ingress/usage/**
- **/junos/services/segment-routing/traffic-engineering/transit/usage**

For gRPC streaming:

- /mpls/signaling-protocols/segment-routing/

Export SR-TE per Label Switched Path (LSP) route statistics using JTI and gRPC services. Using JTI and gRPC services. You can stream SR-TE telemetry statistics for uncolored SR-TE policies statistics to an outside collector. Ingress statistics include statistics for all traffic steered by means of an SR-TE LSP. Transit statistics include statistics for traffic to the Binding SID (BSID) of the SR-TE policy.

To enable these statistics, include the **per-source per-segment-list** option at the [**edit protocols source-packet-routing telemetry statistics**] hierarchy level. When configuring:

- If the statement **set protocols source-packet-routing telemetry statistics no-ingress** is issued, ingress sensors are not created.
- If the statement **set protocols source-packet-routing telemetry statistics no-transit** is issued, transit sensors are not created. Otherwise, if BSID is configured for a tunnel, transit statistics are created.

The following resource paths (sensors) are supported:

- **/junos/services/segment-routing/traffic-engineering/tunnel/lsp/ingress/usage/**
- **/junos/services/segment-routing/traffic-engineering/tunnel/lsp/transit/usage/**

For exporting statistics using UDP native sensors, configure parameters at the [edit services analytics] hierarchy level. To provision sensors to export data through gRPC streaming, use the telemetrySubscribe RPC to specify telemetry parameters.

Default

Disabled.

Options

statistics Create sensors for both the SR-TE policy nexthop and the binding SID that are installed in the forwarding plane. For the SR-TE policy nexthop, the sensors collect traffic statistics steered by all routes that use the SR-TE policy as a nexthop. For the binding SID, the sensors collect statistics on labeled traffic that is steered by the binding-SID route.

per-source per-segment-list Create sensors to export SR-TE per LSP route statistics for uncolored SR-TE policies. Ingress statistics include statistics for all traffic steered by means of an SR-TE LSP. Transit statistics include statistics for traffic to the BSID of the SR-TE policy.

no-transit	Enable sensors only for SR-TE policy nexthops. The sensor will collect statistics on all steering routes that use the SR-TE policy as a nexthop.
no-ingress	Enable sensors only for Binding-SID transit routes.
source-routing-path	Specify the name of the source routing path.
use-for-shortcut	Enable to allow the LSP to be used as a shortcut tunnel.

Required Privilege Level

routing

Release Information

Statement introduced in Junos OS Release 18.3R1.

Option **per-source per-segment-list** is introduced in Junos OS Release 20,1R1 for MX Series and PTX Series routers.

Statement supported in Junos OS Release 20.2R1 for MX240. MX480, MX960, MX2010, and MX2020 with MPC-10E or MPC-11E routers.

RELATED DOCUMENTATION

- Understanding OpenConfig and gRPC on Junos Telemetry Interface | **36**
- Configure a NETCONF Proxy Telemetry Sensor in Junos | **414**
- sensor (Junos Telemetry Interface) | **484**
- *statistics*
- *telemetry*

streaming-server (Junos Telemetry Interface)

IN THIS SECTION

- Syntax | **522**

- Hierarchy Level | 522
- Description | 522
- Options | 523
- Required Privilege Level | 523
- Release Information | 523

Syntax

```
streaming-server streaming-server-name {
    remote-address ip-address;
    remote-port number;
}
```

Hierarchy Level

```
[edit services analytics]
```

Description

For Junos telemetry interface, configure the parameters of the server that collects exported data streamed by a monitored system resource. You can configure more than one streaming server. To collect data, you must associate a configured server with one or more configured sensors. The sensor configuration defines the parameters to monitor a specific system resource. To configure a sensor, include the `sensor` ***sensor-name*** statement at the **[edit services analytics]** hierarchy level.

To configure the server that collects data, you must also configure a destination IP address and a destination port. Junos telemetry interface relies on neighbor reachability information to deliver packets to the destination address. That means that all policies, such as filtering, that apply to the packets for that destination also apply to the exported packets.

NOTE: Starting with Junos OS Release 15.1F6. you can also associate more than one server with a specific sensor configuration, which enables you to transmit streamed data for the same sensor to more than one server.

NOTE: Junos telemetry interface was introduced in Junos OS Release 15.1F3 on MX Series routers with interfaces configured on MPC1 through MPC6E and on PTX Series routers with interfaces configured on FPC3. Starting in Junos OS Release 15.1F5, Junos Telemetry Interface is also supported on MPC7E, MPC8E, and MPC9E on MX Series routers.

Starting with Junos OS Release 16.1R3, FPC1 and FPC2 on PTX Series routers are also supported.

Options

streaming-server-name	Specify a name for the server configured to collect data streamed through Junos Telemetry Interface. You can configure multiple streaming servers. To associate as many as four server names with a sensor configuration, include each name at the **[edit services analytics sensor *sensor-name* streaming server [*streaming-server-names*]]** hierarchy level. If you specify more than one streaming server, you must enclose the names in brackets.
remote-address *ip-address*	Specify the destination address of the streaming server for exported packets.
remote-port *number*	Specify a port number for the destination address of the streaming server for exported packets.

Required Privilege Level

interface—To view this statement in the configuration.

interface-control—To add this statement to the configuration.

Release Information

Statement introduced in Junos OS Release 15.1F3.

RELATED DOCUMENTATION

export-profile (Junos Telemetry Interface) | 480

show agent sensors

IN THIS SECTION

- Syntax | 524
- Description | 524
- Required Privilege Level | 524
- Output Fields | 525
- Sample Output | 526
- Release Information | 532

Syntax

```
show agent sensors
```

Description

Display information about sensors configured for Junos Telemetry Interface.

NOTE: Junos telemetry interface was introduced in Junos OS Release 15.1F3 on MX Series routers with interfaces configured on MPC1 through MPC6E and on PTX Series routers with interfaces configured on FPC3. Starting in Junos OS Release 15.1F5, Junos Telemetry Interface is also supported on MPC7E, MPC8E, and MPC9E on MX Series routers.

Starting with Junos OS Release 16.1R3, FPC1, FPC2, and dual Routing Engines on PTX Series routers are also supported.

Required Privilege Level

view

Output Fields

Table 14 on page 525 lists the output fields for the **show agent sensors** command. Output fields are listed in the approximate order in which they appear.

Table 14: show agent sensors Output Fields

Field Name	Field Description
Sensor Information	Information about sensors configured to monitor system resources and stream data.
Name	Name of configured sensor. **NOTE**: Junos OS Evolved Release 19.1R1 and later does not show output for generated child sensors.
Resource	Resource string used to configure and identify the system resource enabled to monitor and stream data.
Sensor-id	Numerical identifier of the sensor.
Server Information	Information about servers configured to collect sensor data.
Name	Name of server.
Scope-id	Numerical identifier of a scope.
Remote-Address	Destination IP address for exported packets.
Remote-port	Destination port for exported packets.
Profile information	Information about export profiles for sensors.

Table 14: show agent sensors Output Fields *(Continued)*

Field Name	Field Description
Name	Name of export profile.
Rep-interval	Interval, in seconds, at which the sensor generates data to export.
Address	Source address of exported packets.
Port	Source port of exported packets.
Format	Format of exported data message: **GPB**
DSCP	Configured DSCP value for exported packets. **NOTE**: The default value is 0. This value is displayed if you do not configure a DSCP value.
Forwarding-class	Configured forwarding class for exported packets. **NOTE**: The default value is 0. This value is displayed if you do not configure a forwarding class.
Loss-Priority	Configured loss priority for packets streamed through UDP (MX Series only): **high**, **low**, **medium-high**, **medium-low**

Sample Output

show agent sensors (DDOS sensor)

```
user@host> show agent sensors
Sensor Information Sensor name     :__default_fabric_sensor__
        Resource         :/junos/system/linecard/fabric
        Object ID       :2277069355
        Sensor ID      :9288676508521003
        Polling Interval    :2000000000
```

```
Server Information Server name     :__default__snmp_server__
        Server ID :33
        Scope ID :0
        Remote-Address :0.0.0.0
        Remote-port :0
Profile Information: Profile
name     :__default_snmp_export_profile__
        profile ID :1
        Rep-interval :2000
        Local-Address :0.0.0.0
        Local-port :0
        Timestamp :0
        Format :1
        Transport :0
Sensor Information Sensor name :ddos
        Resource :/junos/system/linecard/ddos/
        Object ID :3440566888
        Sensor ID :21110626693866088
        Polling Interval :1000
        Server Information Server
            name :sserver
    Server ID :75
        Scope ID :0 Remote-
Address :10.0.0.1
Remote-port :2000
Local-Address         :10.0.0.10
        Local-port     :21111
        Timestamp         :1
        Format         :1
        Transport         :0
```

show agent sensors (firewall filter sensor)

```
user@host> show agent sensors
Sensor Information :

  Name                                    :firewall-stats
  Resource                                :/junos/system/linecard/firewall/
  Sensor ID                               :93390914

Server Information :
```

```
   Name                                    :jvision-server
   Scope ID                                :0
   Remote-Address                          :160.1.1.1
   Remote-port                             :2001

Profile Information :

  Name                                     :export-common
  Rep-interval                             :2
  Address                                  :160.1.1.2
  Port                                     :1000
  Timestamp                                :1
  Format                                   :GPB
  Transport                                :UDP
  DSCP                                     :0
  Forwarding-class                         :0
  Loss-priority                            :high
```

show agent sensors (CPU memory sensor)

```
user@host> show agent sensors
Sensor Information :

       Name                                : se1
       Resource                            :/junos/system/cpu/memory/
       Version                             : 1.0
       Sensor-id                           : 114833
       Subscription-ID                     : 562949953536145
       Parent-Sensor-Name                  : Not applicable
       Component(s)                        : PFE

 Server Information :

        Name                               : ser1
        Scope-id                           : 0
        Remote-Address                     : 10.3.3.3
        Remote-port                        : 6000
        Transport-protocol                 : UDP

 Profile Information :
```

```
        Name                                : ex1
        Reporting-interval                  : 1
        Payload-size                        : 5000
        Address                             : 0.0.0.0
        Port                                : 1000
        Timestamp                           : 1
        Format                              : GPB
        DSCP                                : 0
        Forwarding-class                    : assured-forwarding
        Loss-priority                       : high
```

show agent sensors (packet forwarding engine statistics)

```
user@host> show agent sensors
Sensor Information :

    Name                                    : packet_stats
    Resource                                : /junos/system/linecard/packet/
usage/
    Version                                 : 1.0
    Sensor-id                               : 3699
    Subscription-ID                         : 562949953425011
    Parent-Sensor-Name                      : Not applicable
    Component(s)                            : PFE

    Server Information :
        Name                                : s1
        Scope-id                            : 0
        Remote-Address                      : 10.1.1.2
        Remote-port                         : 1000
        Transport-protocol                  : UDP

    Profile Information :
        Name                                : ep1
        Reporting-interval                  : 1
        Payload-size                        : 5000
        Address                             : 10.1.1.1
        Port                                : 1000
        Timestamp                           : 1
        Format                              : GPB
```

```
        DSCP                                : 255
        Forwarding-class                    : 255
```

show agent sensors (QFX10008 or QFX10016 switches with Junos OS Release 17.3R1 and later)

```
user@host> show agent sensors
 Sensor Information :

     Name                                   : sensor_1000
     Resource                               : /interfaces/interface/
subinterfaces/
     Version                                : 1.0
     Sensor-id                              : 539528115
     Subscription-ID                        : 1000
     Parent-Sensor-Name                     : Not applicable
     Component(s)                           : PFE,mib2d,xmlproxyd

     Profile Information :

         Name                               : export_1000
         Reporting-interval                 : 6
         Payload-size                       : 5000
         Format                             : GPB

 Sensor Information :

     Name                                   : sensor_1000_1_1
     Resource                               : /junos/system/linecard/interface/
logical/usage/
     Version                                : 1.1
     Sensor-id                              : 3139259737
     Subscription-ID                        : 1000
     Parent-Sensor-Name                     : sensor_1000
     Component(s)                           : PFE

     Profile Information :

         Name                               : export_1000
         Reporting-interval                 : 6
         Payload-size                       : 5000
```

```
         Format                                : GPB

 Sensor Information :

     Name                                      : sensor_1000_2_1
     Resource                                  : /interfaces/interface/
subinterfaces/
     Version                                   : 1.0
     Sensor-id                                 : 3139256665
     Subscription-ID                           : 1000
     Parent-Sensor-Name                        : sensor_1000
     Component(s)                              : mib2d

     Profile Information :

         Name                                  : export_1000
         Reporting-interval                    : 6
         Payload-size                          : 5000
         Format                                : GPB

 Sensor Information :

     Name                                      : sensor_1000_4_1
     Resource                                  : /interfaces/interface/
subinterfaces/
     Version                                   : 1.0
     Sensor-id                                 : 3139262809
     Subscription-ID                           : 1000
     Parent-Sensor-Name                        : sensor_1000
     Component(s)                              : xmlproxyd

     Profile Information :

         Name                                  : export_1000
         Reporting-interval                    : 6
         Payload-size                          : 5000
         Format                                : GPB
```

show agent sensors (Junos OS Evolved Release 19.1R1 and later)

```
user@host> show agent sensors
Sensor Information :

    Name                                    : sensor_1000
    Resource                                : /interfaces/
interface[name='re0:mgmt-0']/
    Version                                 : 1.0
    Sensor-id                               : 562949953421313
    Subscription-ID                         : 1000
    Component(s)                            : mib2d, mgmt-ethd

    Profile Information :

        Name                                : export_1000
        Reporting-interval                  : 2
        Payload-size                        : 5000
        Address                             : 0.0.0.0
        Port                                : 1000
        Timestamp                           : ntp
        Format                              : GPB
        DSCP                                : 0
        Forwarding-class                    : 0
```

Release Information

Statement introduced in Junos OS Release 15.1F3

RELATED DOCUMENTATION

- export-profile (Junos Telemetry Interface) | 480
- sensor (Junos Telemetry Interface) | 484
- streaming-server (Junos Telemetry Interface) | 521

CHAPTER 9

gRPC Services Configuration Statements and Operational Commands

IN THIS CHAPTER

- request system yang add | 533
- request system yang delete | 537
- request system yang update | 539
- request system yang validate | 542
- show spring-traffic-engineering | 544
- show network-agent statistics | 553
- show extension-service request-response clients | 558
- show extension-service request-response servers | 561
- show spring-traffic-engineering | 562
- source-packet-routing | 572
- ssl | 575
- telemetry | 578

request system yang add

IN THIS SECTION

- Syntax | 534
- Description | 534
- Options | 535
- Required Privilege Level | 535
- Sample Output | 536

Release Information | 536

Syntax

```
request system yang add package package-name <proxy-xml> module [modules]
<action-script [scripts]>
<translation-script [scripts]>
<deviation-module [modules]>
<snmp>
```

Description

Define a new YANG package with the modules, deviation modules, and scripts that are added to the device as part of the package, and merge the data models defined in the modules with the Junos OS schema. When you add a custom YANG data model to the device, you must also add at least one translation script or one action script, which provides the mapping between the new data model and Junos OS. To add multiple modules or scripts, include a space-delimited list of absolute or relative file paths enclosed in brackets.

NOTE: To install OpenConfig modules that are packaged as a compressed tar file, use the **request system software add** command. OpenConfig modules and scripts that are installed using the **request system software add** command are always associated with the package identifier **openconfig**.

When you create a new package, the device stores copies of the module and script files in a new location. The device also stores copies of the action script and translation script files under the **/var/db/scripts/action** and **/var/db/scripts/translation** directories, respectively. Junos OS validates the syntax of the modules and scripts, rebuilds its schema to include the new data models, and then validates the active configuration against this schema. Newly added RPCs and configuration hierarchies are immediately available for use.

NOTE: Devices that use the ephemeral configuration database will delete all ephemeral configuration data in the process of rebuilding the schema.

NOTE: To prevent CLI-related or configuration database errors, we recommend that you do not perform any CLI operations, change the configuration, or terminate the operation while a device is in the process of adding, updating, or deleting a YANG package and modifying the schema.

NOTE: Starting in Junos OS Release 18.3R1, adding, deleting, or updating YANG packages in configuration mode with the **run** command is not supported.

Options

action-script [*scripts*]	List of paths for one or more action scripts to add to the device as part of the package.
module [*modules*]	List of paths for one or more YANG modules to add to the device as part of the package. The device merges the data models defined in the modules with the Junos OS schema.
deviation-module [*modules*]	(Optional) List of paths for one or more modules that define deviation statements that should be applied to modules in the package.
package *package-name*	User-defined identifier that represents the collection of YANG modules and scripts.
proxy-xml module [*modules*]	List of paths for one or more new modules that provide user-defined OpenConfig mappings for the XML Proxy process to translate Junos Telemetry Interface statistics exported through gRPC into key-value pairs.
snmp	List of paths for one or more YANG modules to copy to a predefined location and convert it to JSON format. Later snmpd parses this JSON file and builds its internal database. Requires the **package *package-name*** option.
translation-script [*scripts*]	List of paths for one or more translation scripts to add to the device as part of the package.

Required Privilege Level

maintenance

Sample Output

request system yang add

```
user@host> request system yang add package p1 module [yang/if.yang yang/if-aggregate.yang yang/if-show.yang] deviation-module yang/deviation/if-devs.yang translation-script translation/if.slax action-script action/if-show.py

YANG modules validation : START
YANG modules validation : SUCCESS
Scripts syntax validation : START
script check succeeds
Scripts syntax validation : SUCCESS
Scripts syntax validation : START
Scripts syntax validation : SUCCESS
TLV generation: START
TLV generation: SUCCESS
Building schema and reloading /config/juniper.conf.gz ...
Activating /config/juniper.conf.gz ...
mgd: commit complete
Restarting mgd ...

WARNING: cli has been replaced by an updated version:
CLI release 16.1R1 built by builder on 2016-03-30 13:46:11 UTC
Restart cli using the new version ? [yes,no] (yes) yes

Restarting cli ...
user@host>
```

Release Information

Command introduced in Junos OS Release 16.1R1.

proxy-xml option introduced in Junos OS Release 17.3R1 on MX Series and PTX Series routers.

snmp option introduced in Junos OS Release 18.3R1.

RELATED DOCUMENTATION

Managing YANG Packages, Modules, and Scripts on Devices Running Junos OS

Understanding the Management of Nonnative YANG Modules on Devices Running Junos OS

Configure a NETCONF Proxy Telemetry Sensor in Junos

request system yang update

show system yang package

Customized SNMP MIBs for Syslog Traps

request system yang delete

IN THIS SECTION

- Syntax | 537
- Description | 537
- Options | 538
- Required Privilege Level | 538
- Sample Output | 539
- Release Information | 539

Syntax

```
request system yang delete package-name
```

Description

Remove the given YANG package and all of its modules and scripts from the device, and remove the data models associated with that package from the Junos OS schema.

CAUTION: Before you delete a YANG package, ensure that the active configuration does not contain configuration data that has dependencies on the data models added by that package.

NOTE: You must use the **request system software delete** command to remove OpenConfig packages that were installed from a compressed tar file using the **request system software add** command.

When you delete a package, Junos OS rebuilds its schema to remove the data models associated with that package and then validates the active configuration against the newly updated schema. The device removes the copies of the module and script files that were generated when the package was created. The device also removes the copies of the package's action script and translation script files that are stored under the **/var/db/scripts/action** and **/var/db/scripts/translation** directories. If you downloaded the original module and script files to a different location, the original files remain unchanged.

NOTE: Devices that use the ephemeral configuration database will delete all ephemeral configuration data in the process of rebuilding the schema.

NOTE: To prevent CLI-related or configuration database errors, we recommend that you do not perform any CLI operations, change the configuration, or terminate the operation while a device is in the process of adding, updating, or deleting a YANG package and modifying the schema.

NOTE: Starting in Junos OS Release 18.3R1, adding, deleting, or updating YANG packages in configuration mode with the **run** command is not supported.

Options

package-name	Name of the YANG package to remove.

Required Privilege Level

maintenance

Sample Output

request system yang delete

```
user@host> request system yang delete p1
Building schema and reloading /config/juniper.conf.gz ...
Activating /config/juniper.conf.gz ...
mgd: commit complete
Restarting mgd ...

WARNING: cli has been replaced by an updated version:
CLI release 16.1R1 built by builder on 2016-03-30 13:46:11 UTC

Restart cli using the new version ? [yes,no] (yes) yes

Restarting cli ...
```

Release Information

Command introduced in Junos OS Release 16.1R1.

RELATED DOCUMENTATION

- *Managing YANG Packages, Modules, and Scripts on Devices Running Junos OS*
- *Understanding the Management of Nonnative YANG Modules on Devices Running Junos OS*
- *request system yang add*
- *show system yang package*

request system yang update

IN THIS SECTION

- Syntax | 540
- Description | 540

- Options | 541
- Required Privilege Level | 541
- Sample Output | 541
- Release Information | 542

Syntax

```
request system yang update package-name action-script [scripts] deviation-
module [modules] module [modules] proxy-xml [file-path-names] translation-
script [scripts]
```

Description

Update an existing YANG package to include new or modified YANG modules or scripts, and merge the updated data models in that package with the Junos OS schema.

When you update a package, the device stores copies of the new and modified module and script files. Junos OS then rebuilds its schema to include the changes to the data models and validates the active configuration against this schema.

NOTE: Devices that use the ephemeral configuration database will delete all ephemeral configuration data in the process of rebuilding the schema.

NOTE: To prevent CLI-related or configuration database errors, we recommend that you do not perform any CLI operations, change the configuration, or terminate the operation while a device is in the process of adding, updating, or deleting a YANG package and modifying the schema.

NOTE: Starting in Junos OS Release 18.3R1, adding, deleting, or updating YANG packages in configuration mode with the **run** command is not supported.

Options

package-name	Name of the YANG package to update.
action-script [*scripts*]	List of paths for one or more action scripts to add to or update in the package.
deviation-module [*modules*]	List of paths for one or more deviation modules to add to or update in the package.
module [*modules*]	List of paths for one or more YANG modules to add to or update in the package.
proxy-xml [*file-path-names*]	List of paths for one or more YANG modules to add to or update in the package that provide user-defined OpenConfig mappings for the XML Proxy process to translate Junos Telemetry Interface statistics exported through gRPC into key-value pairs.
translation-script [*scripts*]	List of paths for one or more translation scripts to add to or update in the package.

Required Privilege Level

maintenance

Sample Output

request system yang update

```
user@host> request system yang update p1 module yang/if.yang

YANG modules validation : START
YANG modules validation : SUCCESS
TLV generation: START
TLV generation: SUCCESS
Building schema and reloading /config/juniper.conf.gz ...
Activating /config/juniper.conf.gz ...
mgd: commit complete
Restarting mgd ...

WARNING: cli has been replaced by an updated version:
CLI release 16.1R1 built by builder on 2016-03-30 13:46:11 UTC
Restart cli using the new version ? [yes,no] (yes) yes
```

```
Restarting cli ...
```

Release Information

Command introduced in Junos OS Release 16.1R1.

proxy-xml option introduced in Junos OS Release 17.3R1 on MX Series and PTX Series routers.

RELATED DOCUMENTATION

- *Managing YANG Packages, Modules, and Scripts on Devices Running Junos OS*
- *Configure a NETCONF Proxy Telemetry Sensor in Junos*
- *request system yang add*
- *show system yang package*

request system yang validate

IN THIS SECTION

- Syntax | 542
- Description | 543
- Options | 543
- Required Privilege Level | 543
- Sample Output | 543
- Release Information | 543

Syntax

```
request system yang validate action-script [scripts] module [modules] proxy-xml
module [modules] translation-script [scripts]
```

Description

Validate the syntax of one or more YANG modules, translation scripts, or action scripts.

Options

action-script *scripts*	List of paths for one or more action scripts to validate.
module *modules*	List of paths for one or more YANG modules to validate.
proxy-xml module *modules*	List of paths for one or more YANG modules to validate that provide user-defined OpenConfig mappings for the XML Proxy process to translate Junos Telemetry Interface statistics exported through gRPC into key-value pairs.
translation-script *scripts*	List of paths for one or more translation scripts to validate.

Required Privilege Level

maintenance

Sample Output

request system yang validate

```
user@host> request system yang validate module [yang/if.yang yang/if-aggregate.yang] translation-script
translation/if.slax
YANG modules validation : START
YANG modules validation : SUCCESS
Scripts syntax validation : START
script check succeeds
Scripts syntax validation : SUCCESS
```

Release Information

Command introduced in Junos OS Release 16.1R1.

proxy-xml option introduced in Junos OS Release 17.3R1 on MX Series and PTX Series routers.

RELATED DOCUMENTATION

Managing YANG Packages, Modules, and Scripts on Devices Running Junos OS

Understanding the Management of Nonnative YANG Modules on Devices Running Junos OS

Configure a NETCONF Proxy Telemetry Sensor in Junos

show spring-traffic-engineering

IN THIS SECTION

- Syntax | 544
- Description | 544
- Options | 544
- Required Privilege Level | 545
- Output Fields | 545
- Sample Output | 548
- Release Information | 553

Syntax

```
show spring-traffic-engineering (lsp | overview | sbfd)
<brief | detail>
<logical-system (all | logical-system-name)>
<name lsp-name>
```

Description

Display ingress details of SPRING traffic engineering.

Options

brief | detail (Optional) Display the specific level of output.

lsp	Display details of SPRING traffic-engineered LSPs on the ingress router or the Path Computation Client (PCC).
overview	Display overview of SPRING traffic-engineered LSPs on the ingress router, or the PCC.
sbfd	Display the SPRING traffic-engineered BFD session.
name *lsp-name*	(Optional) Regular expression for LSP names to match for displaying SPRING traffic-engineering details.

Required Privilege Level

view

Output Fields

Table 15 on page 545 describes the output fields for the **show spring-traffic-engineering** command. Output fields are listed in the approximate order in which they appear.

Table 15: show spring-traffic-engineering Output Fields

Field Name	Field Description
To	IP address of the SR-TE LSP destination.
State	State of the SR-TE LSP: • Up • Down
LSP Name	Name of the SR-TE LSP.
S-ERO	Source Explicit Route Object (ERO), or LSP path.
Bandwidth	Bandwidth allocated for the SR-TE LSP.

Table 15: show spring-traffic-engineering Output Fields *(Continued)*

Field Name	Field Description

Delegation info	LSP control and routing status:
	• Control-status:
	  • Externally controlled—PCE has control of the source-routing path.
	  This can happen when:
	  • The **lsp-external-controller pccd** statement is configured either under the source-routing path or under the primary segment list.
	  • The **request path-computation-client retry-delegation *lsp-name*** command is issued for a delegated LSP that was not previously controlled by the PCE.
	  • Locally controlled—PCC has control of the source-routing path.
	  This can happen when:
	  • The PCE has returned the control of the source-routing path.
	  • Delegation timer with the PCE has expired.
	• Routing-status: Applicable to delegated source-routing paths only.
	  • Externally routed—PCE provided the ERO for the source-routing path for a delegated LSP through PCUpdate.
	  • Locally routed—PCE does not provide ERO for the source-routing path.

Route preference	Route preference of the SR-TE LSP.
Number of LSPs	Statistics of the total number of SR-TE LSPs and the LSP state.

Table 15: show spring-traffic-engineering Output Fields *(Continued)*

Field Name	Field Description
External controllers	Name of the LSP external controller. By default the only supported external controller is **pccd**.
BFD name	Name of the BFD session. The name is auto-generated in the **V4-srte_bfd_session-*id*** for IPv6. The name is based on the Explicit Route Object (ERO) stack of the LSP path, that is, if multiple LSPs have same path they share the same BFD session name.
BFD status	Status of the BFD session: UP, DOWN.
Referencing LSPs	Name of referencing LSP. If the LSP does not have a path name, then the referencing LSP is displayed as **unnamed path**.
SR-ERO hop count	Number of hops in the segment routing ERO.
Hop 1	Represents the path of the BFD session. If any other LSP is on same path, it has the same BFD session.
Total displayed BFD sessions	Total count of all the BFD sessions.
Tunnel source	Source of the tunnel configuration; for example, **static configuration**.
Ingress telemetry statistics	Ingress telemetry statistics including the sensor name and ID.
Transit telemetry statistics	Transit telemetry statistics including the sensor name and ID.

Table 15: show spring-traffic-engineering Output Fields *(Continued)*

ERO Valid	Indicates whether the received explicit route object (ERO) is valid or not.

Sample Output

show spring-traffic-engineering lsp name

```
user@host> show spring-traffic-engineering lsp name lsp-name
To          State        LSP Name
               10.1.1.7   Up           to-R1
```

show spring-traffic-engineering lsp detail

```
user@host> show spring-traffic-engineering lsp detail
10.1.1.7
                State: Up
                S-ERO: 24.1.1.1(80001) 10.1.1.3(4509) 11.2.1.2(9875)
                Bandwidth: 100M
                The above line is in IP address(label) format.
```

show spring-traffic-engineering lsp detail (BGP-SR-TE policies based tunnel)

```
user@host> show spring-traffic-engineering lsp detail
Name: tunnel15
Tunnel-source: Static configuration
To: 6.6.6.6
State: Up
  Path: sl-15-primary
  Outgoing interface: NA
  Auto-translate status: Disabled Auto-translate result: N/A
  Compute Status:Disabled , Compute Result:N/A , Compute-Profile Name:N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 3
    Hop 1 (Strict):
      NAI: IPv4 Adjacency ID, 0.0.0.0 -> 21.2.4.2
```

```
      SID type: None
    Hop 2 (Strict):
      NAI: None
      SID type: 20-bit label, Value: 400050
    Hop 3 (Strict):
      NAI: None
      SID type: 20-bit label, Value: 400060
  Path: sl-15-backup
  Outgoing interface: ge-0/0/2.0
  Auto-translate status: Disabled Auto-translate result: N/A
  Compute Status:Disabled , Compute Result:N/A , Compute-Profile Name:N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 3
    Hop 1 (Strict):
      NAI: IPv4 Adjacency ID, 0.0.0.0 -> 21.2.3.2
      SID type: None
    Hop 2 (Strict):
      NAI: None
      SID type: 20-bit label, Value: 400050
    Hop 3 (Strict):
      NAI: None
      SID type: 20-bit label, Value: 400060
  Path: sl-15-backup
  Outgoing interface: ge-0/0/2.0
  Auto-translate status: Disabled Auto-translate result: N/A
  Compute Status:Disabled , Compute Result:N/A , Compute-Profile Name:N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 3
    Hop 1 (Strict):
      NAI: IPv4 Adjacency ID, 0.0.0.0 -> 21.2.3.2
      SID type: None
    Hop 2 (Strict):
      NAI: None
      SID type: 20-bit label, Value: 400050
    Hop 3 (Strict):
      NAI: None
      SID type: 20-bit label, Value: 400060

Name: bgp-srte-0.0.0.0-900-7.7.7.7-111
Tunnel-source: BGP SRTE
To: 7.7.7.7-111 State: Up <c>
```

```
Outgoing interface: NA
  Auto-translate status: Disabled Auto-translate result: N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 1
    Hop 1 (Strict):
      NAI: None
      SID type: 32-bit label, Value: 400050, TTL: 10, Exp: 1


Name: bgp-srte-0.0.0.0-900-5.5.5.5-111
Tunnel-source: BGP SRTE
To: 5.5.5.5-111<c>
State: Up
  Outgoing interface: NA
  Auto-translate status: Disabled
  Auto-translate result: N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 1
    Hop 1 (Strict):
      NAI: None
      SID type: 32-bit label, Value: 400050, TTL: 10, Exp: 1

Name: bgp-srte-0.0.0.0-900-6.6.6.6-111
Tunnel-source: BGP SRT E
To: 6.6.6.6-111<c>
State: Up
     Outgoing interface: NA
  Auto-translate status: Disabled
  Auto-translate result: N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 1
    Hop 1 (Strict):
      NAI: None
      SID type: 32-bit label, Value: 400050, TTL: 10, Exp: 1

Total displayed LSPs: 4 (Up: 4, Down: 0)
```

show spring-traffic-engineering lsp detail (BGP-SR-TE policies based colored tunnels)

For colored tunnels, telemetry details is displayed.

```
user@host> show spring-traffic-engineering lsp detail

Name: bgp-srte-0.0.0.0-900-6.6.6.6-111
Tunnel-source: BGP SRTE
To: 6.6.6.6-111
State: Up Telemetry statistics:
Sensor-name: f4248-6.6.6.6-6f, Id: 3758096396
Sensor-name: 6.6.6.6-6f, Id: 3758096395
  Outgoing interface: NA
  Auto-translate status: Disabled Auto-translate result: N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 1
  Hop 1 (Strict):
    NAI: None
    SID type: 32-bit label, Value: 400050, TTL: 10, Exp: 1
```

show spring-traffic-engineering lsp detail (BGP-SRTE filter in tunnel source)

```
user@host> show spring-traffic-engineering lsp detail
```

show spring-traffic-engineering lsp detail (PCE-Delegated LSPs)

```
user@host> show spring-traffic-engineering lsp detail
srte_at_dlg_to_r5
Oct 16 14:39:11
Name: srte_at_dlg_to_r5
Tunnel-source: Static configuration
To: 128.220.14.141
State: Up
  Path: sr_auto_to_r5
  Outgoing interface: NA
  Delegation info:
   Control-status: Externally controlled
   Routing-status: Externally routed
```

```
  Auto-translate status: Disabled Auto-translate result: N/A
  BFD status: N/A BFD name: N/A
```

show spring-traffic-engineering overview

```
user@host> show spring-traffic-engineering overview
Overview of SPRING-TE:
  Route preference: 8
  Number of LSPs: 0 (Up: 0, Down: 0)
  External controllers:
    pccd
```

show spring-traffic-engineering sbfd detail

```
user@host> show spring-traffic-engineering sbfd detail
BFD name: V4-srte_bfd_session-1
BFD status: Down
Referencing LSPs:
  sr-lsp1:path1
  sr-lsp2:path1
SR-ERO hop count: 2
  Hop 1 (Strict):
    NAI: IPv4 Adjacency ID, 1.2.1.1 -> 1.2.1.2
    SID type: 20-bit label, Value: 299776
  Hop 2 (Strict):
    NAI: IPv4 Adjacency ID, 2.3.0.1 -> 2.3.0.2
      SID type: 20-bit label, Value: 299824


Total displayed BFD sessions: 2 (Up: 2, Down: 0)
```

show spring-traffic-engineering lsp detail name <name>

```
user@host> show spring-traffic-engineering lsp detail name sr_plcy1
Name: sr_plcy1
Tunnel source: Static configuration
To: 1.1.1.1
State: Up
```

```
  Path: sl1
Ingress telelemetry statistics:
      Sensor-Name: i;st;0;f;sr_plcy1;sl1, Id: 3758096390
Transit telelemetry statistics:
      Sensor-Name: t;st;0;f;sr_plcy1;sl1, Id: 3758096391
  Path: sl2
Ingress telelemetry statistics:
      Sensor-Name: i;st;0;f;sr_plcy1;sl2, Id: 3758096390
Transit telelemetry statistics:
      Sensor-Name: t;st;0;f;sr_plcy1;sl2, Id: 3758096391
```

Release Information

Command introduced in Junos OS Release 17.2.

sbfd option introduced in Junos OS Release 19.4R1 on all platforms.

RELATED DOCUMENTATION

Enable Segment Routing for the Path Computation Element Protocol

show network-agent statistics

IN THIS SECTION

- Syntax | **554**
- Description | **554**
- Options | **554**
- Required Privilege Level | **554**
- Output Fields | **555**
- Sample Output | **556**
- Release Information | **557**

Syntax

```
show network-agent statistics
<brief | detail>
<juniper>
<gnmi>
<all>
<subscription-id identifier>
<subscription-path path>
```

Description

Display details of all or specific sensor subscriptions configured for Junos telemetry interface (JTI). Subscriptions can be made using wither a Juniper API or a gRPC Network Management Interface (gNMI) API.

Options

brief | detail	(Optional) Display brief or detail level of output.
juniper	(Optional) Displays subscriptions using the Juniper API.
gnmi	(Optional) Displays subscriptions using the gRPC Network Management Interface (gNMI) API.
all	(Optional) Display both Juniper and gNMI-based subscription statistics.
subscription-id *identifier*	(Optional) Display subscription statistics specific to a subscription. Configure an identifier in the range from **0** through **4294967295**. By default, information is displayed for all subscriptions.
subscription-paths *path*	(Optional) Display subscription statistics specific to one or more exact resource paths in a subscription; for example, **[/junos/system/linecard/interface/ /components/]**.

Required Privilege Level

view

Output Fields

Table 16 on page 555 lists the output fields for the **show network-agent statistics** command. Output fields are listed in the approximate order in which they appear.

Table 16: show network-agent statistics Output Fields

Field Name	Field Description
Subscription ID	Numerical identifier of the sensor.
Type	Type of API used for the subscription. Values are **juniper** or **gNMI**.
Client IP	IP address of the client that is collecting sensor data.
Subscription Time	Time of subscription, which helps to correlate statistics information from the provisioning logs that are taken over a period of multiple subscriptions.
Sensor Path	Resource path configured for the subscription; for example, **/components/**.
Reporting Interval	Interval at which statistics are streamed for a subscription.
Component(s)	Component for which statistics are provided.
Average Latency	Average latency values per sensor, which helps to check the latency of any given sensor on the device.
Circular Buffer used	Approximate circular buffer usage per sensor, which provides an early alert if drops are likely for any specific sensor.
Bytes Sent	Number of bytes transiting for this sensor.
Packets Sent	Number of packets transiting for this sensor.
Drops	Number of drops for this sensor.

Table 16: show network-agent statistics Output Fields *(Continued)*

Field Name	Field Description
Initial Sync Bytes Sent	Number of bytes sent for the subscription's initial synchronization.
Initial Sync Packets Sent	Number of packets sent during the subscription's initial synchronization.
Initial Sync Drops	Number of drops during subscription's initial synchronization.

Sample Output

show network-agent statistics (detailed output, no subscription present)

```
user@host> show network-agent statistics detail
No sensors subscribed/available
```

show network-agent statistics (detailed output, subscription creation in progress)

```
user@host> show network-agent statistics detail
Subscription not created completely, so not available for queries right now
```

show network-agent statistics (detailed output, subscription created, system operating in a steady state)

```
user@host> show network-agent statistics detail
Subscription Details :
    Subscription ID                    : 1
    Type                               : juniper
    Client IP                          : ipv6:::ffff:10.209.0.224:45888
    Subscription Time                  : 2020-02-24 04:08:11 UTC

    Sensor Statistics :
```

```
        Sensor Path                     : /components/
        Reporting Interval              : 2
        Component(s)                    : jkdsd,chassisd
        Average Latency                 : 5
        Circular Buffer used            : 12
        Bytes Sent                      : 176530
        Packets Sent                    : 21
        Drops                           : 0

        Child Sensor Statistics :
            Path                        : /components/
            Component                   : chassisd
            Bytes Sent                  : 172773
            Packets Sent                : 14
            Drops                       : 0

        Child Sensor Statistics :
            Path                        : /components/
            Component                   : jkdsd
            Bytes Sent                  : 3757
            Packets Sent                : 7
            Drops                       : 0
```

show network-agent statistics (detailed output, subscription deletion in progress)

```
user@host> show network-agent statistics detail
Unable to receive the subscription details
```

Release Information

Command introduced in Junos OS Release 19.2R1.

RELATED DOCUMENTATION

show agent sensors | 524

show extension-service request-response clients

IN THIS SECTION

- Syntax | 558
- Description | 558
- Options | 558
- Required Privilege Level | 558
- Output Fields | 559
- Sample Output | 559
- Release Information | 560

Syntax

```
show extension-service request-response clients (detail | brief)
```

Description

Display the status of the request-response clients connected to the device.

Options

client-id	The client identifier.
brief	(Default) Display a summary of the information.
detail	Display detailed information.

Required Privilege Level

view

Output Fields

Table 17 on page 559 lists the output fields for the **show extension-service request-response clients** command.

Table 17: show extension-service request-response clients Output Fields

Field Name	Field Description
Client ID	Client identifier.
Socket Address	Address of the socket.
Client Type	Type of the client.
Client Login Time	The most recent login time of the remote procedure call (gRPC) client. This is when the authentication request was received for the channel.
Channel Count	The number of channels.
User Name	The user name for which the session was authenticated in a gRPC session. If authentication is not required, this field displays as “No User.” This helps you identify which users have requested programmable operations.

Sample Output

show extension-service request-response clients

```
user@device> show extension-service request-response clients

Client ID                      Socket Address                Client Type Client
Login Time Channel Count
ipv6:::ffff:10.209.0.224:45888 ipv6:::ffff:10.209.0.224:45888 gRPC
2020-02-24 04:08:11 UTC    1
```

```
unix::20               unix::20                          gRPC
2020-02-23 15:23:47 UTC      1
```

show extension-service request-response clients detail

```
user@device> show extension-service request-response clients detail
Channel information:
  Client ID: ipv6:::ffff:10.209.0.224:45888
  Socket Address: ipv6:::ffff:10.209.0.224:45888
  Client Type: gRPC
  Client Login Time : 2020-02-24 04:08:11 UTC
  Channel Count: 1

    Channel target: unix:/var/run/japi_mgd-api
    Channel status: GRPC_CHANNEL_READY
    User Name: root

Channel information:
  Client ID: unix::20
  Socket Address: unix::20
  Client Type: gRPC
  Client Login Time : 2020-02-23 15:23:47 UTC
  Channel Count: 1

    Channel target: unix:/var/run/japi_na-grpcd
    Channel status: GRPC_CHANNEL_READY
    User Name: No User
```

Release Information

Command introduced in Junos OS.

Client Login Time and **User Name** output fields introduced in Junos OS Release 20.4R1 for PTX5000.

show extension-service request-response servers

IN THIS SECTION

- Syntax | 561
- Description | 561
- Required Privilege Level | 561
- Output Fields | 561
- Sample Output | 562
- Release Information | 562

Syntax

```
show extension-service request-response servers
```

Description

Display the status of the request-response servers connected to the device.

Required Privilege Level

view

Output Fields

Table 18 on page 562 lists the output fields for the **show extension-service request-response servers** command.

Table 18: show extension-service request-response servers Output Fields

Field Name	Field Description
Max connections	The maximum number of simultaneous connections for request-response that can be attached to jsd.
Address	The address of the server.
Status	The status of the server.

Sample Output

show extension-service request-response servers

```
user@device> show extension-service request-response servers
gRPC server information:
  Max connections: 5, Skip-authentication: Disabled

  Address: unix:/var/run/japi_jsd
  Status: Up, Type: Clear-text
```

Release Information

Command introduced in Junos OS.

show spring-traffic-engineering

IN THIS SECTION

- Syntax | 563
- Description | 563

- Options | 563
- Required Privilege Level | 563
- Output Fields | 564
- Sample Output | 567
- Release Information | 572

Syntax

```
show spring-traffic-engineering (lsp | overview | sbfd)
<brief | detail>
<logical-system (all | logical-system-name)>
<name lsp-name>
```

Description

Display ingress details of SPRING traffic engineering.

Options

brief | detail (Optional) Display the specific level of output.

lsp Display details of SPRING traffic-engineered LSPs on the ingress router or the Path Computation Client (PCC).

overview Display overview of SPRING traffic-engineered LSPs on the ingress router, or the PCC.

sbfd Display the SPRING traffic-engineered BFD session.

name *lsp-name* (Optional) Regular expression for LSP names to match for displaying SPRING traffic-engineering details.

Required Privilege Level

view

Output Fields

Table 19 on page 564 describes the output fields for the **show spring-traffic-engineering** command. Output fields are listed in the approximate order in which they appear.

Table 19: show spring-traffic-engineering Output Fields

Field Name	Field Description
To	IP address of the SR-TE LSP destination.
State	State of the SR-TE LSP: • Up • Down
LSP Name	Name of the SR-TE LSP.
S-ERO	Source Explicit Route Object (ERO), or LSP path.
Bandwidth	Bandwidth allocated for the SR-TE LSP.

Table 19: show spring-traffic-engineering Output Fields *(Continued)*

Field Name	Field Description

Delegation info	LSP control and routing status:
	• Control-status:
	  • Externally controlled—PCE has control of the source-routing path.
	  This can happen when:
	  • The **lsp-external-controller pccd** statement is configured either under the source-routing path or under the primary segment list.
	  • The **request path-computation-client retry-delegation *lsp-name*** command is issued for a delegated LSP that was not previously controlled by the PCE.
	  • Locally controlled—PCC has control of the source-routing path.
	  This can happen when:
	  • The PCE has returned the control of the source-routing path.
	  • Delegation timer with the PCE has expired.
	• Routing-status: Applicable to delegated source-routing paths only.
	  • Externally routed—PCE provided the ERO for the source-routing path for a delegated LSP through PCUpdate.
	  • Locally routed—PCE does not provide ERO for the source-routing path.

Route preference	Route preference of the SR-TE LSP.
Number of LSPs	Statistics of the total number of SR-TE LSPs and the LSP state.

Table 19: show spring-traffic-engineering Output Fields *(Continued)*

Field Name	Field Description
External controllers	Name of the LSP external controller. By default the only supported external controller is **pccd**.
BFD name	Name of the BFD session. The name is auto-generated in the **V4-srte_bfd_session-*id*** for IPv6. The name is based on the Explicit Route Object (ERO) stack of the LSP path, that is, if multiple LSPs have same path they share the same BFD session name.
BFD status	Status of the BFD session: UP, DOWN.
Referencing LSPs	Name of referencing LSP. If the LSP does not have a path name, then the referencing LSP is displayed as **unnamed path**.
SR-ERO hop count	Number of hops in the segment routing ERO.
Hop 1	Represents the path of the BFD session. If any other LSP is on same path, it has the same BFD session.
Total displayed BFD sessions	Total count of all the BFD sessions.
Tunnel source	Source of the tunnel configuration; for example, **static configuration**.
Ingress telemetry statistics	Ingress telemetry statistics including the sensor name and ID.
Transit telemetry statistics	Transit telemetry statistics including the sensor name and ID.

Table 19: show spring-traffic-engineering Output Fields *(Continued)*

ERO Valid	Indicates whether the received explicit route object (ERO) is valid or not.

Sample Output

show spring-traffic-engineering lsp name

```
user@host> show spring-traffic-engineering lsp name lsp-name
To          State        LSP Name
               10.1.1.7   Up           to-R1
```

show spring-traffic-engineering lsp detail

```
user@host> show spring-traffic-engineering lsp detail
10.1.1.7
                State: Up
                S-ERO: 24.1.1.1(80001) 10.1.1.3(4509) 11.2.1.2(9875)
                Bandwidth: 100M
                The above line is in IP address(label) format.
```

show spring-traffic-engineering lsp detail (BGP-SR-TE policies based tunnel)

```
user@host> show spring-traffic-engineering lsp detail
Name: tunnel15
Tunnel-source: Static configuration
To: 6.6.6.6
State: Up
  Path: sl-15-primary
  Outgoing interface: NA
  Auto-translate status: Disabled Auto-translate result: N/A
  Compute Status:Disabled , Compute Result:N/A , Compute-Profile Name:N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 3
    Hop 1 (Strict):
      NAI: IPv4 Adjacency ID, 0.0.0.0 -> 21.2.4.2
```

```
      SID type: None
    Hop 2 (Strict):
      NAI: None
      SID type: 20-bit label, Value: 400050
    Hop 3 (Strict):
      NAI: None
      SID type: 20-bit label, Value: 400060
  Path: sl-15-backup
  Outgoing interface: ge-0/0/2.0
  Auto-translate status: Disabled Auto-translate result: N/A
  Compute Status:Disabled , Compute Result:N/A , Compute-Profile Name:N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 3
    Hop 1 (Strict):
      NAI: IPv4 Adjacency ID, 0.0.0.0 -> 21.2.3.2
      SID type: None
    Hop 2 (Strict):
      NAI: None
      SID type: 20-bit label, Value: 400050
    Hop 3 (Strict):
      NAI: None
      SID type: 20-bit label, Value: 400060
  Path: sl-15-backup
  Outgoing interface: ge-0/0/2.0
  Auto-translate status: Disabled Auto-translate result: N/A
  Compute Status:Disabled , Compute Result:N/A , Compute-Profile Name:N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 3
    Hop 1 (Strict):
      NAI: IPv4 Adjacency ID, 0.0.0.0 -> 21.2.3.2
      SID type: None
    Hop 2 (Strict):
      NAI: None
      SID type: 20-bit label, Value: 400050
    Hop 3 (Strict):
      NAI: None
      SID type: 20-bit label, Value: 400060

Name: bgp-srte-0.0.0.0-900-7.7.7.7-111
Tunnel-source: BGP SRTE
To: 7.7.7.7-111 State: Up <c>
```

```
Outgoing interface: NA
  Auto-translate status: Disabled Auto-translate result: N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 1
    Hop 1 (Strict):
      NAI: None
      SID type: 32-bit label, Value: 400050, TTL: 10, Exp: 1


Name: bgp-srte-0.0.0.0-900-5.5.5.5-111
Tunnel-source: BGP SRTE
To: 5.5.5.5-111<c>
State: Up
  Outgoing interface: NA
  Auto-translate status: Disabled
  Auto-translate result: N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 1
    Hop 1 (Strict):
      NAI: None
      SID type: 32-bit label, Value: 400050, TTL: 10, Exp: 1

Name: bgp-srte-0.0.0.0-900-6.6.6.6-111
Tunnel-source: BGP SRT E
To: 6.6.6.6-111<c>
State: Up
     Outgoing interface: NA
  Auto-translate status: Disabled
  Auto-translate result: N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 1
    Hop 1 (Strict):
      NAI: None
      SID type: 32-bit label, Value: 400050, TTL: 10, Exp: 1

Total displayed LSPs: 4 (Up: 4, Down: 0)
```

show spring-traffic-engineering lsp detail (BGP-SR-TE policies based colored tunnels)

For colored tunnels, telemetry details is displayed.

```
user@host> show spring-traffic-engineering lsp detail

Name: bgp-srte-0.0.0.0-900-6.6.6.6-111
Tunnel-source: BGP SRTE
To: 6.6.6.6-111
State: Up Telemetry statistics:
Sensor-name: f4248-6.6.6.6-6f, Id: 3758096396
Sensor-name: 6.6.6.6-6f, Id: 3758096395
  Outgoing interface: NA
  Auto-translate status: Disabled Auto-translate result: N/A
  BFD status: N/A BFD name: N/A
  ERO Valid: true
  SR-ERO hop count: 1
  Hop 1 (Strict):
    NAI: None
    SID type: 32-bit label, Value: 400050, TTL: 10, Exp: 1
```

show spring-traffic-engineering lsp detail (BGP-SRTE filter in tunnel source)

```
user@host> show spring-traffic-engineering lsp detail
```

show spring-traffic-engineering lsp detail (PCE-Delegated LSPs)

```
user@host> show spring-traffic-engineering lsp detail
srte_at_dlg_to_r5
Oct 16 14:39:11
Name: srte_at_dlg_to_r5
Tunnel-source: Static configuration
To: 128.220.14.141
State: Up
  Path: sr_auto_to_r5
  Outgoing interface: NA
  Delegation info:
   Control-status: Externally controlled
   Routing-status: Externally routed
```

```
  Auto-translate status: Disabled Auto-translate result: N/A
  BFD status: N/A BFD name: N/A
```

show spring-traffic-engineering overview

```
user@host> show spring-traffic-engineering overview
Overview of SPRING-TE:
  Route preference: 8
  Number of LSPs: 0 (Up: 0, Down: 0)
  External controllers:
    pccd
```

show spring-traffic-engineering sbfd detail

```
user@host> show spring-traffic-engineering sbfd detail
BFD name: V4-srte_bfd_session-1
BFD status: Down
Referencing LSPs:
  sr-lsp1:path1
  sr-lsp2:path1
SR-ERO hop count: 2
  Hop 1 (Strict):
    NAI: IPv4 Adjacency ID, 1.2.1.1 -> 1.2.1.2
    SID type: 20-bit label, Value: 299776
  Hop 2 (Strict):
    NAI: IPv4 Adjacency ID, 2.3.0.1 -> 2.3.0.2
      SID type: 20-bit label, Value: 299824


Total displayed BFD sessions: 2 (Up: 2, Down: 0)
```

show spring-traffic-engineering lsp detail name <name>

```
user@host> show spring-traffic-engineering lsp detail name sr_plcy1
Name: sr_plcy1
Tunnel source: Static configuration
To: 1.1.1.1
State: Up
```

```
  Path: sl1
Ingress telelemetry statistics:
      Sensor-Name: i;st;0;f;sr_plcy1;sl1, Id: 3758096390
Transit telelemetry statistics:
      Sensor-Name: t;st;0;f;sr_plcy1;sl1, Id: 3758096391
  Path: sl2
Ingress telelemetry statistics:
      Sensor-Name: i;st;0;f;sr_plcy1;sl2, Id: 3758096390
Transit telelemetry statistics:
      Sensor-Name: t;st;0;f;sr_plcy1;sl2, Id: 3758096391
```

Release Information

Command introduced in Junos OS Release 17.2.

sbfd option introduced in Junos OS Release 19.4R1 on all platforms.

RELATED DOCUMENTATION

Enable Segment Routing for the Path Computation Element Protocol

source-packet-routing

IN THIS SECTION

- Syntax | **573**
- Hierarchy Level | **573**
- Description | **573**
- Default | **574**
- Options | **574**
- Required Privilege Level | **574**
- Release Information | **575**

Syntax

```
source-packet-routing {
    telemetry {
        statistics {
            per-source per-segment-list
            no-transit;
            no-ingress;
            }
        }
     source-routing-path {
         use-for-shortcut;
         }
    }
```

Hierarchy Level

```
[edit protocols]
```

Description

Enable BGP and statically configured Segment Routing Traffic Engineering (SR-TE) traffic statistics sensor support for Junos telemetry interface (JTI).

Export JTI statistics using either remote procedure call (gRPC) services or UDP native sensors to stream statistics. The following resource paths are supported. For UDP native sensors:

- **/junos/services/segment-routing/traffic-engineering/ingress/usage/**
- **/junos/services/segment-routing/traffic-engineering/transit/usage**

For gRPC streaming:

- /mpls/signaling-protocols/segment-routing/

Export SR-TE per Label Switched Path (LSP) route statistics using JTI and gRPC services. Using JTI and gRPC services. You can stream SR-TE telemetry statistics for uncolored SR-TE policies statistics to an outside collector. Ingress statistics include statistics for all traffic steered by means of an SR-TE LSP. Transit statistics include statistics for traffic to the Binding SID (BSID) of the SR-TE policy.

To enable these statistics, include the **per-source per-segment-list** option at the [**edit protocols source-packet-routing telemetry statistics**] hierarchy level. When configuring:

- If the statement **set protocols source-packet-routing telemetry statistics no-ingress** is issued, ingress sensors are not created.
- If the statement **set protocols source-packet-routing telemetry statistics no-transit** is issued, transit sensors are not created. Otherwise, if BSID is configured for a tunnel, transit statistics are created.

The following resource paths (sensors) are supported:

- **/junos/services/segment-routing/traffic-engineering/tunnel/lsp/ingress/usage/**
- **/junos/services/segment-routing/traffic-engineering/tunnel/lsp/transit/usage/**

For exporting statistics using UDP native sensors, configure parameters at the [edit services analytics] hierarchy level. To provision sensors to export data through gRPC streaming, use the telemetrySubscribe RPC to specify telemetry parameters.

Default

Disabled.

Options

statistics	Create sensors for both the SR-TE policy nexthop and the binding SID that are installed in the forwarding plane. For the SR-TE policy nexthop, the sensors collect traffic statistics steered by all routes that use the SR-TE policy as a nexthop. For the binding SID, the sensors collect statistics on labeled traffic that is steered by the binding-SID route.
per-source per-segment-list	Create sensors to export SR-TE per LSP route statistics for uncolored SR-TE policies. Ingress statistics include statistics for all traffic steered by means of an SR-TE LSP. Transit statistics include statistics for traffic to the BSID of the SR-TE policy.
no-transit	Enable sensors only for SR-TE policy nexthops. The sensor will collect statistics on all steering routes that use the SR-TE policy as a nexthop.
no-ingress	Enable sensors only for Binding-SID transit routes.
source-routing-path	Specify the name of the source routing path.
use-for-shortcut	Enable to allow the LSP to be used as a shortcut tunnel.

Required Privilege Level

routing

Release Information

Statement introduced in Junos OS Release 18.3R1.

Option **per-source per-segment-list** is introduced in Junos OS Release 20,1R1 for MX Series and PTX Series routers.

Statement supported in Junos OS Release 20.2R1 for MX240. MX480, MX960, MX2010, and MX2020 with MPC-10E or MPC-11E routers.

RELATED DOCUMENTATION

- Understanding OpenConfig and gRPC on Junos Telemetry Interface | **36**
- Configure a NETCONF Proxy Telemetry Sensor in Junos | **414**
- sensor (Junos Telemetry Interface) | **484**
- *statistics*
- *telemetry*

ssl

IN THIS SECTION

- Syntax | **575**
- Hierarchy Level | **576**
- Description | **576**
- Options | **576**
- Required Privilege Level | **577**
- Release Information | **577**

Syntax

```
ssl {
    address ip-address;
    local-certificate local-certificate;
```

```
    mutual-authentication {
        certificate-authority certificate-authority-profile-name;
        client-certificate-request (no-certificate | request-certificate |
request-certificate-and-verify | require-certificate | require-certificate-and-
verfiy);
        }
    hot-reloading;
    port port;
}
```

Hierarchy Level

```
[edit system services extension-service request-response grpc]
```

Description

Configure API connection settings based on Secure Sockets Layer (SSL) technology.

Options

address *ip-address*

Specify the IP address to listen for incoming connections. If you use the default IP address 0.0.0.0, the JET service process (jsd) listens on the IP address in the default routing instance.

- **Default:** 0.0.0.0

mutual-authentication

Enable bidirectional authentication. Use this option, in conjunction with **client-certificate-request** and **certificate-authority *profile-name*** to configure client authentication using SSL-based certificates.

client-certificate-request

Specify the requirements for a client certificate.

no-certificate—Client certificate is not requested.

> **NOTE**: We strongly recommend that you use this option in a test environment only.

request-certificate—Request certificate from client but do not verify.

request-certificate-and-verify—Request certificate from client and verify if provided.

require-certificate—Client certificate is mandatory, but do not verify.

require-certificate-and-verfiy—Client certificate is mandatory, and certificate is verified.

- **Default:** no-certificate

> **NOTE**: You can specify only one value for a client certificate.

hot-reloading Enable persistent gRPC sessions across SSL certificate updates between a collector and a client. If this feature is not enabled, when a certificate is updated between a client and a collector, all existing gRPC sessions are terminated.

certificate-authority *profile-name* Specify the name of a certificate-authorirty profile configured at the [**edit security** `pki` **ca-profile**] hierarchy level. This profile is used to validate the certificate provided by the client.

port *port* Specify the port number to accept incoming connections.

> **NOTE**: For gRPC connections used to stream telemetry data, the required port number is 32767.

- **Range:** 1 through 65535
- **Default:** 9090

The remaining statement is explained separately. See CLI Explorer.

Required Privilege Level

system—To view this statement in the configuration.

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

Release Information

Statement introduced in Junos OS Release 16.1.

mutual-authentication, **client-certificate-request**, and **certificate-authority** options introduced in Junos OS Release 17.4R1.

RELATED DOCUMENTATION

grpc

JET Service Process Overview

Configuring Request-Response Service for JET Applications

telemetry

IN THIS SECTION

- Syntax | 578
- Hierarchy Level | 579
- Description | 579
- Options | 580
- Required Privilege Level | 580
- Release Information | 580

Syntax

```
telemetry {
    subscriber-statistics;
    service-statistics;
    }
    interfaces junos-interface-name {
        unit "$junos-interface-unit" {
            family [inet | inet6] {
                filter {
                    input "inputFilter";
                    output "outputFilter";
                }
```

```
            }
        }
    }
    queue-statistics {
        interface $junos-interface-name {
            refresh rate;
            queues queue-set;
        }
        interface-set $junos-interface-set-name {
            refresh rate;
            queues queue-set;
        }
    }
}
```

Hierarchy Level

```
[edit dynamic-profiles profile-name]
```

Description

Enable telemetry collection of subscriber statistics and queue statistics.

Include the **subscriber-statistics** statement to enable the export of subscriber statistics through telemetry. When this statement is configured, you must also include the **actual-transit-statistics** statement at the [**edit dynamic-profiles *profile-name* interfaces *interface-name* unit *unit-name***} hierarchy level to enable subscriber-statistics.

Include the **queue-statistics** statement to instruct the statistics infrastructure to collect queue statistics for dynamic interfaces or interface-sets queue-statistics and enable export via Junos Telelemetry Interface (JTI).

The profile variable **$junos-interface-name”** and **“$junos-interface-set-name”** are generated from the corresponding device, unit and interface-set elements in the interfaces stanza at profile instantiation time. Using these derived variables is a convenient way to configure telemetry behavior for the interface or interface-set without the need to mimic the specific configuration in the interfaces stanza.

After telemetry for these statistics is enabled, they are eligible for export through a collector subscription.

For information about subscribing to the statistics through an external collector, see "Configure a NETCONF Proxy Telemetry Sensor in Junos" on page 414. For information about supported sensors for

subscriber statistics and queue statistics, see "Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface)" on page 73.

Options

subscriber-statistics Enable the export of interface meta-data and export of subscriber accurate statistics. When this statement is configured, you must also include the **actual-transit-statistics** statement at the [**edit dynamic-profiles** *profile-name* **interfaces** *interface-name* **unit** *unit-name*] hierarchy level.

queue statistics interface "$junos-interface-name"** Enable the export of interface meta-data and interface queue statistics. The profile variable **$junos-interface-name" is generated from the corresponding device, unit and interface elements in the interfaces stanza at profile instantiation time.

queue statistics interface-set "$junos-interface-set-name"** Enable the export of interface-set meta-data and interface-set queue statistics. The profile variable **"$junos-interface-set-name" is generated from the corresponding device, unit and interface-set elements in the interfaces stanza at profile instantiation time.

refresh *rate* Override the default internal queue statistics collection interval. If dynamic interfaces and interface-sets are created as a result of multiple dynamic profiles, each with their own refresh intervals, the smallest interval for each object type (interface or interface-set) is used to poll queue statistics for that object type. The default is 900 seconds.

Range: 300 seconds (5 minutes) to 86,400 seconds (24 hours)

queue "*queue-set***"** Specify the set of queues for which queue-statistics will be exported. The queue set is a comma delimited string of integers. The default is all queues (**0,1,2,3,4,5,6,7**) are eligible for export.

Range: 0 to 7

Required Privilege Level

interface—To view this statement in the configuration.

interface-control—To add this statement to the configuration.

Release Information

Statement introduced in Junos OS 18.4.

RELATED DOCUMENTATION

- Enable Export of Subscriber Statistics and Queue Statistics | **446**
- Understanding Enabling Export of Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | **444**
- Guidelines for Exporting Subscriber Statistics and Queue Statistics for Dynamic Interfaces and Interface-Sets | **458**
- Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface) | **73**

CHAPTER 10

Network Telemetry Framework (NTF) Configuration Statements and Operational Commands

IN THIS CHAPTER

- agent (Analytics) | 582
- analytics | 585
- inputs (Analytics) | 591
- outputs (Analytics) | 595
- service-agents (Analytics) | 598
- show services analytics agent | 601
- traceoptions (Analytics Agent) | 604

agent (Analytics)

IN THIS SECTION

- Syntax | 582
- Hierarchy Level | 584
- Description | 584
- Required Privilege Level | 584
- Release Information | 584

Syntax

```
agent {
    service-agents {
```

```
        agent-name {
            inputs {
                analytics {
                    parameters {
                        generate-tags value;
                        sample-frequency value;
                        sensors file-path;
                    }
                }
                input-ipfix {
                    parameters {
                        maximum-connections number;
                        tcp-port port-number;
                        vrf-name name;
                    }
                }
                input-jti-ipfix {
                    parameters {
                        record-group group-name {
                            record ipfix-record-name;
                            reporting-interval seconds;
                        }
                    }
                }
            }
            outputs {
                file {
                    parameters {
                        path file-path;
                    }
                }
                kafka {
                    parameters {
                        server ip-address;
                        topic topic-name;
                        encoding encoding-type;
                    }
                }
                output-ipfix {
                    parameters {
                        collector-address ip-address;
                        collector-ca-certificate file-path;
                        collector-certificate file-path;
```

```
                        collector-certificate-key file-path;
                        collector-connection-retry-interval seconds;
                        collector-tcp-port port-number;
                        collector-vrf-name vrf-name;
                    }
                }
            }
        }
    }
    traceoptions {
        filename filename;
        flag (debug | error | info | trace);
    }
}
```

Hierarchy Level

```
[edit services analytics]
```

Description

Configure the Network Telemetry Framework (NTF) agent and corresponding service agents that use input and output plug-ins to collect, transform, and forward network telemetry data.

The remaining statements are explained separately. Search for a statement in CLI Explorer or click a linked statement in the Syntax section for details.

Required Privilege Level

system

Release Information

Statement introduced in Junos OS Release 18.3R1.

RELATED DOCUMENTATION

- *Configuring the BNG as an IPFIX Mediator to Collect and Export IPFIX Data*
- *Configuring the Collection and Export of Local Telemetry Data on the IPFIX Mediator*

Configuring NTF Agent

IPFIX Mediation on the BNG

Telemetry Data Collection on the IPFIX Mediator for Export to an IPFIX Collector

analytics

IN THIS SECTION

- Syntax (EX Series and QFX Series) | 585
- Syntax (MX Series & PTX Series) | 588
- Hierarchy Level | 590
- Description | 590
- Required Privilege Level | 590
- Release Information | 590

Syntax (EX Series and QFX Series)

Junos OS Release 13.2X51-D15 and later:

```
analytics {
    collector {
        local {
            file filename {
                size size;
                files number;
            }
        }
        address ip-address {
            port number {
                transport protocol {
                    export-profile profile-name;
                }
            }
        }
```

```
    }
    export-profiles {
        profile-name {
            interface {
                information;
                statistics {
                    queue;
                    traffic;
                }
                status {
                    link;
                    queue;
                    traffic;
                }
            }
            stream-format format;
            system {
                information;
                status {
                    queue;
                    traffic;
                }
            }
        }
    }
    resource {
        interfaces {
            interface-name {
                resource-profile name;
            }
        }
        system {
            polling-interval {
                queue-monitoring interval;
                traffic-monitoring interval;
            }
            resource-profile name;
        }
    }
    resource-profiles {
        profile-name {
            depth-threshold {
                high number;
```

```
                low number;
            }
            latency-threshold {
                high number;
                low number;
            }
            no-queue-monitoring;
            no-traffic-monitoring;
            queue-monitoring;
            traffic-monitoring;
        }
    }
    traceoptions {
        file filename {
            files number;
            size size;
        }
    }
}
```

Junos OS Release 13.2X50-D15 and 13.2X51-D10 only:

```
analytics {
    interfaces {
        all {
            depth-threshold high number low number;
            latency-threshold high number low number;
            queue-statistics;
            no-queue-statistics;
            traffic-statistics;
            no-traffic-statistics;
        }
        interface-name {
            depth-threshold high number low number;
            latency-threshold high number low number;
            queue-statistics;
            no-queue-statistics;
            traffic-statistics;
            no-traffic-statistics;
        }
    }
    queue-statistics {
```

```
        file filename {
            files number-of-files;
            size size;
        }
        interval interval;
    }
    streaming-servers {
        address ip-address {
            port number {
                stream-format format;
                stream-type type
            }
        }
    }
    traceoptions {
        file filename {
            files number;
            size size;
        }
    }
    traffic-statistics {
        file filename {
            files number-of-files;
            size size;
        }
        interval interval;
    }
}
```

Syntax (MX Series & PTX Series)

```
analytics {
    agent {
        service-agents {
            agent-name {
                inputs {
                    analytics {
                        parameters {
                            generate-tags value;
                            sample-frequency value;
                            sensors file-path;
```

```
            }
        }
        input-ipfix {
            parameters {
                maximum-connections number;
                tcp-port port-number;
                vrf-name name;
            }
        }
        input-jti-ipfix {
            parameters {
                record-group group-name {
                    record ipfix-record-name;
                    reporting-interval seconds;
                }
            }
        }
    }
    outputs {
        file {
            parameters {
                path file-path;
            }
        }
        kafka {
            parameters {
                server ip-address;
                topic topic-name;
                encoding encoding-type;
            }
        }
        output-ipfix {
            parameters {
                collector-address ip-address;
                collector-ca-certificate file-path;
                collector-certificate file-path;
                collector-certificate-key file-path;
                collector-connection-retry-interval seconds;
                collector-tcp-port port-number;
                collector-vrf-name vrf-name;
            }
        }
    }
```

```
            }
        }
        traceoptions {
            filename filename;
            flag (debug | error | info | trace);
        }
    }
}
```

Hierarchy Level

```
[edit services]
```

Description

Configure the network analytics feature that includes monitoring for traffic and queue statistics. The network analytics processes running on the Packet Forwarding Engine and Routing Engine collect and analyze the data, and generate reports that may be saved in log files or sent as streaming data to remote servers.

The remaining statements are explained separately. Search for a statement in CLI Explorer or click a linked statement in the Syntax section for details.

Required Privilege Level

interface—To view this statement in the configuration.

interface-control—To add this statement to the configuration.

Release Information

Statement introduced in Junos OS Release 13.2.

RELATED DOCUMENTATION

- Network Analytics Overview
- *Configuring the BNG as an IPFIX Mediator to Collect and Export IPFIX Data*
- Configuring NTF Agent
- *IPFIX Mediation on the BNG*

Configuring the Collection and Export of Local Telemetry Data on the IPFIX Mediator

Telemetry Data Collection on the IPFIX Mediator for Export to an IPFIX Collector

inputs (Analytics)

IN THIS SECTION

- Syntax | **591**
- Hierarchy Level | **592**
- Description | **592**
- Options | **592**
- Required Privilege Level | **594**
- Release Information | **594**

Syntax

```
inputs {
    analytics {
        parameters {
            generate-tags value;
            sample-frequency value;
            sensors path;
        }
    }
    input-ipfix {
        parameters {
            maximum-connections number;
            tcp-port port-number;
            vrf-name name;
        }
    }
    input-jti-ipfix {
        parameters {
            record-group group-name {
                record ipfix-record-name;
```

```
                reporting-interval seconds;
            }
        }
    }
}
```

Hierarchy Level

```
[edit services analytics agent service-agents agent-name]
```

Description

Configure parameters for a Network Telemetry Framework (NTF) service agent input plug-in. For each service agent instance, you can configure more than one input plug-in to push data to the output plug-in.

NOTE: When you modify the input plug-in configuration of a service agent instance, the associated service agent daemon is restarted.

Options

analytics parameters — Configure parameters to collect data from Junos Telemetry Interface (JTI) sensors.

generate-tags *value* — (Optional) Enable tag generation.

- **Default:** Enabled

sample-frequency *value* — Specify the frequency interval (in seconds) at which the JTI sensor generates data to export to the data collector. Range is from 0 to 24 hours.

- **Default:** 5 seconds

sensors *file-path* — Specify the resource string associated with the JTI sensor for collecting JTI data from a specific resource. The format is a file path and must be entered exactly. For a list of available JTI resource string options, see the sensor configuration statement and Guidelines for gRPC and gNMI Sensors (Junos Telemetry Interface) documentation.

input-ipfix parameters — Configure parameters for the IPFIX mediation service agent to gather and consolidate IPFIX records from downstream devices.

NOTE: Any change you make to an existing **input-ipfix** plug-in configuration restarts the IPFIX service agent daemon to apply the changes.

NOTE: Although each of the parameters has a default value, you must configure at least one of the parameters to enable the plug-in. If you configure only one parameter and want to use the default value, you must specify that value.

maximum-connections *number*

(Optional) Maximum number of TCP connections that the IPFIX mediator can support.

- **Range:** 1 through 500
- **Default:** 100

tcp-port *port-number*

(Optional) TCP port on the IPFIX mediator that receives TCP packets; the listening port.

- **Default:** 4739

vrf-name *name*

(Optional) Name of the VRF (routing instance) in which IPFIX packets are accepted.

- **Default:** default

input-jti-ipfix parameters

Configure parameters for the IPFIX mediation service agent to collect and report local sensor data from the BNG configured as an IPFIX mediator. For each group of records, the plug-in subscribes to the specific sensor data sets associated with each record.

When you remove a record group from the configuration, the sensor sets for the member records are unsubscribed. The template IDs for the associated IPFIX records are returned to the pool for re-use.

record *ipfix-record-name*

One of the following individual IPFIX records associated with a nonconfigurable set of local sensor data. See *Telemetry Data Collection on the IPFIX Mediator for Export to an IPFIX Collector* for the sensors collected by each record.

address-pool-utilization	port-statistics

chassis-inventory	resource-utilization
chassis-power	subscriber-statistics
dhcpv4-server-stats	thermal
interface-metadata	uptime
interface-queue-statistics	

BEST PRACTICE: We recommend that you configure the **interface-metadata** record whenever you configure the **interface-queue-statistics** record. The metadata information is essential for understanding details about the subscriber whose queue statistics are being collected.

record-group *group-name*

Name of a group of IPFIX records that subscribes to the sensor data sets associated with the individual records that comprise the record group. You can configure a maximum of 10 record groups.

reporting-interval *seconds*

(Optional) Interval in seconds between reports for the subscribed sensor data. The interval applies to all records (and all sensor sets) in the record group.

- **Range:** 60 through 86,400 seconds
- **Default:** 900 seconds

Required Privilege Level

system

Release Information

Statement introduced in Junos OS Release 18.3R1.

input-jti-ipfix option added in Junos OS Release 18.4R1 on MX Series routers.

analytics option added in Junos OS Release 18.4R1 on MX Series and PTX Series routers.

RELATED DOCUMENTATION

- *Configuring the BNG as an IPFIX Mediator to Collect and Export IPFIX Data*
- *Configuring the Collection and Export of Local Telemetry Data on the IPFIX Mediator*
- Configuring NTF Agent
- *IPFIX Mediation on the BNG*
- *Telemetry Data Collection on the IPFIX Mediator for Export to an IPFIX Collector*

outputs (Analytics)

IN THIS SECTION

- Syntax | 595
- Hierarchy Level | 596
- Description | 596
- Options | 596
- Required Privilege Level | 598
- Release Information | 598

Syntax

```
outputs {
    file {
        parameters {
            path file-path;
        }
    }
    kafka {
        parameters {
            server ip-address;
            topic topic-name;
            encoding encoding-type;
        }
    }
```

```
    output-ipfix {
        parameters {
            collector-address ip-address;
            collector-ca-certificate file-path;
            collector-certificate file-path;
            collector-certificate-key file-path;
            collector-connection-retry-interval seconds;
            collector-tcp-port port-number;
            collector-vrf-name vrf-name;
        }
    }
}
```

Hierarchy Level

```
[edit services analytics agent service-agents agent-name]
```

Description

Configure parameters for the Network Telemetry Framework (NTF) agent output plug-in.

NOTE: When you modify the output plug-in configuration of a service agent instance, the associated service agent daemon is restarted.

Options

file parameters	Configure parameters for sending data in a log file to a data collector.
path *pathname*	Path for the log file to which to save the data. For example, **path /tmp/example_file.log**
kafka parameters	Configure parameters for sending data to a Kafka data collector.
server *ip-address*	IP address of the Kafka server.
topic *filename*	Kafka topic name. The naming convention of the topic is *server-name*.jti.*encoding-type*. The encoding type options are **avro**, **json**, or **msgpack**.

encoding *encoding-type*
Encoding type. Options are **avro**, **json**, or **msgpack**.

output-ipfix parameters
Configure parameters for the IPFIX mediation service agent to send the IPFIX records that have been consolidated on the router to the IPFIX collector.

You must configure the IP address of the upstream IPFIX collector. When you optionally configure at least one of the collector certificate options (**collector-ca-certificate**, **collector-certificate**, and **collector-certificate-key**), the IPFIX mediator attempts to use TLS to connect with the collector. Otherwise, the mediator uses a TCP connection.

> **NOTE**: Any change you make to an existing **output-ipfix** output plug-in configuration restarts the IPFIX service agent daemon to apply the changes.

collector-address *ip-address*
IP address of the upstream IPFIX collector.

collector-ca-certificate *file-path*
(Optional) Path for the certificate, provided by a trusted certificate authority (CA), that is used to sign the peer certificate at the peer (IPFIX collector) level. The certificate is expected to be in .pem container format.

collector-certificate *file-path*
(Optional) Path for the client certificate that the server (IPFIX collector) uses to authenticate the client and enable mutual authentication. The fully-qualified domain name (FQDN) of both the client and the server are stored in the certificate's Subject Alternative Name field when the client and server certificates are generated. The certificate is expected to be in .pem container format.

collector-certificate-key *file-path*
(Optional) Private key file that is loaded to decrypt the encrypted message sent from the peer.

collector-connection-retry-interval *seconds*
(Optional) Interval in seconds at which the output plug-in retries connecting to the IPFIX collector.

- **Range:** 1 through 25
- **Default:** 20

collector-tcp-port *port-number*
(Optional) Number of the TCP port used to connect to the IPFIX collector.

- **Default:** 4740

collector-vrf-name *vrf-name*
(Optional) Name of the VRF (routing instance) in which IPFIX packets are routed.

- **Default:** default

Required Privilege Level

system

Release Information

Statement introduced in Junos OS Release 18.3R1.

kafka and **file** options added in Junos OS Release 18.4R1 on MX Series and PTX Series routers.

RELATED DOCUMENTATION

Configuring the BNG as an IPFIX Mediator to Collect and Export IPFIX Data

Configuring the Collection and Export of Local Telemetry Data on the IPFIX Mediator

Configuring NTF Agent

IPFIX Mediation on the BNG

Telemetry Data Collection on the IPFIX Mediator for Export to an IPFIX Collector

service-agents (Analytics)

IN THIS SECTION

- Syntax | **599**
- Hierarchy Level | **600**
- Description | **600**
- Required Privilege Level | **600**
- Release Information | **600**

Syntax

```
service-agents {
    agent-name {
        inputs {
            analytics {
                parameters {
                    generate-tags value;
                    sample-frequency value;
                    sensors file-path;
                }
            }
            input-ipfix {
                parameters {
                    maximum-connections number;
                    tcp-port port-number;
                    vrf-name name;
                }
            }
            input-jti-ipfix {
                parameters {
                    record-group group-name {
                        record ipfix-record-name;
                        reporting-interval seconds;
                    }
                }
            }
        }
        outputs {
            file {
                parameters {
                    path file-path;
                }
            }
            kafka {
                parameters {
                    server ip-address;
                    topic topic-name;
                    encoding encoding-type;
                }
            }
            output-ipfix {
```

```
                parameters {
                    collector-address ip-address;
                    collector-ca-certificate file-path;
                    collector-certificate file-path;
                    collector-certificate-key file-path;
                    collector-connection-retry-interval seconds;
                    collector-tcp-port port-number;
                    collector-vrf-name vrf-name;
                }
            }
        }
    }
}
```

Hierarchy Level

```
[edit services analytics agent]
```

Description

Configure a network analytics service agent that uses input and output plug-ins to collect, transform, and forward network telemetry data.

The remaining statements are explained separately. Search for a statement in CLI Explorer or click a linked statement in the Syntax section for details.

Required Privilege Level

system

Release Information

Statement introduced in Junos OS Release 18.3R1.

RELATED DOCUMENTATION

> *Configuring the BNG as an IPFIX Mediator to Collect and Export IPFIX Data*
>
> *Configuring the Collection and Export of Local Telemetry Data on the IPFIX Mediator*

Configuring NTF Agent

IPFIX Mediation on the BNG

Telemetry Data Collection on the IPFIX Mediator for Export to an IPFIX Collector

show services analytics agent

IN THIS SECTION

- Syntax | 601
- Description | 601
- Options | 601
- Required Privilege Level | 602
- Output Fields | 602
- Sample Output | 603
- Release Information | 604

Syntax

```
show services analytics agent
<brief | detail>
```

Description

Display information about running instances of Network Telemetry Framework (NTF) agent.

Options

none (Same as brief) Display summary information about analytics agents.

brief | detail (Optional) Display information about analytics agents for the specified level of output.

Required Privilege Level

view

Output Fields

Table 20 on page 602 lists the output fields for the **show services analytics agent** command. Output fields are listed in the approximate order in which they appear.

Table 20: show services analytics agent Output Fields

Field Name	Field Description	Level of Output
Agent ID	Name of the agent.	**brief** none
Output Plugins	Number of output plug-ins configured for the agent.	**brief** none
Input Plugins	Number of input plug-ins configured for the agent.	**brief** none
Process ID	Number that uniquely identifies the active process for the service agent at the **brief** and none levels. At the **detail** level, the process ID is displayed for the analytics agent (the parent NTF agent) and for the active service agents.	All levels
Analytics agent	Information about the parent NTF agent.	**detail**
Configuration File	Path where the NTF agent configuration file is located.	**detail**
Log File	Path where logs are stored for the NTF agent.	**detail**
Service Agent Count	Number of active service agents.	**detail**

Table 20: show services analytics agent Output Fields *(Continued)*

Field Name	Field Description	Level of Output
Analytics Service agent(s)	Information about the active service agents.	**detail**
Agent Name	Name of the service agent.	**detail**
Input Plugin/s	Name of all input plug-ins configured for the service agent.	**detail**
Output Plugin/s	Name of all output plug-ins configured for the service agent.	**detail**

Sample Output

show services analytics agent

```
user@host> show services analytics agent

Agent ID        Output Plugins    Input Plugins    Process ID
ipfix           1                 2                8368
```

show services analytics agent (Brief)

```
user@host> show services analytics agent brief
Agent ID        Output Plugins    Input Plugins    Process ID
ipfix           1                 2                8368
```

show services analytics agent (Detail)

```
user@host> show services analytics agent detail
Analytics agent:
Process ID          : 6246
```

```
Configuration File  : /var/etc/ntf-agent.conf
Log File            : /var/log/ntf-agent.log
Service Agent Count : 1
Analytics service agent(s):
  Agent Name        : ipfix
  Input Plugin/s    : input-ipfix
  Output Plugin/s   : output-ipfix
  Process ID        : 8368
```

Release Information

Command introduced in Junos OS Release 18.3R1.

RELATED DOCUMENTATION

IPFIX Mediation on the BNG

Configuring NTF Agent

traceoptions (Analytics Agent)

IN THIS SECTION

- Syntax | 604
- Hierarchy Level | 605
- Description | 605
- Options | 605
- Required Privilege Level | 606
- Release Information | 606

Syntax

```
traceoptions {
    file filename;
```

```
    flag (debug | error | info | trace);
}
```

Hierarchy Level

```
[edit services analytics agent]
```

Description

Configure tracing operations for Network Telemetry Framework (NTF) agent. You can specify the name of the file where the NTF agent log messages are stored. You can also specify a severity level for messages to be logged. The severity level that you configure depends on the issue that you are trying to resolve. In some cases you might be interested in seeing all messages relevant to the logged event, so you specify **trace**. As levels become more restrictive, fewer messages are logged.

NOTE: Although the syntax uses the keyword **flag**, its function in this statement corresponds to the **level** keyword used for other **traceoptions** statements.

Options

file *filename*

Name of the file to receive the output of the tracing operation. The file is stored in the **/var/log/** directory of your device.

- **Default:** ntf-agent

flag (debug | error | info | trace)

Specify the severity level for messages to be logged. The order of severity, from most to least severe is as follows:

error > info > debug > trace

- **debug**—Match debug messages.
- **error**—Match error messages. This is the most restrictive level.
- **info**—Match informational messages.
- **trace**—Match all messages.
- **Default:** error

Required Privilege Level

system

Release Information

Statement introduced in Junos OS Release 18.3R1.

RELATED DOCUMENTATION

> *IPFIX Mediation on the BNG*
>
> Configuring NTF Agent

CHAPTER 11

J-Insight Device Monitor Configuration Statements and Operational Commands

IN THIS CHAPTER

- clear chassis fpc errors | 607
- clear system errors | 609
- clear trace | 611
- delete services jinsightd subscribe health-monitor | 612
- error | 613
- set services jinsightd subscribe health-monitor | 617
- set services jinsightd traceoptions | 618
- show chassis alarms | 620
- show system errors active | 647
- show system errors count | 653
- show system errors error-id | 655
- show system errors fru | 659
- show system health-monitor | 666
- show trace | 670

clear chassis fpc errors

IN THIS SECTION

- Syntax | 608
- Description | 608
- Options | 608

- Required Privilege Level | 608
- Output Fields | 608
- Sample Output | 609
- Release Information | 609

Syntax

```
clear chassis fpc errors fpc-slot fpc-slot (all | error-id error-id)
```

Description

Clear the chassis FPC errors. You can choose to clear a particular error or all errors on the FPC.

Options

fpc-slot *fpc-slot*	The slot number of the FPC in which you want to run this command.
all	Clear all the errors on the FPC.
error-id *error-id*	Clear a particular error identified by an error-id. An *error-id*, a unique error identifier, is represented as a Uniform Resource Identifier (URI). For example, **"/cpu/0/memory/0/memory-uncorrected-error"** is an error-id that indicates an uncorrectable error under CPU memory module instance **0**.

Required Privilege Level

clear

Output Fields

When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear chassis fpc errors

```
user@host> clear chassis fpc errors fpc-slot
1 all

Clearing error(s) on fpc 1, option all
```

Release Information

Command introduced in Junos OS Release 18.2R1.

RELATED DOCUMENTATION

error

clear system errors

IN THIS SECTION

- Syntax | 610
- Description | 610
- Options | 610
- Required Privilege Level | 610
- Output Fields | 610
- Release Information | 610

Syntax

```
clear system errors fpc fpc-slot fpc-slot
<all>
<error-id error-id-uri>
```

Description

Clear system errors associated with J-Insight fault monitoring.

Options

all	(Optional) Clear all systems errors.
error-id *error-id-uri*	(Optional) Clear system errors for a specified error ID URI.
fpc-slot *fpc-slot*	Clear system errors for a specified FPC.

Required Privilege Level

clear

Output Fields

This command produces no output.

Release Information

Command introduced in Junos OS Release 18.2R1.

RELATED DOCUMENTATION

J-Insight Device Monitor Basic Configuration | 470

show system errors active

show system errors count

show system errors fru

clear trace

IN THIS SECTION

- Syntax | 611
- Description | 611
- Options | 611
- Required Privilege Level | 611
- Sample Output | 612
- Release Information | 612

Syntax

```
clear trace
<all-traces | application application-name | node node-name>
```

Description

Clear traces on the system. Trace data from all nodes is collected in a file on the Routing Engine. By default, applications are traced at the info level, which is informational messages.

Options

```
<all-traces | application application-name | node node-name>
```

all-traces	(Optional) Remove all traces.
application *application-name*	(Optional) Remove all traces for the specified application.
node *node-name*	(Optional) Remove all traces for the specified node.

Required Privilege Level

view

Sample Output

clear trace

```
user@host> clear trace
```

Release Information

Command introduced in Junos OS Evolved Release 18.3R1.

Options **all-traces**, **application**, and **node** introduced in Junos OS Evolved Release 19.1R1.

RELATED DOCUMENTATION

show trace | 670

delete services jinsightd subscribe health-monitor

IN THIS SECTION

- Syntax | 612
- Description | 613
- Options | 613
- Required Privilege Level | 613
- Release Information | 613

Syntax

```
delete services jinsightd subscribe health-monitor
```

Description

Disables the J-Insight health monitor. Starting in Junos OS Release 18.2R1, J-Insight provides health monitoring capabilities for FPC FRUs on the MX series routers. The health monitor is disabled by default.

Options

This command has no options.

Required Privilege Level

system

Release Information

Command introduced in Junos OS Release 18.2R1.

RELATED DOCUMENTATION

J-Insight Device Monitor Basic Configuration | 470

set services jinsightd subscribe health-monitor | 617

error

IN THIS SECTION

- Syntax | 614
- Junos OS | 614
- Junos OS Evolved | 614
- Description | 614
- Options | 615
- Required Privilege Level | 617
- Release Information | 617

Syntax

```
error {
    (fatal | major | minor) {
        threshold threshold value;
        action (alarm | disable-pfe | offline-pic | log | get-state |offline |
reset);
    }
    scope error-scope {
        category category {
            (fatal | major | minor) {
                threshold threshold value;
                action (alarm | disable-pfe | log | get-state |offline | reset);
            }
        }
    }
    error-id;
}
```

Junos OS

[edit chassis]

[edit chassis fpc *slot-number*]

Junos OS Evolved

[edit chassis fpc *slot-number*]

[edit chassis sib slot *slot-number*]

Description

Configure the threshold at which FPC or SIB errors will take the action you configure to be performed by the device. Starting from Junos OS Release 18.1R3, you can configure error thresholds and actions at the error scope and error category levels on MX Series routers.

Some Juniper devices include an internal framework for detecting and correcting FPC errors that can have the potential to affect services. You can classify the errors according to severity, set an automatic recovery action for each severity, and set a threshold (i.e., the number of times the error must occur before the action is triggered).

NOTE:

- You cannot configure the severity level of an error. However you can modify the severity of an error by using the error ID. See *error-id*.
- On the MX104 routers, Junos does not initiate restart of the system on encountering a Fatal error. Additionally, though you can configure the action **disable-pfe** for Major errors on the MX104, the router does not disable its only PFE on encountering a Major error.

Options

You can configure the threshold for the following severity levels:

- **fatal**—Fatal error on the FPC. An error that results in blockage of considerable amount of traffic across modules is a fatal error.
- **major**—Major error on the FPC. An error that results in continuing loss of packet traffic but does not affect other modules is a major error.
- **minor**—Minor error on the FPC. An error that results in the loss of a single packet but is fully recoverable is a minor error.
- **threshold *threshold-value***—Configure the threshold value at which to take action. If the severity level of the error is fatal, the action is carried out only once when the total number of errors crosses the threshold value. If the severity level of the error is major, the action is carried out once after the occurrence crosses the threshold. If the severity level is minor, the action is carried out as many times as the value specified by the threshold. For example, when the severity level is minor, and you have configured the threshold value as 10, the action is carried out after the tenth occurrence. On Junos OS Evolved, for the errors belonging to the **internal** category, the default threshold value is 1.

  NOTE: You can set the threshold value to 0 for errors with severity level as minor. This implies that no action is taken for that error. You cannot set the threshold value to 0 for errors with severity level as major or fatal.

  Default: The error count for fatal and major actions is 1. The default error count for minor actions is 10.

  Range: 0—429,496,729

The available detection and recovery actions are as follows:

- **alarm**—Raise an alarm.

- **disable-pfe**—Disable the PFE interfaces on the FPC.
- **get-state**—Get the current state of the FPC.
- **log**—Generate a log for the event.
- **offline**—Take the FPC offline.
- **offline-pic**—Take the PIC (installed in the FPC) offline.
- **reset**—Reset the FPC.

> **NOTE**: Starting in Junos OS Evolved Release 19.1R1, the **offline** and **disable-pfe** actions are not available for errors with **minor** severity (under the hierarchy **edit chassis error minor action**).

The available detection and recovery actions are as follows for devices running Junos OS Evolved:

- **alarm**—Raise an alarm.
- **fault**—System goes to fault state but stays up (diagnostics can be run on it).
- **get-state**—Get the current state of the FPC.
- **log**—Generate a log for the event.

> **NOTE**: Starting in Junos OS Release 17.2R1, if you configure the **disable-pfe**, **offline**, **offline-pic** or **reset** action on an MX Series or PTX Series router, the **get-state** action is additionally configured on the router. This means, for example, if you configure the **disable-pfe** action on the router, the router gets both **disable-pfe** and **get-state** actions configured.

- **scope** ***error-scope***—Group the errors of a particular severity into different scopes. Errors belonging to each error scope is further grouped into categories, before thresholds and actions are defined at the group level. The following scopes are available: **board** and **pfe**. Junos OS Evolved also supports the scope **switch**.
- **category** ***category***—Categorize errors into various subgroups under the scope level. An error category helps you group similar errors belonging to a particular scope and define actions for them at once. This feature eliminates the need for configurations against individual error-ids. Some of the error-categories are **functional**, **io** (input/output errors), **storage** (for example, errors related to HDD, SSD, and flash), **memory** (for example, errors related to static RAM), **processing** (for example, CPU-related errors), and **switch**. Junos OS Evolved also supports the category **internal**. On every occurrence of an error belonging to the **internal** category, the software by default raises an alarm at

the individual error level (not at the scope or category level). You cannot configure an action against errors belonging to the **internal** category.

- ***error-id***—Use the error ID to disable an error or modify the error severity associated with that error. An *error-id*, which is a unique error identifier, is represented as a Uniform Resource Identifier (URI). For example, **/cpu/0/memory/0/memory-uncorrected-error** is an error ID that indicates an uncorrectable error under CPU memory module instance **0**.

Required Privilege Level

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

Release Information

Statement introduced in Junos OS Release 13.3.

RELATED DOCUMENTATION

- *Fabric Resiliency and Degradation*
- *Configuring FPC Error Levels and Actions*
- *show chassis fabric errors*
- *show chassis fpc errors*

set services jinsightd subscribe health-monitor

IN THIS SECTION

- Syntax | **618**
- Description | **618**
- Options | **618**
- Required Privilege Level | **618**
- Release Information | **618**

Syntax

```
set services jinsightd subscribe health-monitor
```

Description

Enables the J-Insight health monitor. Starting in Junos OS Release 18.2R1, J-Insight provides health monitoring capabilities for FPC FRUs on the MX series routers. The health monitor is disabled by default.

Options

This command has no options.

Required Privilege Level

system

Release Information

Command introduced in Junos OS Release 18.2R1.

RELATED DOCUMENTATION

J-Insight Device Monitor Basic Configuration | 470

delete services jinsightd subscribe health-monitor | 612

set services jinsightd traceoptions

IN THIS SECTION

- Syntax | 619
- Description | 619
- Options | 619

Required Privilege Level | 619
Release Information | 619

Syntax

```
set services jinsightd traceoptions flag
<all>
<core>
<database>
<rule-engine>
<timer>
```

Description

Define tracing operations that track J-Insight functionality. To specify more than one tracing operation, include multiple **flag** statements.

Options

all	All tracing operations.
core	J-Insight core events.
database	Database events.
rule-engine	Rule engine events.
timer	Timer events.

Required Privilege Level

system

Release Information

Command introduced in Junos OS Release 18.2R1.

RELATED DOCUMENTATION

J-Insight Device Monitor Basic Configuration | 470

show chassis alarms

IN THIS SECTION

- Syntax | 620
- Syntax (MX Series Routers) | 621
- Syntax (SRX1500, SRX4100, and SRX4200) | 621
- Syntax (SRX4600) | 621
- Syntax (TX Matrix Routers) | 621
- Syntax (TX Matrix Plus Routers) | 621
- Syntax (MX104, MX2010, MX2020, and MX2008 Universal Routing Platforms) | 622
- Syntax (MX10003, MX204, MX10008, OCX Series, PTX Series, ACX Series, EX9251, and EX9253) | 622
- Syntax (QFX Series) | 622
- Description | 622
- Options | 622
- Additional Information | 623
- Required Privilege Level | 629
- Output Fields | 629
- Sample Output | 630
- Release Information | 646

Syntax

```
show chassis alarms
```

Syntax (MX Series Routers)

```
show chassis alarms
<all-members>
<local>
<member member-id>
```

Syntax (SRX1500, SRX4100, and SRX4200)

```
show chassis alarms
1 alarms currently active
Alarm time               Class  Description
2020-02-28 10:07:16 CST  Major  FPC0: PEM 0 Not Present
```

Syntax (SRX4600)

```
show chassis alarms
node0:
--------------------------------------------------------------------------
2 alarms currently active
Alarm time Class Description
2020-10-08 19:42:06 UTC Major FPC 0 BITS CPLD Version Mismatch
2020-10-08 19:42:06 UTC Minor PEM 1 Not Present
```

Syntax (TX Matrix Routers)

```
show chassis alarms
<lcc number | scc>
```

Syntax (TX Matrix Plus Routers)

```
show chassis alarms
<lcc number | sfc number>
```

Syntax (MX104, MX2010, MX2020, and MX2008 Universal Routing Platforms)

```
show chassis alarms
<satellite [slot-id slot-id]>
```

Syntax (MX10003, MX204, MX10008, OCX Series, PTX Series, ACX Series, EX9251, and EX9253)

```
show chassis alarms
```

Syntax (QFX Series)

```
show chassis alarms
<interconnect-device name>
<node-device name>
```

Description

Display information about the conditions that have been configured to trigger alarms. In Junos, the chassis alarms are different from the system alarms (viewed by using the **show system alarms** command). The system alarms indicate a missing rescue configuration or software license, where valid. For more information, see Alarm Overview.

Options

none	Display information about the conditions that have been configured to trigger alarms.
all-members	(MX Series routers only) (Optional) Display information about alarm conditions for all the member routers of the Virtual Chassis configuration.
interconnect-device *name*	(QFabric systems only) (Optional) Display information about alarm conditions for the Interconnect device.
lcc *number*	(TX Matrix router and TX Matrix Plus router only) (Optional) Line-card chassis number. Replace *number* with the following values depending on the LCC configuration:

- 0 through 3, when T640 routers are connected to a TX Matrix router in a routing matrix.
- 0 through 3, when T1600 routers are connected to a TX Matrix Plus router in a routing matrix.
- 0 through 7, when T1600 routers are connected to a TX Matrix Plus router with 3D SIBs in a routing matrix.
- 0, 2, 4, or 6, when T4000 routers are connected to a TX Matrix Plus router with 3D SIBs in a routing matrix.

local (MX Series routers only) (Optional) Display information about alarm conditions for the local Virtual Chassis member.

member *member-id* (MX Series routers only) (Optional) Display information about alarm conditions for the specified member of the Virtual Chassis configuration. Replace *member-id* variable with a value of 0 or 1.

node-device *name* (QFabric systems only) (Optional) Display information about alarm conditions for the Node device.

satellite [slot-id *slot-id*] (Junos Fusion only)(Optional) Display information about alarm conditions for the specified satellite device in a Junos Fusion, or for all satellite devices in the Junos Fusion if no satellite devices are specified.

scc (TX Matrix router only) (Optional) Show information about the TX Matrix router (switch-card chassis).

sfc *number* (TX Matrix Plus router only) (Optional) Show information about the respective TX Matrix Plus router, which is the switch-fabric chassis. Replace *number* variable with **0**.

Additional Information

Chassis alarms are preset. You cannot modify them.

You cannot clear the alarms for chassis components. Instead, you must remedy the cause of the alarm. When a chassis alarm LED is lit, it indicates that you are running the router or switch in a manner that we do not recommend.

On routers, you can manually silence external devices connected to the alarm relay contacts by pressing the alarm cutoff button, located on the craft interface. Silencing the device does not remove the alarm

messages from the display (if present on the router) or extinguish the alarm LEDs. In addition, new alarms that occur after you silence an external device reactivate the external device.

NOTE: MX10003 routers do not support craft interface.

In Junos OS release 11.1 and later, alarms for fans also show the slot number of the fans in the CLI output.

In Junos OS Release 11.2 and later, the command output on EX8200 switches shows the detailed location (**Plane/FPC/PFE**) for link errors in the chassis.

In Junos OS Release 10.2 and later, an alarm is shown on T Series routers for a standby SONET Clock Generator (SCG) that is offline or absent.

You may often see the following error messages, in which only the error code is shown and no other information is provided:

```
Apr 12 08:04:10 send: red alarm set, device FPC 6, reason FPC 6 Major Errors -
Error code: 257
Apr 12 08:04:19 send: red alarm set, device FPC 1, reason FPC 1 Major Errors -
Error code: 559
```

To understand what CM_ALARM error codes mean, you need to first identify the structure of the CM Alarm codes. A CM_ALARM code has the following structure:

Bits:	Error type:
1-31	Major (1)
0	Minor (0)

According to the table above, the LSB (bit 0) identifies the **Error Type** (major alarm, if the bit is set and minor alarm if the bit is unset). The rest of the bits (1 - 31) identify the actual error code.

Take an example of the following error code, which was logged on a T1600:

```
Apr 12 08:04:10 send: red alarm set, device FPC 1, reason FPC 1 Major Errors -
Error code: 559
```

First, you have to convert 559 to binary; that is **1000101111**. The LSB in this case is **1**, which means that this is a major alarm. After removing the LSB, you are left with **100010111**, which is equal to 279 in decimal. This is the actual error code, its meaning can be found from the following list:

Chip Type: L Chip	**Code**
CMALARM_LCHIP_LOUT_DESRD_PARITY_ERR	1
CMALARM_LCHIP_LOUT_DESRD_UNINIT_ERR	2
CMALARM_LCHIP_LOUT_DESRD_ILLEGALLINK_ERR	3
CMALARM_LCHIP_LOUT_DESRD_ILLEGALSIZE_ERR	4
CMALARM_LCHIP_LOUT_HDRF_TOERR_ERR	5
CMALARM_LCHIP_LOUT_HDRF_PARITY_ERR	6
CMALARM_LCHIP_LOUT_HDRF_UCERR_ERR	7
CMALARM_LCHIP_LOUT_NLIF_CRCDROP_ERR	8
CMALARM_LCHIP_LOUT_NLIF_CRCERR_ERR	9
CMALARM_LCHIP_UCODE_TIMEOUT_ERR	10
CMALARM_LCHIP_LIN_SRCTL_ACCT_DROP_ERR	11
CMALARM_LCHIP_LIN_SRCTL_ACCT_ADDR_SIZE_ERR	12
CMALARM_LCHIP_SRAM_PARITY_ERR	13
CMALARM_LCHIP_UCODE_OVFLW_ERR	14

CMALARM_LCHIP_LOUT_HDRF_MTU_ERR	15

Chip Type: M Chip	**Code**
CMALARM_MCHIP_ECC_UNCORRECT_ERR	128

Chip Type: N Chip	**Code**
CMALARM_NCHIP_RDDMA_JBUS_TIMEOUT_ERR	256
CMALARM_NCHIP_RDDMA_FIFO_OVFLW_ERR	257
CMALARM_NCHIP_RDDMA_FIFO_UNFLW_ERR	258
CMALARM_NCHIP_RDDMA_SIZE_ERR	259
CMALARM_NCHIP_RDDMA_JBUS_CRC_ERR	260
CMALARM_NCHIP_WRDMA_PKTR_ERR	261
CMALARM_NCHIP_WRDMA_PKT_CRC_ERR	262
CMALARM_NCHIP_WRDMA_JBUS_TIMEOUT_ERR	263
CMALARM_NCHIP_WRDMA_FIFO_OVFLW_ERR	264
CMALARM_NCHIP_WRDMA_FIFO_UNFLW_ERR	265
CMALARM_NCHIP_WRDMA_PKT_LEN_ERR	266
CMALARM_NCHIP_WRDMA_JBUS_CRC_ERR	267

CMALARM_NCHIP_PKTR_DMA_AGE_ERR	268
CMALARM_NCHIP_PKTR_ICELLSIG_ERR	269
CMALARM_NCHIP_PKTR_FTTL_ERR	270
CMALARM_NCHIP_RODR_OFFSET_OVFLW_ERR	271
CMALARM_NCHIP_PKTR_TMO_CELL_ERR	272
CMALARM_NCHIP_PKTR_TMO_OUTRANGE_ERR	273
CMALARM_NCHIP_PKTR_MD_REQUEST_Q_OVFLW_ERR	274
CMALARM_NCHIP_PKTR_DMA_BUFFER_OVFLW_ERR	275
CMALARM_NCHIP_PKTR_GRT_OVFLW_ERR	276
CMALARM_NCHIP_FRQ_ERR	277
CMALARM_NCHIP_RODR_IN_Q_OVFLW_ERR	278
CMALARM_NCHIP_DBUF_CRC_ERR	279

Chip Type: R Chip	**Code**
CMALARM_RCHIP_SRAM_PARITY_ERR	512

Chip Type: R Chip	**Code**
CMALARM_ICHIP_WO_DESRD_ID_ERR	601

CMALARM_ICHIP_WO_DESRD_DATA_ERR	602
CMALARM_ICHIP_WO_DESRD_OFLOW_ERR	603
CMALARM_ICHIP_WO_HDRF_UCERR_ERR	604
CMALARM_ICHIP_WO_HDRF_MTUERR_ERR	605
CMALARM_ICHIP_WO_HDRF_PARITY_ERR	606
CMALARM_ICHIP_WO_HDRF_TOERR_ERR	607
CMALARM_ICHIP_WO_IP_CRC_ERR	608
CMALARM_ICHIP_WO_IP_INTER_ERR	609
CMALARM_ICHIP_WI_WAN_TIMEOUT_ERR	625
CMALARM_ICHIP_WI_FAB_TIMEOUT_ERR	626
CMALARM_ICHIP_RLDRAM_BIST_ERR	630
CMALARM_ICHIP_SDRAM_BIST_ERR	631
CMALARM_ICHIP_RLDRAM_PARITY_ERR	632
CMALARM_ICHIP_SDRAM_UNCORRECT_ERR	633
CMALARM_ICHIP_SDRAM_CORRECT_ERR	634
CMALARM_ICHIP_FUSE_DONE_ERR	635

According to the table above, the **279** error code corresponds to **CMALARM_NCHIP_DBUF_CRC_ERR**; this means that new CRC errors were seen on the NCHIP of this particular FPC, which is FPC as per the logs.

If you do not want to convert decimal to binary and vice versa, you may use the following shortcut:

For major alarms, the **Actual Error Code = (Error Code - 1)/2**, where **Error Code** is the code that you get in the log message. For example, if you get the following log:

```
    Apr 12 08:04:10 send: red alarm set, device FPC 6, reason FPC 6 Major Errors
- Error code: 257
```

Actual Error Code = (257-1)/2 = 128. Similarly, for minor alarms, Actual Error Code = (Error Code)/2

NOTE: Starting in Junos OS Release 18.2R1, on MX Series routers, the **show chassis alarms** output does not display error codes for PFE-related errors. You can use the following commands to view more details of the errors that caused the alarms:

- **show chassis errors active**
- **show chassis errors active detail**

Required Privilege Level

view

Output Fields

Table 21 on page 629 lists the output fields for the **show chassis alarms** command. Output fields are listed in the approximate order in which they appear.

Table 21: show chassis alarms Output Fields

Field Name	Field Description
Alarm time	Date and time the alarm was first recorded.
Class	Severity class for this alarm: **Minor** or **Major**.

Table 21: show chassis alarms Output Fields *(Continued)*

Field Name	Field Description
Description	Information about the alarm.

Sample Output

show chassis alarms (Alarms Active)

```
user@host> show chassis alarms
3 alarms are currently active
Alarm time               Class  Description
2000-02-07 10:12:22 UTC Major fxp0: ethernet link down
2000-02-07 10:11:54 UTC Minor YELLOW ALARM - PEM 1 Removed
2000-02-07 10:11:03 UTC Minor YELLOW ALARM - Lower Fan Tray Removed
```

show chassis alarms (No Alarms Active)

```
user@host> show chassis alarms
No alarms are currently active
```

show chassis alarms (Fan Tray)

```
user@host> show chassis alarms
4 alarms currently active
Alarm time               Class  Description
2010-11-11 20:27:38 UTC  Major  Side Fan Tray 7 Failure
2010-11-11 20:27:13 UTC  Minor  Side Fan Tray 7 Overspeed
2010-11-11 20:27:13 UTC  Major  Side Fan Tray 5 Failure
2010-11-11 20:27:13 UTC  Major  Side Fan Tray 0 Failure
```

show chassis alarms (MX150)

```
user@host > show chassis alarms
1 alarms currently active
Alarm time               Class  Description
2016-06-04 01:49:43 PDT  Major  Fan Tray 1 Fan 0 failed
```

show chassis alarms (MX104 Router)

```
user@host >show chassis alarms
1 alarms currently active
Alarm time               Class  Description
2013-06-05 14:43:31 IST  Minor  Backup RE Active
```

show chassis alarms (MX2010 Router)

```
user@host> show chassis alarms
7 alarms currently active
Alarm time               Class  Description
2012-08-07 00:46:06 PDT  Major  Fan Tray 2 Failure
2012-08-06 18:24:36 PDT  Minor  Redundant feed missing for PSM 6
2012-08-06 07:41:04 PDT  Minor  Redundant feed missing for PSM 8
2012-08-04 02:42:06 PDT  Minor  Redundant feed missing for PSM 5
2012-08-03 21:14:24 PDT  Minor  Loss of communication with Backup RE
2012-08-03 12:26:03 PDT  Minor  Redundant feed missing for PSM 4
2012-08-03 10:40:18 PDT  Minor  Redundant feed missing for PSM 7
```

show chassis alarms (MX2020 Router)

```
user@host> show chassis alarms
1 alarms currently active
Alarm time Class Description
2012-10-03 12:14:59 PDT Minor Plane 0 not online
```

show chassis alarms (MX10003 Router)

```
user@host> show chassis alarms

9 alarms currently active
Alarm time               Class  Description
2017-07-13 21:50:31 PDT  Major  FPC 1 Temperature Hot
2017-07-13 21:50:04 PDT  Minor  FPC 1 PIC 1 Invalid port profile configuration
2017-07-13 21:49:13 PDT  Minor  FPC 1 PIC 0 Invalid port profile configuration
2017-07-13 21:48:54 PDT  Major  FPC 0 Temperature Hot
2017-07-13 21:43:54 PDT  Minor  CB 1 Voltage Sensor ADS7830_0x4B Sensor Failed
2017-07-13 21:43:54 PDT  Minor  CB 0 Voltage Sensor ADS7830_0x4B Sensor Failed
2017-07-13 21:43:31 PDT  Minor  Loss of communication with Backup RE
```

Starting in Junos OS Release 19.2R1, the MX10003 routers do not raise an alarm if a Power Entry Module (PEM) slot is empty. However, when the number of operational PEMs goes below 2, the router raises a major alarm. This alarm is cleared when the required number of PEMs are made available.

show chassis alarms (MX204 Router)

```
user@host> show chassis alarms

1 alarms currently active
Alarm time               Class  Description
2017-11-05 22:13:03 PST  Major  PEM 0 Not Present
```

show chassis alarms (MX2008 Router)

```
user@host>show chassis alarms
No alarms currently active
```

show chassis alarms (MX960, MX480, and MX240 Routers showing Major CB Failure)

A major CB 0 failure alarm occurs in the event of a bad CB (unknown or mismatched CBs do not trigger this alarm in Junos Release OS 12.3R9 and later). Following GRES or recovery, if the hardware issue persists, the traffic moves to the good CB and continues. If the alarm was triggered by something transient like a power zone budget on GRES, bringing the CB back online can clear the alarm. Otherwise,

replace the bad CB. Note that fabric link speed is not impacted by an offline SCB. The alarm migh be raised on CB0, CB1, and CB2.

```
user@host> show chassis alarms
6 alarms currently active
Alarm time               Class  Description
2014-10-31 16:49:41 EDT  Major  PEM 3 Not OK
2014-10-31 16:49:41 EDT  Major  PEM 2 Not OK
2014-10-31 16:49:31 EDT  Major  CB 0 Failure
2014-10-31 16:49:31 EDT  Minor  CB 0 Fabric Chip 0 Not Online
2014-10-31 16:49:31 EDT  Minor  CB 0 Fabric Chip 1 Not Online
2014-10-31 16:49:31 EDT  Minor  Backup RE Active
```

show chassis alarms (PTX10008 Router)

```
user@host>show chassis alarms
12 alarms currently active
Alarm time               Class  Description
2017-05-09 01:38:55 PDT  Minor  Loss of communication with Backup RE
2017-05-05 06:49:57 PDT  Major  FPC 5 LCPU Temp Sensor Access Failed
2017-05-05 06:49:57 PDT  Major  FPC 5 PE2 Temp Sensor Hot
2017-05-05 06:49:57 PDT  Major  FPC 5 PE1 Temp Sensor Hot
2017-05-05 06:49:57 PDT  Major  FPC 5 PE0 Temp Sensor Hot
2017-05-05 06:49:57 PDT  Major  FPC 5 Exhaust-C Temp Sensor Hot
2017-05-05 06:49:57 PDT  Major  FPC 5 Exhaust-B Temp Sensor Hot
2017-05-05 06:49:57 PDT  Major  FPC 5 Exhaust-A Temp Sensor Hot
2017-05-05 06:49:57 PDT  Major  FPC 5 Intake-B Temp Sensor Access Failed
2017-05-05 06:49:57 PDT  Major  FPC 5 Intake-A Temp Sensor Access Failed
2017-05-05 06:49:57 PDT  Major  Fan Tray 0 Fan 5 running at lower speed
2017-05-05 06:49:57 PDT  Major  Fan Tray 0 Fan 4 running at lower speed
```

show chassis alarms (T4000 Router)

```
user@host> show chassis alarms
9 alarms currently active
Alarm time               Class  Description
2007-06-02 01:41:10 UTC  Minor  RE 0 Not Supported
2007-06-02 01:41:10 UTC  Minor  CB 0 Not Supported
2007-06-02 01:41:10 UTC  Minor  Mixed Master and Backup RE types
```

```
2007-05-30 19:37:33 UTC  Major  SPMB 1 not online
2007-05-30 19:37:29 UTC  Minor  Front Bottom Fan Tray Absent
2007-05-30 19:37:13 UTC  Major  PEM 1 Input Failure
2007-05-30 19:37:13 UTC  Major  PEM 0 Not OK
2007-05-30 19:37:03 UTC  Major  PEM 0 Improper for Platform
2007-05-30 19:37:03 UTC  Minor  Backup RE Active
```

show chassis alarms (Unreachable Destinations Present on a T Series Router)

```
user@host> show chassis alarms
10 alarms currently active
Alarm time               Class  Description
2011-08-30 18:43:53 PDT  Major  FPC 7 has unreachable destinations
2011-08-30 18:43:53 PDT  Major  FPC 5 has unreachable destinations
2011-08-30 18:43:52 PDT  Major  FPC 3 has unreachable destinations
2011-08-30 18:43:52 PDT  Major  FPC 2 has unreachable destinations
2011-08-30 18:43:52 PDT  Minor  SIB 0 Not Online
2011-08-30 18:43:33 PDT  Minor  SIB 4 Not Online
2011-08-30 18:43:28 PDT  Minor  SIB 3 Not Online
2011-08-30 18:43:05 PDT  Minor  SIB 2 Not Online
2011-08-30 18:43:28 PDT  Minor  SIB 1 Not Online
2011-08-30 18:43:05 PDT  Major  PEM 1 Not Ok
```

show chassis alarms (FPC Offline Due to Unreachable Destinations on a T Series Router)

```
user@host> show chassis alarms
10 alarms currently active
Alarm time               Class  Description
2011-08-30 18:43:53 PDT  Major  FPC 7 offline due to unreachable destinations
2011-08-30 18:43:53 PDT  Major  FPC 5 offline due to unreachable destinations
2011-08-30 18:43:52 PDT  Major  FPC 3 offline due to unreachable destinations
2011-08-30 18:43:52 PDT  Major  FPC 2 offline due to unreachable destinations
2011-08-30 18:43:52 PDT  Minor  SIB 0 Not Online
2011-08-30 18:43:33 PDT  Minor  SIB 4 Not Online
2011-08-30 18:43:28 PDT  Minor  SIB 3 Not Online
2011-08-30 18:43:05 PDT  Minor  SIB 2 Not Online
2011-08-30 18:43:28 PDT  Minor  SIB 1 Not Online
2011-08-30 18:43:05 PDT  Major  PEM 1 Not Ok
```

show chassis alarms (SCG Absent on a T Series Router)

```
user@host> show chassis alarms
4 alarms currently active
Alarm time               Class  Description
2011-01-23 21:42:46 PST  Major  SCG 0 NO EXT CLK MEAS-BKUP SCG ABS
```

show chassis alarms (Alarms Active on a TX Matrix Router)

```
user@host> show chassis alarms
scc-re0:
--------------------------------------------------------------------------
8 alarms currently active
Alarm time               Class  Description
2004-08-05 18:43:53 PDT  Minor  LCC 0 Minor Errors
2004-08-05 18:43:53 PDT  Minor  SIB 3 Not Online
2004-08-05 18:43:52 PDT  Major  SIB 2 Absent
2004-08-05 18:43:52 PDT  Major  SIB 1 Absent
2004-08-05 18:43:52 PDT  Major  SIB 0 Absent
2004-08-05 18:43:33 PDT  Major  LCC 2 Major Errors
2004-08-05 18:43:28 PDT  Major  LCC 0 Major Errors
2004-08-05 18:43:05 PDT  Minor  LCC 2 Minor Errors
lcc0-re0:
--------------------------------------------------------------------------
5 alarms currently active
Alarm time               Class  Description
2004-08-05 18:43:53 PDT  Minor  SIB 3 Not Online
2004-08-05 18:43:49 PDT  Major  SIB 2 Absent
2004-08-05 18:43:49 PDT  Major  SIB 1 Absent
2004-08-05 18:43:49 PDT  Major  SIB 0 Absent
2004-08-05 18:43:28 PDT  Major  PEM 0 Not OK
lcc2-re0:
--------------------------------------------------------------------------
5 alarms currently active
Alarm time               Class  Description
2004-08-05 18:43:35 PDT  Minor  SIB 3 Not Online
2004-08-05 18:43:33 PDT  Major  SIB 2 Absent
2004-08-05 18:43:33 PDT  Major  SIB 1 Absent
2004-08-05 18:43:33 PDT  Major  SIB 0 Absent
2004-08-05 18:43:05 PDT  Minor  PEM 1 Absent
```

show chassis alarms (TX Matrix Plus router with 3D SIBs)

```
user@host> show chassis alarms
sfc0-re0:
--------------------------------------------------------------------------
Alarm time               Class  Description

2014-04-08 14:35:13 IST  Minor  FPM 0 SFC Config Size Changed
2014-04-08 14:32:58 IST  Major  Fan Tray Failure
2014-04-08 14:31:53 IST  Major  SIB F13 6 Fault
2014-04-08 14:31:43 IST  Major  SIB F13 11 Fault
2014-04-08 14:31:08 IST  Minor  Check SIB F13 12 CXP 14 Fbr Cbl
2014-04-08 14:31:08 IST  Minor  Check SIB F13 12 CXP 8 Fbr Cbl
2014-04-08 14:31:08 IST  Minor  Check SIB F13 12 CXP 3 Fbr Cbl
2014-04-08 14:31:08 IST  Major  SIB F13 12 CXP 15 fault
2014-04-08 14:31:08 IST  Minor  SIB F13 12 CXP 14 LOL
2014-04-08 14:31:08 IST  Minor  Check SIB F13 12 CXP 14
2014-04-08 14:31:08 IST  Major  SIB F13 12 CXP 10 fault
2014-04-08 14:31:08 IST  Minor  SIB F13 12 CXP 8 LOL
2014-04-08 14:31:08 IST  Minor  Check SIB F13 12 CXP 8
2014-04-08 14:31:08 IST  Major  SIB F13 12 CXP 7 fault
2014-04-08 14:31:08 IST  Major  SIB F13 12 CXP 4 fault
2014-04-08 14:31:08 IST  Minor  SIB F13 12 CXP 3 LOL
2014-04-08 14:31:08 IST  Minor  Check SIB F13 12 CXP 3
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 14 Fbr Cbl
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 12 Fbr Cbl
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 8 Fbr Cbl
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 6 Fbr Cbl
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 4 Fbr Cbl
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 2 Fbr Cbl
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 0 Fbr Cbl
2014-04-08 14:31:08 IST  Minor  SIB F13 6 CXP 14 LOL
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 14
2014-04-08 14:31:08 IST  Minor  SIB F13 6 CXP 12 LOL
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 12
2014-04-08 14:31:08 IST  Major  SIB F13 6 CXP 10 fault
2014-04-08 14:31:08 IST  Minor  SIB F13 6 CXP 8 LOL
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 8
2014-04-08 14:31:08 IST  Minor  SIB F13 6 CXP 6 LOL
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 6
2014-04-08 14:31:08 IST  Minor  SIB F13 6 CXP 4 LOL
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 4
```

```
2014-04-08 14:31:08 IST  Minor  SIB F13 6 CXP 2 LOL
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 2
2014-04-08 14:31:08 IST  Minor  SIB F13 6 CXP 0 LOL
2014-04-08 14:31:08 IST  Minor  Check SIB F13 6 CXP 0
2014-04-08 14:31:08 IST  Minor  SIB F13 12 CXP 14 XC HSL Link Error
2014-04-08 14:29:27 IST  Minor  LCC 0 Minor Errors
2014-04-08 14:28:37 IST  Major  LCC 0 Major Errors
2014-04-08 14:28:37 IST  Major  LCC 2 Major Errors
2014-04-08 14:28:37 IST  Minor  LCC 2 Minor Errors
2014-04-08 14:28:24 IST  Major  SIB F2S 4/6 Absent
2014-04-08 14:28:24 IST  Major  SIB F2S 4/4 Absent
2014-04-08 14:28:24 IST  Major  SIB F2S 4/2 Absent
2014-04-08 14:28:24 IST  Major  SIB F2S 4/0 Absent
2014-04-08 14:28:24 IST  Major  SIB F2S 3/6 Absent
2014-04-08 14:28:24 IST  Major  SIB F2S 3/4 Absent
2014-04-08 14:28:24 IST  Major  SIB F2S 3/2 Absent
2014-04-08 14:28:24 IST  Major  SIB F2S 3/0 Absent
2014-04-08 14:28:24 IST  Major  SIB F13 9 Absent
2014-04-08 14:28:24 IST  Major  SIB F13 8 Absent
2014-04-08 14:28:24 IST  Major  SIB F13 7 Absent
2014-04-08 14:28:24 IST  Major  SIB F13 4 Absent
2014-04-08 14:28:24 IST  Major  SIB F13 1 Absent
2014-04-08 14:28:22 IST  Major  PEM 0 Input Failure
2014-04-08 14:28:22 IST  Major  PEM 0 Not OK

lcc0-re0:
--------------------------------------------------------------------------
12 alarms currently active
Alarm time               Class  Description
2014-04-08 14:36:08 IST  Minor  CB 1  M/S Switch Changed
2014-04-08 14:36:08 IST  Minor  CB 1  CHASSIS ID Changed
2014-04-08 14:35:43 IST  Minor  CB 0  M/S Switch Changed
2014-04-08 14:35:43 IST  Minor  CB 0  CHASSIS ID Changed
2014-04-08 14:29:30 IST  Minor  SIB 4 Not Online
2014-04-08 14:29:30 IST  Minor  SIB 3 Not Online
2014-04-08 14:29:30 IST  Minor  SIB 2 Not Online
2014-04-08 14:29:24 IST  Major  Rear Fan Tray Failure
2014-04-08 14:29:24 IST  Major  Front Bottom Fan Tray Improper for Platform
2014-04-08 14:29:24 IST  Major  Front Top Fan Tray Improper for Platform
2014-04-08 14:28:37 IST  Major  SIB 4 Absent
2014-04-08 14:28:37 IST  Major  SIB 3 Absent

lcc2-re0:
```

```
--------------------------------------------------------------------------
12 alarms currently active
Alarm time               Class  Description
2014-04-08 14:36:02 IST  Minor  CB 1  M/S Switch Changed
2014-04-08 14:36:02 IST  Minor  CB 1  CHASSIS ID Changed
2014-04-08 14:35:42 IST  Minor  CB 0  M/S Switch Changed
2014-04-08 14:34:42 IST  Minor  CB 0  CHASSIS ID Changed
2014-04-08 14:29:29 IST  Minor  SIB 0 CXP 7 Unsupported Optics
2014-04-08 14:29:27 IST  Major  Front Bottom Fan Tray Improper for Platform
2014-04-08 14:29:27 IST  Major  Front Top Fan Tray Improper for Platform
2014-04-08 14:29:25 IST  Minor  SIB 4 Not Online
2014-04-08 14:29:25 IST  Minor  SIB 3 Not Online
2014-04-08 14:28:47 IST  Major  PEM 0 Not OK
2014-04-08 14:28:36 IST  Major  SIB 2 Absent
2014-04-08 14:28:36 IST  Minor  Host 0 Boot from alternate media

lcc6-re0:
--------------------------------------------------------------------------
2 alarms currently active
Alarm time               Class  Description
2013-11-06 04:03:56 PST  Minor  SIB 1 CXP 0 XC HSL Link Error
2013-11-06 03:49:32 PST  Major  PEM 1 Not OK
```

show chassis alarms (Alarms on a T4000 Router After the enhanced-mode Statement is Enabled)

To enable improved virtual private LAN service (VPLS) MAC address learning on T4000 routers, you must include the **enhanced-mode** statement at the **[edit chassis network-services]** hierarchy level and reboot the router. When router reboots, only the T4000 Type 5 FPCs are required to be present on the router. If there are any other FPCs (apart from T4000 Type 5 FPCs) on the T4000 router, such FPCs become offline, and FPC misconfiguration alarms are generated. The **show chassis alarm** command output displays FPC misconfiguration (**FPC *fpc-slot* misconfig**) as the reason for the generation of the alarms.

```
user@host> show chassis alarms
2 alarms currently active
        Alarm time               Class  Description
        2011-10-22 10:10:47 PDT  Major  FPC 1 misconfig
        2011-10-22 10:10:46 PDT  Major  FPC 0 misconfig
```

show chassis alarms (Backup Routing Engine)

```
user@host> show chassis alarms
2 alarms are currently active
Alarm time               Class  Description
2005-04-07 10:12:22 PDT  Minor  Host 1 Boot from alternate media
2005-04-07 10:11:54 PDT  Major  Host 1 compact-flash missing in Boot List
```

show chassis alarms (EX Series Switch)

```
user@switch> show chassis alarms

 4 alarms currently active
Alarm time               Class  Description
2014-03-12 15:36:09 UTC  Minor  Require a Fan Tray upgrade
2014-03-12 15:00:02 UTC  Major  PEM 0 Input Failure
2014-03-12 15:00:02 UTC  Major  PEM 0 Not OK
2014-03-12 14:59:51 UTC  Minor  Host 1 Boot from alternate media
```

show chassis alarms (Alarms Active on the QFX Series and OCX Series Switches)

```
user@switch> show chassis alarms
1 alarms currently active
Alarm time               Class  Description
2012-03-05    2:10:24 UTC  Major  FPC 0 PEM 0 Airflow not matching Chassis
Airflow
```

show chassis alarms node-device (Alarms Active on the QFabric System)

```
user@switch> show chassis alarms node-device
Test
node-device ED3694
3 alarms currently active
Alarm time               Class  Description
2011-08-24 16:04:15 UTC  Major  Test:fte-0/1/2: Link down
2011-08-24 16:04:14 UTC  Major  Test:fte-0/1/0: Link down
2011-08-24 14:21:14 UTC  Major  Test PEM 0 is not supported/powered
```

show chassis alarms (Alarms Active on the QFabric System)

```
user@switch> show chassis alarms
IC-1:
--------------------------------------------------------------------------
1 alarms currently active
Alarm time               Class  Description
2011-08-24 16:04:15 UTC  Minor  Backup RE Active

Test:
--------------------------------------------------------------------------
3 alarms currently active
Alarm time               Class  Description
2011-08-24 16:04:15 UTC  Major  Test:fte-0/1/2: Link down
2011-08-24 16:04:14 UTC  Major  Test:fte-0/1/0: Link down
2011-08-24 14:21:14 UTC  Major  Test PEM 0 is not supported/powered

SNG-0:
--------------------------------------------------------------------------

NW-NG-0:
--------------------------------------------------------------------------
1 alarms currently active
Alarm time               Class  Description
2011-08-24 15:49:27 UTC  Major  Test PEM 0 is not supported/powered
```

show chassis alarms (Alarms Active on an EX8200 Switch)

```
user@switch> show chassis alarms

6 alarms currently active
Alarm time               Class  Description
2010-12-02 19:15:22 UTC  Major  Fan Tray Failure
2010-12-02 19:15:22 UTC  Major  Fan Tray Failure
2010-12-02 19:15:14 UTC  Minor  Check CB 0 Fabric Chip 1 on Plane/FPC/PFE:
1/5/0, 1/5/1, 1/5/2, 1/5/3, 1/7/0, 1/7/1, 1/7/2, 1/7/3, 2/5/0, 2/5/1, ...
2010-12-02 19:15:14 UTC  Minor  Check CB 0 Fabric Chip 0 on Plane/FPC/PFE:
1/5/0, 1/5/1, 1/5/2, 1/5/3, 1/7/0, 1/7/1, 1/7/2, 1/7/3, 2/5/0, 2/5/1, ...
```

```
2010-12-02 19:14:18 UTC  Major  PSU 1 Output Failure
2010-12-02 19:14:18 UTC  Minor  Loss of communication with Backup RE
```

show chassis alarms (EX9251 Switch)

```
user@switch> show chassis alarms

 2 alarms currently active
Alarm time               Class  Description
2018-03-08 05:13:10 PST  Major  PEM 0 Not Powered
2018-03-08 05:13:10 PST  Major  Fan Tray 2 is not present
```

show chassis alarms (EX9253 Switch)

```
user@switch> show chassis alarms

6 alarms currently active
Alarm time               Class  Description
2018-03-07 01:09:01 PST  Major  Power Budget:Insufficient Power
2018-03-06 23:56:34 PST  Minor  Loss of communication with Backup RE
2018-02-15 00:48:10 PST  Minor  PEM 3 Not Present
2018-02-15 00:48:10 PST  Minor  PEM 2 Not Present
2018-02-15 00:48:07 PST  Major  PEM 4 Not Powered
2018-02-15 00:48:07 PST  Major  PEM 1 Not Powered
```

show chassis alarms (Alarms Active on a PTX5000 Packet Transport Router)

```
user@host> show chassis alarms

23 alarms currently active
Alarm time               Class  Description
2011-07-12 16:22:05 PDT  Minor  No Redundant Power for Rear Chassis
2011-07-12 16:22:05 PDT  Major  PDU 0 PSM 1 Not OK
2011-07-12 16:21:57 PDT  Minor  No Redundant Power for Fan 0-2
2011-07-12 16:21:57 PDT  Major  PDU 0 PSM 0 Not OK
2011-07-12 15:56:06 PDT  Major  PDU 1 PSM 2 Not OK
2011-07-12 15:56:06 PDT  Minor  No Redundant Power for FPC 0-7
2011-07-12 15:56:06 PDT  Major  PDU 0 PSM 3 Not OK
```

```
2011-07-12 15:28:20 PDT  Major  PDU 0 PSM 2 Not OK
2011-07-12 15:19:14 PDT  Minor  Backup RE Active
```

show chassis alarms (Mix of PDUs Alarm on a PTX5000 Packet Transport Router with FPC2-PTX-P1A)

All PDUs installed on a PTX5000 router must be of the same type. The **Mix of PDUs** or **Power Manager Non Operational** alarm is raised when different types of PDUs are installed on a PTX5000 router.

```
user@host> show chassis alarms
15 alarms currently active
Alarm time               Class  Description
2013-03-19 23:03:53 PDT  Minor  No Redundant Power
2013-03-19 23:03:48 PDT  Minor  Mix of PDUs
2013-03-19 23:03:47 PDT  Minor  PDU 1 PSM 3 Absent
2013-03-19 23:03:47 PDT  Minor  PDU 1 PSM 2 Absent
2013-03-19 23:03:47 PDT  Minor  PDU 1 PSM 1 Absent
2013-03-19 23:03:47 PDT  Minor  PDU 1 PSM 0 Absent
2013-03-19 23:03:46 PDT  Major  No CG Online
```

show chassis alarms (PDU Converter Failed Alarm on a PTX5000 Packet Transport Router with FPC2-PTX-P1A)

The **PDU Converter Failed** alarm is raised when one or more 36 V booster converter of a DC PDU fails. If two or more 36 V booster converter fails, fan trays fail and the router might get over heated. Therefore, when this alarm is raised, check the PDU and replace it, if required.

```
user@host> show chassis alarms
11 alarms currently active
Alarm time               Class  Description
2013-12-11 22:14:13 PST  Minor  No Redundant Power for System
2013-12-11 22:14:10 PST  Major  PDU 0 PSM 7 Not OK
2013-12-11 22:14:10 PST  Major  PDU 0 PSM 6 Not OK
2013-12-11 22:14:10 PST  Major  PDU 0 PSM 5 Not OK
2013-12-11 22:14:10 PST  Major  PDU 0 PSM 4 Not OK
2013-12-11 22:14:10 PST  Major  PDU 0 PSM 3 Not OK
2013-12-11 22:14:10 PST  Major  PDU 0 PSM 2 Not OK
2013-12-11 22:14:10 PST  Major  PDU 0 PSM 1 Not OK
2013-12-11 22:14:10 PST  Major  PDU 0 PSM 0 Not OK
```

```
2013-12-11 22:14:10 PST  Major  PDU 0 Not OK
2013-12-11 22:14:01 PST  Major  PDU 0 Converter Failed
```

show chassis alarms (No Power for System Alarm on a PTX5000 Packet Transport Router with FPC2-PTX-P1A)

```
user@host> show chassis alarms
8 alarms currently active
Alarm time               Class  Description
2013-11-19 01:58:41 PST  Major  No Power for System
2013-11-19 01:58:37 PST  Major  PDU 0 PSM 1 Not OK
2013-11-19 01:56:46 PST  Major  PDU 0 PSM 2 Not OK
2013-11-19 01:54:26 PST  Major  PDU 0 PSM 3 Not OK
2013-11-19 01:53:30 PST  Major  PDU 1 PSM 3 Not OK
2013-11-19 01:53:29 PST  Major  PDU 1 PSM 2 Not OK
2013-11-19 01:53:29 PST  Major  PDU 1 PSM 1 Not OK
2013-11-19 01:53:29 PST  Major  PDU 1 PSM 0 Not OK
```

show chassis alarms (Alarms Active on an ACX2000 Universal Metro Router)

```
user@host> show chassis alarms
7 alarms currently active
Alarm time               Class  Description
2012-05-22 11:19:09 UTC  Major  xe-0/3/1: Link down
2012-05-22 11:19:09 UTC  Major  xe-0/3/0: Link down
2012-05-22 11:19:09 UTC  Major  ge-0/1/7: Link down
2012-05-22 11:19:09 UTC  Major  ge-0/1/6: Link down
2012-05-22 11:19:09 UTC  Major  ge-0/1/3: Link down
2012-05-22 11:19:09 UTC  Major  ge-0/1/2: Link down
2012-05-22 11:19:09 UTC  Major  ge-0/1/1: Link down
```

show chassis alarms (Active Alarm to Indicate Status of the Bad SCB Clock on MX Series)

```
user@host> show chassis alarms
1 alarm currently active
Alarm time               Class  Description
2013-08-06 07:48:35 PDT  Major  CB 0 19.44 MHz clock failure
```

show chassis alarms (Alarms active on a PTX1000 Packet Transport Router)

```
user@host> show chassis alarms
2 alarms currently active
Alarm time               Class  Description
2004-08-10 00:55:49 UTC  Major  PEM 1 Not Present
2004-08-10 00:55:49 UTC  Major  PEM 0 Not Present
```

show chassis alarms (MX10003 Router)

If LCMD is down on the backup RE, then the following alarm is seen on the primary.

```
user@host> show chassis alarms
1 alarm currently active
Alarm time               Class  Description
2017-05-09 13:26:27 PDT  Major  VMHost RE 1 host application failed
```

If LCMD is down on the primary, then following alarms are displayed.

```
user@host> show chassis alarms
3 alarms currently active
Alarm time               Class  Description
2017-05-10 14:12:21 PDT  Major  VMHost RE 0 host application failed
2017-05-10 14:12:16 PDT  Minor  LCM Peer Absent
2017-05-09 13:26:27 PDT  Major  VMHost RE 1 host application failed
```

If the LCMD process is crashing on the primary, the system will switchover after one minute provided the backup RE LCMD connection is stable. The system will not switchover under the following conditions: if the backup RE LCMD connection is unstable or if the current primary just gained primary role. When the primary has just gained primary role, the switchover happens only after four minutes.

The LCM peer connection un-stable alarm is raised when the LCMD-CHASD IPC communication flaps three times within a small interval of two to three minutes. Once LCM peer connection un-stable alarm is raised, the connection status is monitored for two minutes.

```
user@host> show chassis alarms
7 alarms currently active
Alarm time               Class  Description
2017-05-29 10:12:17 PDT  Minor  LCM Peer Connection un-stable
```

```
2017-05-29 09:04:17 PDT  Minor  PEM 8 Not Powered
2017-05-29 09:04:17 PDT  Minor  PEM 9 Not Powered
2017-05-29 09:04:17 PDT  Minor  PEM 7 Not Powered
2017-05-29 09:04:17 PDT  Minor  PEM 3 Not Powered
2017-05-29 09:04:17 PDT  Minor  PEM 0 Not Powered
2017-05-29 09:04:08 PDT  Minor  Loss of communication with Backup RE
```

If there are no more connection flaps within this two minutes time interval, the LCM peer connection un-stable alarm is cleared.

```
6 alarms currently active
Alarm time               Class  Description
2017-05-29 09:04:17 PDT  Minor  PEM 8 Not Powered
2017-05-29 09:04:17 PDT  Minor  PEM 9 Not Powered
2017-05-29 09:04:17 PDT  Minor  PEM 7 Not Powered
2017-05-29 09:04:17 PDT  Minor  PEM 3 Not Powered
2017-05-29 09:04:17 PDT  Minor  PEM 0 Not Powered
2017-05-29 09:04:08 PDT  Minor  Loss of communication with Backup RE
```

A major alarm is raised even if there is on one PLL lock error, and this alarm can be cleared only through an FPC restart.

```
user@host> show chassis alarms
4 alarms currently active
Alarm time               Class  Description
2017-02-16 09:06:06 PDT  Major  FPC 0 Major Errors
2017-02-16 09:08:40 PDT  Major  FPC 1 Major Errors
2017-02-16 09:11:47 PST  Minor  Fan Tray 3 Pair 1 Outer Fan running at over speed
2017-02-16 09:11:47 PST  Minor  Fan Tray 3 Pair 1 Inner Fan running at over speed
```

show chassis alarms (Alarms active on a MX10008 Router)

```
user@host> show chassis alarms
13 alarms currently active
Alarm time               Class  Description
2018-07-17 05:48:08 PDT  Major  FPC 2 I2C Failure
2018-07-17 05:47:02 PDT  Minor  Mixed Master and Backup RE types
2018-07-17 05:47:01 PDT  Major  Fan Tray 0 Fan 5 Failed
2018-07-17 05:47:01 PDT  Major  Fan Tray 0 Fan 4 Failed
2018-07-17 05:47:01 PDT  Minor  PEM 5 Not Powered
```

```
2018-07-17 05:47:01 PDT  Minor  PEM 5 Feed 2 has no input source
2018-07-17 05:47:01 PDT  Minor  PEM 5 Feed 1 has no input source
2018-07-17 05:47:01 PDT  Minor  PEM 4 Not Powered
2018-07-17 05:47:01 PDT  Minor  PEM 4 Feed 2 has no input source
2018-07-17 05:47:01 PDT  Minor  PEM 4 Feed 1 has no input source
2018-07-17 05:47:01 PDT  Minor  PEM 3 Not Powered
2018-07-17 05:47:01 PDT  Minor  PEM 3 Feed 2 has no input source
2018-07-17 05:47:01 PDT  Minor  PEM 3 Feed 1 has no input source
```

show chassis alarms (ACX710 Router)

```
user@host> show chassis alarms
Alarm time               Class  Description
2011-01-23 21:42:46 PST  Major  PTP Local Clock OOS
2011-01-23 21:42:46 PST  Major  PTP No Foreign Master
2011-01-23 21:42:46 PST  Major  Chassis Loss of all Equipment Clock Synch
References
2011-01-23 21:42:46 PST  Major  Chassis Loss of Equipment Clock Synch Reference 1
2011-01-23 21:42:46 PST  Major  Chassis Loss of Equipment Clock Synch Reference 2
2011-01-23 21:42:46 PST  Major  Equipment Clock QL Below Threshold
2011-01-23 21:42:46 PST  Major  TOD Input A Signal Fail
2011-01-23 21:42:46 PST  Major  1PPS lost
2011-01-23 21:42:46 PST  Major  SyncE Port incompatible Media Type
```

Release Information

Command introduced before Junos OS Release 7.4.

sfc option introduced in Junos OS Release 9.6 for the TX Matrix Plus router.

satellite option introduced in Junos OS Release 14.2R3 for Junos Fusion.

Command introduced in Junos OS Release 18.2R1 for EX9253 Switches and MX10008 Universal Routing Platforms.

RELATED DOCUMENTATION

- Configuring an RMON Alarm Entry and Its Attributes
- Chassis Conditions That Trigger Alarms

show system errors active

IN THIS SECTION

- Syntax | 647
- Description | 647
- Options | 647
- Required Privilege Level | 648
- Output Fields | 648
- Sample Output | 649
- Release Information | 653

Syntax

show system errors active
<detail [*fru slot-number* **[scope** *error-scope***] [category** *error-category***]]>**
< ***fru slot-number*** **>**

Description

Display information collected by the J-Insight fault monitoring feature. Specifically, display summary or detailed information about the active errors based on FRU, error scope, or error category.

NOTE: In PTX Series routers with Junos OS Evolved, the details of the Packet Forwarding Engine errors (reported through CMError), when set and cleared, are moved from the output of **show system errors active** command to the output of **show system errors inactive** command. However, the output of the **show system errors inactive detail** does not contain the details of the active FRU board errors that are cleared.

Options

none Display a brief summary of the system error information for all applicable FRUs.

category *error-category*	(Optional) Display system error information based on error category. An error category categorizes errors into various subgroups under a specific error scope level. Values include: core, functional, io, memory, processing, storage, and switch.
detail	(Optional) Display detailed system error information.
fru slot-number	(Optional) Display system error information for a specific FRU. For devices running Junos OS, output displays error details for FPC FRUs. For devices running Junos OS Evolved, output displays error details for FPC and other components such as fan, PSM, CB, and chassis.
scope *error-scope*	(Optional) Display system error information based on error scope. An error scope provides a level of classification above error category. Values include: board, pfe, and scope-all.

Required Privilege Level

admin

Output Fields

Table 22 on page 648 list the output fields for the **show system errors active** command. Output fields are listed in the approximate order in which they appear.

Table 22: show system errors active Output Fields

Field Name	Field Description
Error Name	Name of error.
Identifier	Each error is uniquely identified with an error ID that is represented as a Uniform Resource Identifier (URI).
Description	Description of the error.
State	State of the error. Values are: enabled or disabled.
Scope	Scope classification to which the error belongs. Values include board and pfe.

Table 22: show system errors active Output Fields *(Continued)*

Field Name	Field Description
Category	Category subgroup under the scope level to which the error belongs. Values include: core, functional, io, memory, processing, storage, and switch.
Level	Severity level of the error.
Threshold	Configured threshold value. The associated detection and recovery actions are triggered when this value is exceeded.
Error Limit	The maximum number of times the error is reported.
Support	Support details for the error type.
Occur count	Number of times errors of a specific scope, category, and severity level has occurred.
Clear count	Number of times error instances have been cleared.
Last occurred (ms ago)	Amount of time (in milliseconds) passed since the error last occurred.

Sample Output

show system errors active

For devices running Junos OS, output displays error details for FPC FRUs. For devices running Junos OS Evolved, output displays error details for FPC and other components such as fan, PSM, CB, and chassis.

```
user@host> show system errors active

System Active Errors Information
CB 0
---------------------------------
```

```
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
CHASSIS 0
----------------------------------
Active Minor Errors           : 0
Active Major Errors           : 5
Active Fatal Errors           : 0
FAN 0
----------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
FAN 1
----------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
FAN 2
----------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
FAN 3
----------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
FAN 4
----------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
FPC 0
----------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
FPC 1
----------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
```

```
FPC 2
---------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
FPC 3
---------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
FPM 0
---------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
PDU 0
---------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
PICS 0
---------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
PICS 1
---------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
PSM 0
---------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
PSM 1
---------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
PSM 2
---------------------------------
Active Minor Errors           : 0
```

```
Active Major Errors           : 0
Active Fatal Errors           : 0
PSM 3
---------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
RE 0
---------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
SIB 0
---------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
SIB 1
---------------------------------
Active Minor Errors           : 0
Active Major Errors           : 0
Active Fatal Errors           : 0
```

show system errors active fpc-slot

```
user@host> show system errors active fpc-slot
0
System Active Errors Information
FPC 0
-------------------------------------------------
Active Minor Errors: 0
Active Major Errors: 1
Active Fatal Errors: 0
```

show system errors active detail

```
user@host> show system errors active detail
System Active Errors Detail Information
CHASSIS 0
-----------------------------------------------------------------
```

```
Error Name : fan_tray_removal
Identifier : /chassis/0/hwdre/0/cm/0/fan_tray/Fan Tray 0/fan_tray_removal
Description : Fan_tray_absent
State : disabled
Scope : board
Category : functional
Level : major
Threshold : 1
Error limit : 1
Support : No help info provided
Occur count : 1
Clear count : 0
Last occurred(ms ago) : 339112691
```

Release Information

Command introduced in Junos OS Release 18.2R1.

RELATED DOCUMENTATION

- *show system errors count*
- *show system errors error-id*
- *show system errors fru*

show system errors count

IN THIS SECTION

- Syntax | 654
- Description | 654
- Options | 654
- Required Privilege Level | 654
- Output Fields | 654
- Sample Output | 655

Release Information | 655

Syntax

```
show system errors count
```

Description

Display information collected by the J-Insight fault monitoring feature. Specifically, display information about the number of detected errors and recovery actions triggered based on error severity level.

Options

This command has no options.

Required Privilege Level

admin

Output Fields

Table 23 on page 654 lists the output fields for the **show system errors count** command. Output fields are listed in the approximate order in which they appear.

Table 23: show system errors count Output Fields

Field Name	Field Description
Level	Severity level of the error. Values are: Minor, Major, or Fatal.
Occurred	Number of times errors of a specific severity level occurred.
Cleared	Number of times errors of a specific severity level were cleared.

Table 23: show system errors count Output Fields *(Continued)*

Field Name	Field Description
Action-Taken	Number of times a recovery action was triggered for a specific severity level.

Sample Output

show system errors count

```
user@host> show system errors count
Level    Occurred    Cleared      Action-Taken
-----------------------------------------------------------
 Minor:  0           0             0
 Major:  1           0             1
 Fatal:  0           0             0
```

Release Information

Command introduced in Junos OS Release 18.2R1.

RELATED DOCUMENTATION

- *show system errors active*
- *show system errors error-id*
- *show system errors fru*

show system errors error-id

IN THIS SECTION

- Syntax | 656

- Description | 656
- Options | 656
- Additional Information | 656
- Required Privilege Level | 656
- Output Fields | 656
- Sample Output | 658
- Release Information | 658

Syntax

```
show system errors error-id error-id-uri
```

Description

Display information collected by the J-Insight fault monitoring feature. Specifically, display information about detected errors based on the error ID Uniform Resource Identifier (URI). For devices running Junos OS Evolved, output displays only errors that have occurred at least once in the system.

Options

This command has no options.

Additional Information

Required Privilege Level

admin

Output Fields

Table 24 on page 657 lists the output fields for the **show system errors error-id** command. Output fields are listed in the approximate order in which they appear.

Table 24: show system errors error-id Output Fields

Field Name	Field Description
Error Name	Name of error.
Identifier	Each error is uniquely identified with an error ID that is represented as a Uniform Resource Identifier (URI).
Description	Description of the error.
State	State of the error. Values are: enabled or disabled.
Scope	Scope classification to which the error belongs. Values include board and pfe.
Category	Category subgroup under the scope level to which the error belongs. Values include: core, functional, io, memory, processing, storage, and switch.
Level	Severity level of the error.
Threshold	Configured threshold value. The associated detection and recovery actions are triggered when this value is exceeded.
Error Limit	The maximum number of times the error is reported.
Support	Support details for the error type.
Occur count	Number of times errors of a specific scope, category, and severity level has occurred.
Clear count	Number of times error instances have been cleared.
Last occurred (ms ago)	Amount of time (in milliseconds) passed since the error last occurred.

Sample Output

show system errors error-id

```
user@host> show system errors error-id "/chassis/0/hwdre/0/cm/0/fan_tray/Fan
Tray 0/fan_tray_removal"
System Errors Detail Information
CHASSIS 0
-----------------------------------------------------------------
Error Name            : fan_tray_removal
Identifier            : /chassis/0/hwdre/0/cm/0/fan_tray/Fan Tray 0/
fan_tray_removal
Description           : Fan_tray_absent
State                 : enabled
Scope                 : board
Category              : functional
Level                 : major
Threshold             : 1
Error limit           : 1
Support               : No help info provided
Occur count           : 1
Clear count           : 0
Last occurred(ms ago) : 84091182
```

Release Information

Command introduced in Junos OS Release 19.1R1.

RELATED DOCUMENTATION

- *show system errors active*
- *show system errors count*
- *show system errors fru*

show system errors fru

IN THIS SECTION

- Syntax | 659
- Description | 659
- Options | 659
- Required Privilege Level | 660
- Output Fields | 660
- Sample Output | 661
- Sample Output | 663
- Release Information | 665

Syntax

show system errors fru detail [*fru slot-number*]

Description

Display information collected by the J-Insight fault monitoring feature. Specifically, display information about detected errors based on the FRU.

Options

none	Display a brief summary of the system error information for the FRU.
detail	(Optional) Display detailed system error information.
fru slot-number	(Optional) Display system error information for a specific FRU. For devices running Junos OS, output displays error details for FPC FRUs. For devices running Junos OS Evolved, output displays error details for FPC and other components such as fan, PSM, CB, and chassis.

Required Privilege Level

admin

Output Fields

Table 25 on page 660 lists the output fields for the **show system errors fru** command. Output fields are listed in the approximate order in which they appear.

Table 25: show system errors fru Output Fields

Field Name	Field Description
FRU	FRU identification number.
Scope	An error scope provides a level of classification above error category. Error scope values are: pfe and board.
Category	An error category categorizes errors into various subgroups under a specific error scope level. Values include: functional, io, memory, processing, storage, and switch.
Level	Severity level of the error.
Occurred	Number of times errors of a specific scope, category, and severity level has occurred.
Cleared	Number of times errors of a specific scope, category, and severity level were cleared.
Threshold	Configured threshold value. The associated detection and recovery actions are triggered when this value is exceeded.
Action-Taken	Number of times a user-configured recovery action was triggered for errors of a specific scope, category, and severity level.

Table 25: show system errors fru Output Fields *(Continued)*

Field Name	Field Description
Action	Action that is triggered when the threshold value is exceeded.

Sample Output

show system errors fru detail

```
user@host> show system errors fru detail
Fru     Scope   Category    Level   Occurred    Cleared     Threshold   Action-
Taken    Action
FPC 0
        board
                functional  Minor        0           0           10
0           LOG|
                            Major        0           0            1
0          GET STATE|CM ALARM|
                            Fatal        0           0            1
0          DISABLE PFE
                  memory    Minor        0           0           10
0           LOG|
                            Major        0           0            1
0          GET STATE|CM ALARM|
                            Fatal        0           0            1
0          DISABLE PFE
                     io     Minor        0           0           10
0           LOG|
                            Major        0           0            1
0          GET STATE|CM ALARM|
                            Fatal        0           0            1
0          DISABLE PFE
                 storage    Minor        0           0           10
0           LOG|
                            Major        0           0            1
0          GET STATE|CM ALARM|
                            Fatal        0           0            1
0          DISABLE PFE
                  switch    Minor        0           0           10
```

```
0            LOG|
                          Major        0           0            1
0          GET STATE|CM ALARM|
                          Fatal        0           0            1
0          DISABLE PFE
               processing  Minor        0           0           10
0            LOG|
                          Major        0           0            1
0          GET STATE|CM ALARM|
                          Fatal        0           0            1
0          DISABLE PFE
        pfe
                functional  Minor        0           0           10
0            LOG|
                          Major        0           0            1
0          GET STATE|CM ALARM|
                          Fatal        0           0            1
0          DISABLE PFE
                 memory    Minor        0           0           10
0            LOG|
                          Major        0           0            1
0          GET STATE|CM ALARM|
                          Fatal        0           0            1
0          DISABLE PFE
                     io    Minor        0           0           10
0            LOG|
                          Major        0           0            1
0          GET STATE|CM ALARM|
                          Fatal        0           0            1
0          DISABLE PFE
                  storage    Minor        0           0           10
0            LOG|
                          Major        0           0            1
0          GET STATE|CM ALARM|
                          Fatal        0           0            1
0          DISABLE PFE
                 switch    Minor        0           0           10
0            LOG|
                          Major        0           0            1
0          GET STATE|CM ALARM|
                          Fatal        0           0            1
0          DISABLE PFE
               processing  Minor        0           0           10
```

```
0            LOG|
                           Major        0           0            1
0          GET STATE|CM ALARM|
                           Fatal        0           0            1
0          DISABLE PFE
```

Sample Output

show system errors fru detail (PTX10003)

The following output has been shortened for clarity. For each part of a FRU, the full output displays any errors in the functional, io, memory, processing, storage, and switch categories, similar to the CB 0 FRU below.

```
user@host> show system errors fru detail

Fru     Scope   Category    Level   Occurred    Cleared     Threshold   Action-
Taken    Action
CB 0
        board
                functional  Minor        0           0           10
0            LOG|
                           Major        0           0            1
0          GET STATE|CM ALARM|
                           Fatal        0           0            1
0          CM ALARM|RESET
                     io    Minor        0           0           10
0            LOG|
                           Major        0           0            1
0          GET STATE|CM ALARM|
                           Fatal        0           0            1
0          CM ALARM|RESET
                  memory   Minor        0           0           10
0            LOG|
                           Major        0           0            1
0          GET STATE|CM ALARM|
                           Fatal        0           0            1
0          CM ALARM|RESET
                processing  Minor        0           0           10
0            LOG|
                           Major        0           0            1
```

```
0          GET STATE|CM ALARM|
                            Fatal        0           0            1
0          CM ALARM|RESET
                  storage   Minor        0           0           10
0            LOG|
                            Major        0           0            1
0          GET STATE|CM ALARM|
                            Fatal        0           0            1
0          CM ALARM|RESET
                   switch   Minor        0           0           10
0            LOG|
                            Major        0           0            1
0          GET STATE|CM ALARM|
                            Fatal        0           0            1
0          CM ALARM|RESET
CHASSIS 0
        board
...
FAN 0
        board
...
FAN 1
        board
...
FPC 0
        board

...
        pfe
...
FPC 1
        board
...

        pfe
...
FPM 0
        board
...
PDU 0
        board
...
PICS 0
```

```
        board
...
PICS 1
        board
...
PSM 0
        board
...
PSM 1
        board
...
RE 0
        board
 ...
SIB 0
        board
...
        switch
...
SIB 1
        board
...
        switch
...
```

Release Information

Command introduced in Junos OS Release 18.2R1.

RELATED DOCUMENTATION

- *show system errors active*
- *show system errors count*
- *show system errors error-id*

show system health-monitor

IN THIS SECTION

- Syntax | 666
- Description | 666
- Options | 666
- Required Privilege Level | 666
- Output Fields | 667
- Sample Output | 667
- Release Information | 670

Syntax

```
show system health-monitor
<fpc fpc-slot fpc-slot>
```

Description

Display the J-Insight health monitor results. Starting with Junos OS Release 18.2R1, J-Insight supports health monitoring for FPC FRUs on the MX Series routers.

Options

none	Display information for all FPCs.
fpc fpc-slot *fpc-slot*	(Optional) Display information for a specified FPC.

Required Privilege Level

admin

Output Fields

Table 26 on page 667 lists the output fields for the **show system health-monitor** command. Output fields are listed in the approximate order in which they appear.

Table 26: show system health-monitor Output Fields

Field Name	Field Description
Component	Platform component name.
Health-Parameter	Health parameter name.
Value	Reported health value collected by the health monitor.
Threshold	Default threshold value for the health parameter.
Health-Status	State of the health parameter. Values are: GREEN, YELLOW, or RED.
FPC SLOT	FPC slot number.

Sample Output

show system health-monitor

```
user@host> show system health-monitor
Component      Health-Parameter     Value        Threshold       Health-Status
-------------------------------------------------------------------------------
FPC SLOT: 0

board.0.cpu.0     CPU Load 1 (1  sec)         15              NA          NA
board.0.cpu.0     CPU Load 2 (5  sec)         16              NA          NA
board.0.cpu.0     CPU Load 3 (10 sec)         15              NA          NA
board.0.cpu.0     CPU Load 4 (1  min)         15              NA          NA
board.0.cpu.0     heap_util[Kernel]           11              NA          NA
board.0.cpu.0     heap_util[LAN buffer]       20              NA          NA
board.0.temp.0    Exhaust A                   46 C/114.8 F    75          GREEN
```

```
board.0.temp.0    Exhaust B                59 C/138.2 F    75          GREEN
board.0.temp.0    Intake                   41 C/105.8 F    75          GREEN
board.0.temp.0    LU 0 Chip                55 C/131 F      NA          NA
board.0.temp.0    LU 0 TSen                50 C/122 F      NA          NA
board.0.temp.0    LU 1 Chip                49 C/120.2 F    NA          NA
board.0.temp.0    LU 1 TSen                50 C/122 F      NA          NA
board.0.temp.0    LU 2 Chip                57 C/134.6 F    NA          NA
board.0.temp.0    LU 2 TSen                50 C/122 F      NA          NA
board.0.temp.0    LU 3 Chip                64 C/147.2 F    NA          NA
board.0.temp.0    LU 3 TSen                50 C/122 F      NA          NA
board.0.temp.0    PLX Switch Chip          55 C/131 F      NA          NA
board.0.temp.0    PLX Switch TSen          50 C/122 F      NA          NA
board.0.temp.0    XF 0 Chip                69 C/156.2 F    NA          NA
board.0.temp.0    XF 0 TSen                50 C/122 F      NA          NA
board.0.temp.0    XM 0 Chip                58 C/136.4 F    NA          NA
board.0.temp.0    XM 0 TSen                50 C/122 F      NA          NA
npu.0.fabric.0    PLANE0.dest[0-31]        0x80000003      NA          NA
npu.0.fabric.0    PLANE0.dest[128-159]     0x00000300      NA          NA
npu.0.fabric.0    PLANE0.dest[160-191]     0x20000000      NA          NA
npu.0.fabric.0    PLANE0.dest[192-223]     0x00000000      NA          NA
npu.0.fabric.0    PLANE0.dest[224-239]     0x00000000      NA          NA
npu.0.fabric.0    PLANE0.dest[32-63]       0x00200000      NA          NA
npu.0.fabric.0    PLANE0.dest[64-95]       0x00000000      NA          NA
npu.0.fabric.0    PLANE0.dest[96-127]      0x00000080      NA          NA
npu.0.fabric.0    PLANE1.dest[0-31]        0x80000003      NA          NA
npu.0.fabric.0    PLANE1.dest[128-159]     0x00000300      NA          NA
npu.0.fabric.0    PLANE1.dest[160-191]     0x20000000      NA          NA
npu.0.fabric.0    PLANE1.dest[192-223]     0x00000000      NA          NA
npu.0.fabric.0    PLANE1.dest[224-239]     0x00000000      NA          NA
npu.0.fabric.0    PLANE1.dest[32-63]       0x00200000      NA          NA
npu.0.fabric.0    PLANE1.dest[64-95]       0x00000000      NA          NA
npu.0.fabric.0    PLANE1.dest[96-127]      0x00000080      NA          NA
npu.0.fabric.0    PLANE2.dest[0-31]        0x80000003      NA          NA
npu.0.fabric.0    PLANE2.dest[128-159]     0x00000300      NA          NA
npu.0.fabric.0    PLANE2.dest[160-191]     0x20000000      NA          NA
npu.0.fabric.0    PLANE2.dest[192-223]     0x00000000      NA          NA
npu.0.fabric.0    PLANE2.dest[224-239]     0x00000000      NA          NA
npu.0.fabric.0    PLANE2.dest[32-63]       0x00200000      NA          NA
npu.0.fabric.0    PLANE2.dest[64-95]       0x00000000      NA          NA
npu.0.fabric.0    PLANE2.dest[96-127]      0x00000080      NA          NA
npu.0.fabric.0    PLANE3.dest[0-31]        0x80000003      NA          NA
npu.0.fabric.0    PLANE3.dest[128-159]     0x00000300      NA          NA
npu.0.fabric.0    PLANE3.dest[160-191]     0x20000000      NA          NA
```

```
npu.0.fabric.0    PLANE3.dest[192-223]        0x00000000      NA          NA
npu.0.fabric.0    PLANE3.dest[224-239]        0x00000000      NA          NA
npu.0.fabric.0    PLANE3.dest[32-63]          0x00200000      NA          NA
npu.0.fabric.0    PLANE3.dest[64-95]          0x00000000      NA          NA
npu.0.fabric.0    PLANE3.dest[96-127]         0x00000080      NA          NA
npu.0.fabric.0    PLANE4.dest[0-31]           0x00000000      NA          NA
npu.0.fabric.0    PLANE4.dest[128-159]        0x00000000      NA          NA
npu.0.fabric.0    PLANE4.dest[160-191]        0x00000000      NA          NA
npu.0.fabric.0    PLANE4.dest[192-223]        0x00000000      NA          NA
npu.0.fabric.0    PLANE4.dest[224-239]        0x00000000      NA          NA
npu.0.fabric.0    PLANE4.dest[32-63]          0x00000000      NA          NA
npu.0.fabric.0    PLANE4.dest[64-95]          0x00000000      NA          NA
npu.0.fabric.0    PLANE4.dest[96-127]         0x00000000      NA          NA
npu.0.fabric.0    PLANE5.dest[0-31]           0x00000000      NA          NA
npu.0.fabric.0    PLANE5.dest[128-159]        0x00000000      NA          NA
npu.0.fabric.0    PLANE5.dest[160-191]        0x00000000      NA          NA
npu.0.fabric.0    PLANE5.dest[192-223]        0x00000000      NA          NA
npu.0.fabric.0    PLANE5.dest[224-239]        0x00000000      NA          NA
npu.0.fabric.0    PLANE5.dest[32-63]          0x00000000      NA          NA
npu.0.fabric.0    PLANE5.dest[64-95]          0x00000000      NA          NA
npu.0.fabric.0    PLANE5.dest[96-127]         0x00000000      NA          NA
npu.0.fabric.0    PLANE6.dest[0-31]           0x00000000      NA          NA
npu.0.fabric.0    PLANE6.dest[128-159]        0x00000000      NA          NA
npu.0.fabric.0    PLANE6.dest[160-191]        0x00000000      NA          NA
npu.0.fabric.0    PLANE6.dest[192-223]        0x00000000      NA          NA
npu.0.fabric.0    PLANE6.dest[224-239]        0x00000000      NA          NA
npu.0.fabric.0    PLANE6.dest[32-63]          0x00000000      NA          NA
npu.0.fabric.0    PLANE6.dest[64-95]          0x00000000      NA          NA
npu.0.fabric.0    PLANE6.dest[96-127]         0x00000000      NA          NA
npu.0.fabric.0    PLANE7.dest[0-31]           0x00000000      NA          NA
npu.0.fabric.0    PLANE7.dest[128-159]        0x00000000      NA          NA
npu.0.fabric.0    PLANE7.dest[160-191]        0x00000000      NA          NA
npu.0.fabric.0    PLANE7.dest[192-223]        0x00000000      NA          NA
npu.0.fabric.0    PLANE7.dest[224-239]        0x00000000      NA          NA
npu.0.fabric.0    PLANE7.dest[32-63]          0x00000000      NA          NA
npu.0.fabric.0    PLANE7.dest[64-95]          0x00000000      NA          NA
npu.0.fabric.0    PLANE7.dest[96-127]         0x00000000      NA          NA
npu.0.memory.0    Counters_EDMEM Utilization  50              NA          NA
npu.0.memory.0    EDMEM Utilization           37              NA          NA
npu.0.memory.0    ENCAPS_EDMEM Utilization    100             NA          NA
npu.0.memory.0    Firewall_EDMEM Utilization  1               NA          NA
npu.0.memory.0    HASH_EDMEM Utilization      100             NA          NA
npu.0.memory.0    HASH_OMEM Utilization       100             NA          NA
```

```
npu.0.memory.0    IDMEM Utilization           86              NA          NA
npu.0.memory.0    LMEM_LMEM Utilization       100             NA          NA
npu.0.memory.0    Next_Hop_EDMEM Utilization  65              NA          NA
npu.0.memory.0    OMEM Utilization            1               NA          NA
npu.0.memory.0    UEID_SHARED_SPACE_EDMEM Utilization 1       NA          NA
npu.0.memory.0    UEID_SPACE_EDMEM Utilization 1              NA          NA
npu.0.util.0      EDMEM Avg Load              1               NA          NA
npu.0.util.0      Global Utilization          1               NA          NA
npu.0.util.0      IDMEM Avg Load              1               NA          NA
npu.0.util.0      OMEM Avg Load               0               NA          NA
```

Release Information

Command introduced in Junos OS Release 18.2R1.

RELATED DOCUMENTATION

J-Insight Device Monitor Basic Configuration | **470**

delete services jinsightd subscribe health-monitor | **612**

set services jinsightd traceoptions | **618**

show trace

IN THIS SECTION

- Syntax | **671**
- Description | **671**
- Options | **671**
- Required Privilege Level | **672**
- Output Fields | **672**
- Sample Output | **673**
- Release Information | **674**

Syntax

```
show trace
<application app-name>
<live>
<node node-name>
<pid pid-value>
<terse>
<time time-elapsed>
```

Description

Show the trace data from all nodes that is collected on the primary Routing Engine in **/var/log/traces**. All applications are traced at the info level for informational messages. You can refine the traces to show by specifying trace time elapsed, application, process ID, and node.

The options provide you with a way to target the traces you want to see. The ouput will prompt you to use the options, like so:

```
[WARNING] Number of contributing trace folders is 2880 .
[WARNING] This might cause some logs not to be displayed.
[WARNING] Please filter your search using the available knobs (including time)
```

Options

none	Display all traces.
application ***app-name***	(Optional) Display traces for the specified application name.
live	(Optional) Enable a mode in which the command remains active and new traces are displayed as they come in.
node ***node-name***	(Optional) Display traces for the specified node name.
pid ***pid-value***	(Optional) Display traces for the specified process ID.
terse	(Optional) Display briefer output for traces.
time ***time-elapsed***	(Optional) Display traces for the specified elapsed time.

- **Range:** 1 through 840 minutes

Required Privilege Level

view

Output Fields

Table 27 on page 672 lists the output fields for the **show trace** command. Output fields are listed in the approximate order in which they appear.

Table 27: show trace Output Fields

Field Name	Field Description
timestamp	Timestamp field in the following format: YYYY-MM-DD HH:MM:SS.123456789.
node	Node where trace message originated.
system-process	System process where trace message originated.
tracepoint	Tracepoint value of the trace message.
trace-level	Trace level of the trace message.
application	Application where trace message originated.
message-type	Message type of the trace message.
Function	Function name where the trace message was generated.
Message	Message associated with the tracepoint.

Sample Output

show trace

```
root@evovbracklaq_RE0> show trace

[WARNING] Number of contributing trace folders is 2880 .
[WARNING] This might cause some logs not to be displayed.
[WARNING] Please filter your search using the available knobs (including time)


2019-09-26 08:46:29.658883645 re0:aft-sysinfo:14325 libevoinfra_INFO_APP
Function = "evoapp_init_commons", node_type = "RE", node_slot = 0, node_name =
"re0", app_name = "aft-sysinfo", app_id = 0
2019-09-26 08:46:29.659055906 re0:aft-sysinfo:14325 libevoinfra_INFO_STR
Function = "evoapp_init_commons", Message = "Running : /usr/sbin/aft-sysinfo -
p /var/pfe --app-name aft-sysinfo "
2019-09-26 08:46:29.659076131 re0:aft-sysinfo:14325 libevoinfra_INFO_2STR
Function = "evoapp_init_commons", Message1 = "Object subscription mode",
Message2 = "Object Select"
2019-09-26 08:46:29.659755689 re0:aft-sysinfo:14325 libevoinfra_INFO_2STR
Function = "evoapp_load_dsl", Message1 = "App Lua config not set, using app
file", Message2 = "/usr/conf/evoapp/aft-sysinfo.lua"
2019-09-26 08:46:30.291258500 re0:aft-sysinfo:14325 lltp_info  message =
"Setting up ZooClient for app aft-sysinfo"
2019-09-26 08:46:30.291305775 re0:aft-sysinfo:14325 lltp_info  message =
"Connecting to Zookeeper : attempt 1"
2019-09-26 08:46:30.291422845 re0:aft-sysinfo:14325 lltp_info  message =
"Zookeeper address 127.0.0.1:2181"
2019-09-26 08:46:30.291441778 re0:aft-sysinfo:14325 lltp_info  message =
"Connecting to Zookeeper: path 127.0.0.1:2181"
2019-09-26 08:46:30.308878435 re0:aft-sysinfo:14325 lltp_info  message = "Wait
for Zookeeper connection to get established"
2019-09-26 08:46:30.314930581 re0:aft-sysinfo:14325 lltp_info  message =
"zookeeperWatcher: event type ZOO_SESSION_EVENT state ZOO_CONNECTED_STATE path "
2019-09-26 08:46:30.314958284 re0:aft-sysinfo:14325 lltp_info  message = "Saving
client id 10000015c6f0068 to aft-sysinfo"
2019-09-26 08:46:30.315649988 re0:aft-sysinfo:14325 lltp_info  message = "Async
getConfig completed path /zookeeper/config rc 0"
2019-09-26 08:46:31.309018911 re0:aft-sysinfo:14325 libevoinfra_INFO_STR
Function = "evoapp_zoo_init", Message = "Connected to Zookeeper"
```

```
2019-09-26 08:46:31.312922419 re0:aft-sysinfo:14325 lltp_info  message = "Get
Xapp static config for aft-sysinfo"
2019-09-26 08:46:31.314689699 re0:aft-sysinfo:14325 libevoinfra_INFO_EVOAPP
Function = "evoapp_zoo_init", Message = "App managed by SysMan", app_name = "aft-
sysinfo", node_name = "re0", app_version = 0, shared_app_version = 0,
node_attr_match = ""
2019-09-26 08:46:31.321618770 re0:aft-sysinfo:14325 lltp_info  message = "Create
node local production set: Path /system/nodes/re0/apps/aft-sysinfo/infra/restart
Version "
2019-09-26 08:46:31.321623149 re0:aft-sysinfo:14325 libevoinfra_INFO_EVOAPP
Function = "evoapp_zoo_init", Message = "Generated app local version", app_name
= "aft-sysinfo", node_name = "re0", app_version = 3698991357035064051,
shared_app_version = 0, node_attr_match = ""
2019-09-26 08:46:31.324009193 re0:aft-sysinfo:14325 lltp_info  message = "Create
shared production set: Path /system/apps/aft-sysinfo/restart Version
12377670930056552194"
. . .
```

show trace application live

```
user@host> show trace application cmdd live
2019-09-27 10:57:13.999923130 re0:cmdd:7955 lltp_info  message =
"DdxClientConn::DdxClientConn: name = cmdd, owner = 0x7f097a7d5c00, this =
0x7f097abd4600, stream = 0x7f097a797b80"
2019-09-27 10:57:13.999926928 re0:cmdd:7955 lltp_info  message =
"DdxClientConn::start: name = cmdd, owner = 0x7f097a7d5c00, this =
0x7f097abd4600, stream = 0x7f097a797b80"
```

Release Information

Command introduced in Junos OS Evolved Release 18.3R1.

RELATED DOCUMENTATION

clear trace | 611