



OcNOS®

**Open Compute Network Operating System
for Service Providers**

Streaming Telemetry

Version 7.0.0

February 2026

©2026 IP Infusion Inc. All Rights Reserved.

This documentation is subject to change without notice. The software described in this document and this documentation are furnished under a license agreement or nondisclosure agreement. The software and documentation may be used or copied only in accordance with the terms of the applicable agreement. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or any means electronic or mechanical, including photocopying and recording for any purpose other than the purchaser's internal use without the written permission of IP Infusion Inc.

IP Infusion Inc.

3979 Freedom Circle, Suite 900

Santa Clara, CA 95054

+1 408-400-1900

<http://www.ipinfusion.com/>

For support, questions, or comments via E-mail, contact:

support@ipinfusion.com

Trademarks:

IP Infusion and OcNOS are trademarks or registered trademarks of IP Infusion. All other trademarks, service marks, registered trademarks, or registered service marks are the property of their respective owners.

Use of certain software included in this equipment is subject to the IP Infusion, Inc. End User License Agreement at <http://www.ipinfusion.com/license>. By using the equipment, you accept the terms of the End User License Agreement.

| CONTENTS

Contents	3
Preface	16
About this Guide	16
Audience	16
Conventions	16
IP Infusion Product Release Version	16
Related Documentation	17
Feature Availability	17
Migration Guide	17
IP Maestro Support	17
Technical Support	17
Technical Sales	17
Technical Documentation	17
Documentation Disclaimer	18
Comments	18
Command Line Interface	19
Overview	19
Chapter Organization	19
Command Line Interface Help	19
Command Completion	20
Command Abbreviations	20
Command Line Errors	21
Command Negation	21
Syntax Conventions	21
Variable Placeholders	22
Command Description Format	23
Keyboard Operations	23
Show Command Modifiers	24
Begin Modifier	24
Include Modifier	25
Exclude Modifier	25
Redirect Modifier	26
Last Modifier	26
String Parameters	26
Command Modes	27
Command Mode Tree	28
Transaction-based Command-line Interface	28
Streaming Telemetry	30
Overview	30
Feature Characteristics	30
gNMI Subscription Modes	30

Streaming Telemetry Dial-In Mode	30
Streaming Telemetry Dial-Out Mode (Persistent Subscriptions)	30
gNMI In-Band Support	30
Streaming Telemetry Modes	31
Stream Mode	31
Poll Mode	31
Once Mode	31
Encoding Types	32
Protocol Buffers (protobuf)	32
JavaScript Object Notation	32
JSON-IETF	32
Encoding Limitations (Protobuf)	32
gnmic Installation	32
gNMI Collector Tool	32
Support for IPI Native Data Models and OpenConfig Data Models	33
Wildcard Support in Sensor Paths	33
Explicit Wildcard for Key Names	33
Implicit Wildcard (Omission of Key Name)	33
Partial Wildcard for Key Name	33
Partial Wildcard for Multiple Keys	33
Use case 1: Wildcard Support in Dial-In Mode	34
Use case 2: Wildcard Support in Dial-Out Mode	35
gnmic Output	36
XPath Formatting Rules for Streaming Telemetry	39
XPath Formatting Rules for gnmic Subscriptions	39
XPath Format Support by Telemetry Mode	40
Scale and Minimum Sample Interval Supported	41
Scale Scenarios	42
New Subscribe RPC Request Makes Total Paths To Not Exceed Max Allowed	42
New Subscribe RPC Request Makes Total Paths To Reach Allowed Max:	42
New Subscribe RPC Request Makes Total Paths To Exceed Allowed Max	42
Minimum Sample Interval	42
gNMI Server Cache Optimization	42
Cache Update Mechanism	43
Staggering Sensor-path Processing	43
Key Benefits	43
Streaming Telemetry Commands	43
crypto pki load source-interface	45
Command Syntax	45
Parameters	45
Default	45
Command Mode	45
Applicability	45
Example	45
crypto pki generate rsa common-name	46
Command Syntax	46
Parameters	46

Default	46
Command Mode	46
Applicability	46
Examples	46
debug cml	48
Command Syntax	48
Parameters	48
Default	48
Command Mode	48
Applicability	48
Examples	48
debug telemetry gnmi	49
Command Syntax	49
Parameters	49
Default	49
Command Mode	49
Applicability	49
Examples	49
destination-group	51
Command Syntax	51
Parameters	51
Default	51
Command Mode	51
Applicability	51
Example	51
destination-group GRPC	52
Command Syntax	52
Parameters	52
Default	52
Command Mode	52
Applicability	52
Example	52
encoding	54
Command Syntax	54
Parameters	54
Default	54
Command Mode	54
Applicability	54
Example	54
feature streaming-telemetry	55
Command Syntax	55
Parameters	55
Default	55
Command Mode	55
Applicability	55
Examples	55
grpc-tunnel-server retry-interval	57

Command Syntax	57
Parameters	57
Default	57
Command Mode	57
Applicability	57
Example	57
port	58
Command Syntax	58
Parameters	58
Default	58
Command Mode	58
Applicability	58
Examples	58
sensor-group	60
Command Syntax	60
Parameters	60
Default	60
Command Mode	60
Applicability	60
Example	60
sensor-group sample-interval	61
Command Syntax	61
Parameters	61
Default	61
Command Mode	61
Applicability	61
Example	61
sensor-path	63
Command Syntax	63
Parameters	63
Default	63
Command Mode	63
Applicability	63
Example	63
show crypto csr	64
Command Syntax	64
Parameters	64
Default	64
Command Mode	64
Applicability	64
Example	64
show streaming-telemetry	66
Command Syntax	66
Parameters	66
Command Mode	66
Applicability	66
Examples	66

show streaming-telemetry dynamic-subscriptions	70
Command syntax	70
Parameters	70
Command Mode	70
Applicability	70
Examples	70
show streaming-telemetry persistent-subscriptions	73
Command Syntax	73
Parameters	73
Default	73
Command Mode	73
Applicability	73
Example	73
show running-config streaming-telemetry	76
Command Syntax	76
Parameters	76
Command Mode	76
Applicability	76
Examples	76
subscription-name	77
Command Syntax	77
Parameters	77
Default	77
Command Mode	77
Applicability	77
Example	77
suppress-threshold	78
Command Syntax	78
Parameters	78
Default	78
Command Mode	78
Applicability	78
Example	78
telemetry cpu-monitor	80
Command Syntax	80
Parameters	80
Default	80
Command Mode	80
Applicability	80
Example	80
telemetry maximum-subscribe-paths	84
Command Syntax	84
Parameters	84
Default	84
Command Mode	84
Applicability	84
Examples	84

telemetry minimum-sample-interval	85
Command Syntax	85
Parameters	85
Default	85
Command Mode	85
Applicability	85
Examples	85
tls tls-port	86
Command Syntax	86
Parameters	86
Default	86
Command Mode	86
Applicability	86
Examples	86
tunnel-server	89
Command Syntax	89
Parameters	89
Default	89
Command Mode	89
Applicability	89
Example	89
Troubleshooting	90
gNMI Get RPC Mode	92
Overview	92
Feature Characteristics	92
Benefits	93
Configuration	94
Prerequisites	94
Topology	94
Use Case 1: Get RPC Requests for Configuration Data Type	94
Use Case 2: Get RPC Requests for State Data Type	95
Use Case 3: Get RPC Requests for All Data Types	96
Streaming Telemetry Dial-In Mode	99
Overview	99
Feature Characteristics	99
Benefits	99
Prerequisites	100
gNMI Subscription Limits	100
Global Subscription Limit	100
Per-Client Subscription Limit	100
Sample Stream Mode	101
Sampling Stream Mode Data Flow Description: Subscribe Request and Response	101
Step 1: Subscription Request Initiation	101
Step 2: Data Collection and Processing	101
Step 3: Continuous Subscription Response Streaming	101
Sample Stream Mode Benefits	103

On-Change Stream Mode	103
On-Change Stream Mode Data Flow Description	103
Step 1: Subscription Request	103
Step 2: Subscription Initialization	103
Step 3: Initial Data Transmission	103
Step 4: Monitoring Phase	103
Step 5: Data Change Detection and Notification Delivery	103
Step 6: Heartbeat Trigger	104
Step 7: Delete Notification	104
Supported Sensor Path Types in On-Change Mode	104
On-Change Stream Mode Benefits	105
Configuration	105
Telemetry Subscription Request via gnmic Command	106
Telemetry Subscription Request via gnmic Command and YAML Input	106
Telemetry Subscription Request via gnmic Command with a Single Path Option	107
Invoking Subscribe RPC with gnmic	108
Use Case 1: Monitoring Interface State with Single Path Option	108
Use Case 2: Monitoring Interface State with Multiple Path Option	110
Use Case 3: Monitoring Interface State Using Proto Encoding for IPI Xpath	112
Use Case 4: Monitoring Interface State Using JSON Encoding for IPI Xpath	113
Use Case 5: Monitoring Interface State Using JSON Encoding for OpenConfig Xpath	114
Use Case 6: On-Change Stream Mode Behavior for BGP Operational State	115
Use Case 7: Dial-In Telemetry Connection over IPv6 Interface	118
YAML File Input for Multiple Path Subscription	121
Use Case 1: Configuring One Subscription Requests with Multiple Path Option	121
Use Case 2: Configuring Multiple Subscription Requests with Multiple Path Option	124
Use Case 3: Configuring Multiple Subscription Requests with Prefix Option	128
Implementation Examples	131
Multi-Tenant Data Center Monitoring:	131
Scenario	131
Implementation	131
Dial-In Mode Command	132
Glossary	132
Streaming Telemetry Dial-Out Mode	133
Overview	133
Feature Characteristics	133
Data Flow	134
Benefits	135
Prerequisites	135
Configuration	135
Topology	135
Use Case 1: Configuring and Validating Telemetry on Management VRF	136
Use Case 2: Configuring and Validating Telemetry on a User-defined VRF	137
Use Case 3: Configuring and Validating Telemetry on Default VRF	139
Use Case 4: Configuring and Validating Telemetry with Multiple Key Sensor Paths in Management VRF	141

Telemetry Subscription Invoked via gnmic Command and YAML Input	144
Invoke Publish RPC on OcNOS Target	144
Implementation Examples	146
ISP Backbone Network Monitoring	146
Scenario	146
Implementation	146
Dial-Out Commands	146
Revised CLI Commands	146
show techsupport	146
Glossary	147
Streaming Telemetry Over Transport Layer Security	148
Overview	148
Feature Characteristics	148
Benefits	148
User Authentication and Certificate Loading for gNMI TLS Connections	148
Loading X.509 Certificates on OcNOS	149
gNMI TLS Authentication Command	149
Configuration	149
Step 1: Load Server and CA Certificates	149
Step 2: Enable Streaming Telemetry and Configure TLS Port	150
Step 3: Verify Telemetry Configuration	150
Step 4: Establish Secure gNMI Connection from Client	150
Step 5: Observe Streaming Output	151
Certificate Management for OcNOS and gNMI	152
Generate CA certificates	152
Generate Server Certificates	152
Generate Client Certificates	153
Rename and Copy Certificates	153
Insecure TLS Configuration	154
gNMI Client	154
Syntax: Secure TLS	154
Syntax: Insecure TLS	154
TLS Configuration	154
Prerequisites	155
Topology	155
Enable TLS Connection	155
Validation	156
Streaming Telemetry Running Configuration	156
gnmic Response	156
Implementation Examples	166
Secure Network Monitoring in a Data Center	166
Troubleshooting TLS Issues in OcNOS	166
TLS Commands	167
TLS Glossary	167
Streaming Telemetry CPU Monitoring	169
Overview	169

Feature Characteristics	169
Benefits	170
CPU Monitoring Configuration	170
Prerequisites	170
Topology	172
Enable CPU Monitoring and Set Suppression Threshold	173
gNMI Client Behavior When CPU Monitoring is Active	173
Validation	173
Enabled (Normal) State	173
Enabled (Paused) State	176
Client Response for Dial-Out	179
Client Response for Dial-In	182
Running Configuration	183
Implementation Example	184
Dynamic Resource Management in Service Provider Data Center	184
Scenario	184
Implementation	185
Benefits	185
CPU Monitoring Commands	185
Revised Commands	185
show streaming-telemetry	185
CPU Monitoring Glossary	186
Streaming Telemetry IPI Data Models	187
Overview	187
Telemetry IPI Pyang Tree	187
Container Level Sensor Paths and Leaf Attributes	187
IPI-Platform	188
CPU	199
Storage	199
RAM	199
Power-Supply	200
Fan	200
Fan-Tray	200
Transceiver State	200
Transceiver SFP State	201
Transceiver XFP State	201
Transceiver QSFP State	201
Transceiver Channels	202
Platform State	202
IPI-INTERFACE	207
Interface State	207
Interface Counters	208
Extended Ethernet Counters	208
Interface Ethernet State	208
IPI-VXLAN	209
VXLAN State	209

IPI-Platform-CMIS	210
Transceiver EEPROM State	216
CMIS State	217
Transceiver Advertisement Control	217
Transceiver Advertisement Diagnostics Module	218
Transceiver Advertisement Diagnostics Host	218
Transceiver Advertisement Diagnostics Media	218
Transceiver Advertisement Duration	219
Transceiver Advertisement Laser	219
Transceiver Advertisement Laser Grid	219
Transceiver Advertisement Monitoring	220
Transceiver Advertisement Host Monitoring	220
Transceiver Advertisement Host Flags Monitoring	220
Transceiver Advertisement Media Monitoring	220
Transceiver Advertisement Media Flags Monitoring	221
Transceiver Advertisement Pages	221
Transceiver Advertisement Host Application	221
Transceiver Advertisement Media Application	222
Transceiver CMIS Module State	222
Transceiver CMIS Module Monitor States	222
Transceiver CMIS Module Monitor Alarms	223
Transceiver CMIS Host Monitor States	223
Transceiver CMIS Host Monitoring for Monitors	223
Transceiver CMIS Host Monitoring for Flags	223
Transceiver CMIS Host Monitoring for Alarms	224
Transceiver CMIS Host Monitoring for Alarm Flags	224
Transceiver CMIS Media Monitoring for State	224
Transceiver CMIS Media Monitoring for Flags	224
Transceiver CMIS Media Monitoring for Alarms	225
Transceiver CMIS Media Monitoring for Alarm Flags	225
IPI-RIB-VRF	226
FIB IPv4 Routes	226
FIB IPv6 Routes	227
RIB IPv4 VRF Routes	227
RIB IPv6 VRF Routes	227
IPI-RIB	228
Pyang Tree: ipi-vrf	228
RIB Global Counters	228
VRF Global Counters	228
VRF State	228
IPI-IS-IS	229
IS-IS State	230
IS-IS Counters	230
IS-IS LSP State	230
IS-IS LSP Counters	230
IS-IS Interface State	231
IS-IS Interface Adjacency State	231

IS-IS Network Entity State	231
IS-IS Interface Neighbor State	231
IPI-BGP	232
BGP State	236
BGP Counters	236
BGP Address Family State	236
BGP Address Family Counters	237
BGP Address Family VRF State	237
BGP Address Family VRF Counters	238
IPI-BFD	239
BFD State	241
BFD State Counters	241
BFD Interface	241
BFD Sessions	241
BFD Session State	241
BFD Session State Counters	242
BFD Session State Counter IPv4 Packets	242
BFD Session State Counter IPv6 Packets	243
Micro-BFD Sessions State	243
BFD Session Echo State	243
BFD Session MPLS State	244
BFD Session VCCV State	244
BFD Session Packet State	244
IPI-LLDPv2	246
LLDP State	247
LLDP Counters	247
LLDP Interface State	247
LLDP Interface State VLAN	248
LLDP Interface State Management	248
IPI-QoS	249
Pyang Tree: ipi-qos	251
QoS Global State Counters	251
QoS Interface State Counters	251
QoS Interface Ingress Class-Map State	251
QoS Interface Ingress Class-Map State Counters	252
QoS Interface Egress Class-Map (Level 1) State Counters	252
QoS Interface Egress Class-Map (Level 1-2) State Counters	253
QoS Interface Egress Class-Map (Level 1-3) State Counters	253
IPI-MPLS	255
MPLS Label-Switching State	255
MPLS Global State Counters	255
IPI-L2VPN-VPLS	256
L2VPN VPLS Global State Counters	256
IPI-L2VPN-VPWS	257
L2VPN VPWS Global State Counters	257
IPI-LDP	258
LDP Peers State	258

IPI-EVPN-MPLS	259
EVPN MPLS Tenant State	259
EVPN MPLS Global State	259
IPI-VRRP	260
VRRP Interface State	260
VRRP Session Information State	260
VRRP Session Status State	261
VRRP Timers State	261
VRRP Addresses State	261
IPI-IP SLA	262
IP SLA Statistics	262
IPI-LAG	263
LAG Interface State	263
LAG Interface Member State	263
IPI-VLAN	263
VLAN Global Counters	264
IPI-ACL	264
ACL ARP State	268
ACL CoPP IPv4 State	269
ACL CoPP IPv6 State	270
ACL IPv4 State Counters	270
ACL IPv6 State Counters	271
ACL MAC State	272
ACL Summary Information	273
ACL Global State Counters	273
On-change Supported Sensor Paths	274
IPI-VRRP	274
IPI-IS-IS	274
IPI-BGP	275
IPI-Interface	275
IPI-Platform	275
Streaming Telemetry OpenConfig Data Models	279
Overview	279
Telemetry OpenConfig Pyang Tree	279
Container Level Sensor Paths and Leaf Attributes	279
OpenConfig-Platform	280
CPU	281
RAM	281
Power-Supply	281
Fan	282
Platform State	282
CMIS State	282
CMIS Temperature	283
CMIS Transceiver State	283
CMIS Optical Channel State	283
OpenConfig-Interface	284

Interface State	284
Counters State	284

PREFACE

About this Guide

This guide describes how to configure Streaming Telemetry in OcNOS.

Audience

This guide is intended for network administrators and other engineering professionals who configure OcNOS.

Conventions

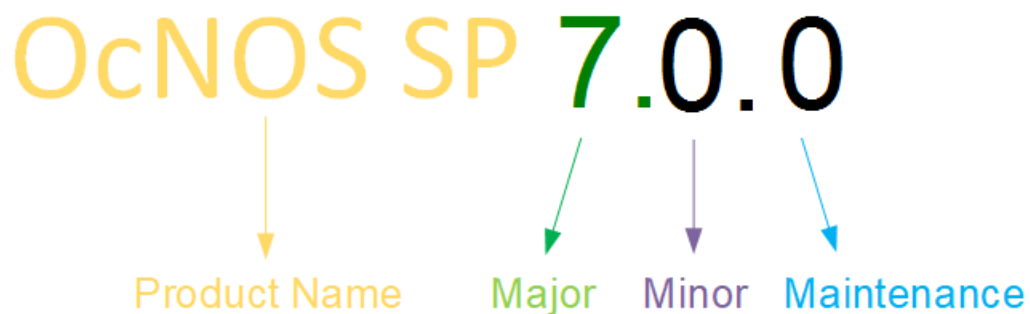
The [Table 1](#) table shows the conventions used in this guide.

Table 1. Conventions

Convention	Description
Italics	Emphasized terms; titles of books
 Note:	Special instructions, suggestions, or warnings
<code>monospaced type</code>	Code elements such as commands, parameters, files, and directories

IP Infusion Product Release Version

Each integer in release numbers indicates Major, Minor, and Maintenance release versions. Build numbers that follow the release numbers are for internal tracking and verification of the software build process and are visible to customers as part of the software version number.



Product Name: IP Infusion Product Family

Major Version: New customer-facing functionality that represents a significant change to the code base; including a significant marketing change or direction in the product.

Minor Version: Enhancements or extensions to existing features, changes to address external needs, or internal improvements to satisfy new sales regions or marketing initiatives.

Maintenance Version: A collection of product bugs or issues usually scheduled every 30 or 60 days, based on the number of issues.

Related Documentation

For information about installing OcNOS, see the *Installation Guide* for your platform.

Feature Availability

Each OcNOS SKU contains a set of supported features. For a list of available features based on the SKU that you purchased, refer to the [Feature Matrix](#).

Migration Guide

Check the *Migration Guide* for necessary configuration changes before migrating from one version of OcNOS to another.

IP Maestro Support

Monitor devices running OcNOS Release 6.3.4-70 and above using IP Maestro software.

Technical Support

IP Infusion maintains an online technical support site that provides a variety of technical support programs for licensed OcNOS customers at the [Technical Assistance Center](#).

Customers and partners enjoy full access to the support website. The site allows customers and partners to open technical support calls, update open calls with new information, and review the status of open or closed calls. The password-protected site includes technical documentation, Release Notes, and descriptions of service offerings.

Technical Sales

Contact the IP Infusion sales representative for more information about the OcNOS solution.

Technical Documentation

For core commands and configuration procedures, visit: [Product Documentation](#).

For training videos, visit: [OcNOS Free Training Videos](#).

For a list of supported platforms and SKUs of OcNOS features, refer to the [OcNOS Feature Matrix](#).

Documentation Disclaimer

The global documentation site is evolving to provide an enhanced website user experience for select topics included in this release. Some guides are now available outside the existing documentation library and can be accessed directly from custom documentation landing pages. These guides offer robust in-built search functionality.

For the latest documentation, visit the product-specific documentation landing page and select the relevant guide.

Comments

If you have comments, or need to report a problem with the content, contact techpubs@ipinfusion.com.

Command Line Interface

This chapter introduces the OcNOS Command Line Interface (CLI) and how to use its features.

Overview

You use the CLI to configure, monitor, and maintain OcNOS devices. The CLI is text-based and each command is usually associated with a specific task.

You can give the commands described in this manual locally from the console of a device running OcNOS or remotely from a terminal emulator such as `putty` or `xterm`. You can also use the commands in scripts to automate configuration tasks.

Chapter Organization

The chapters in command references are organized as described in [Command Description Format \(page 23\)](#).

The chapters in configuration guides are organized into these major sections:

- An overview that explains a configuration in words
 - Topology with a diagram that shows the devices and connections used in the configuration
 - Configuration steps in a table for each device where the left-hand side shows the commands you enter and the right-hand side explains the actions that the commands perform
 - Validation which shows commands and their output that verify the configuration
-

Command Line Interface Help

You access the CLI help by entering a full or partial command string and a question mark “?”. The CLI displays the command keywords or parameters along with a short description. For example, at the CLI command prompt, type:

```
> show ?
```

The CLI displays this keyword list with short descriptions for each keyword:

```
show ?
  application-priority  Application Priority
  arp                  Internet Protocol (IP)
  bfd                  Bidirectional Forwarding Detection (BFD)
  bgp                  Border Gateway Protocol (BGP)
  bi-lsp               Bi-directional lsp status and configuration
  bridge               Bridge group commands
  ce-vlan              COS Preservation for Customer Edge VLAN
  class-map            Class map entry
  cli                  Show CLI tree of current mode
  clns                 Connectionless-Mode Network Service (CLNS)
  control-adjacency    Control Adjacency status and configuration
  control-channel       Control Channel status and configuration
  cspf                 CSPF Information
  customer             Display Customer spanning-tree
  cvlan                Display CVLAN information
  debugging            Debugging functions
  etherchannel         LACP etherchannel
```

```
ethernet          Layer-2
...
```

If you type the ? in the middle of a keyword, the CLI displays help for that keyword only.

```
> show de?
debugging  Debugging functions
```

If you type the ? in the middle of a keyword, but the incomplete keyword matches several other keywords, OcNOS displays help for all matching keywords.

```
> show i? (CLI does not display the question mark).
interface  Interface status and configuration
ip         IP information
isis      ISIS information
```

Command Completion

The CLI can complete the spelling of a command or a parameter. Begin typing the command or parameter and then press the tab key. For example, at the CLI command prompt type **sh**:

```
> sh
```

Press the tab key. The CLI displays:

```
> show
```

If the spelling of a command or parameter is ambiguous, the CLI displays the choices that match the abbreviation. Type **show i** and press the tab key. The CLI displays:

```
> show i
interface ip      ipv6      isis
> show i
```

The CLI displays the **interface** and **ip** keywords. Type **n** to select **interface** and press the tab key. The CLI displays:

```
> show in
> show interface
```

Type **?** and the CLI displays the list of parameters for the **show interface** command.

```
> show interface
IFNAME  Interface name
|       Output modifiers
>       Output redirection
<cr>
```

The CLI displays the only parameter associated with this command, the **IFNAME** parameter.

Command Abbreviations

The CLI accepts abbreviations that uniquely identify a keyword in commands. For example:

```
> sh int xe0
```

is an abbreviation for:

```
> show interface xe0
```

Command Line Errors

Any unknown spelling causes the CLI to display the error **Unrecognized command** in response to the ?. The CLI displays the command again as last entered.

```
> show dd?
% Unrecognized command
> show dd
```

When you press the Enter key after typing an invalid command, the CLI displays:

```
(config)#router ospf here
                        ^
% Invalid input detected at '^' marker.
```

where the ^ points to the first character in error in the command.

If a command is incomplete, the CLI displays the following message:

```
> show
% Incomplete command.
```

Some commands are too long for the display line and can wrap mid-parameter or mid-keyword, as shown below. This does *not* cause an error and the command performs as expected:

```
area 10.10.0.18 virtual-link 10.10.0.19 authentication-key 57393
```

Command Negation

Many commands have a **no** form that resets a feature to its default value or disables the feature. For example:

- The **ip address** command assigns an IPv4 address to an interface
- The **no ip address** command removes an IPv4 address from an interface

Syntax Conventions

[Table 2](#) describes the conventions used to represent command syntax in this reference.

Table 2. Syntax conventions

Convention	Description	Example
monospaced font	Command strings entered on a command line	show ip ospf
lowercase	Keywords that you enter exactly as shown in the command syntax.	show ip ospf
UPPERCASE	See Variable Placeholders (page 22)	IFNAME
()	Optional parameters, from which you must select one. Vertical bars delimit the selections. Do not enter the parentheses or vertical bars as part of the command.	(A.B.C.D <0-4294967295>)
()	Optional parameters, from which you select one or none. Vertical bars delimit the	(A.B.C.D <0-4294967295>)

Table 2. Syntax conventions (continued)

Convention	Description	Example
	selections. Do not enter the parentheses or vertical bars as part of the command.	
()	Optional parameter which you can specify or omit. Do not enter the parentheses or vertical bar as part of the command.	(IFNAME)
{ }	Optional parameters, from which you must select one or more. Vertical bars delimit the selections. Do not enter the braces or vertical bars as part of the command.	{intra-area <1-255> inter-area <1-255> external <1-255>}
[]	Optional parameters, from which you select zero or more. Vertical bars delimit the selections. Do not enter the brackets or vertical bars as part of the command.	[<1-65535> AA:NN internet local-AS no-advertise no-export]
?	Nonrepeatable parameter. The parameter that follows a question mark can only appear once in a command string. Do not enter the question mark as part of the command.	?route-map WORD
.	Repeatable parameter. The parameter that follows a period can be repeated more than once. Do not enter the period as part of the command.	set as-path prepend .<1-65535>

Variable Placeholders

[Table 3](#) shows the tokens used in command syntax use to represent variables for which you supply a value.

Table 3. Variable placeholders

Token	Description
WORD	A contiguous text string (excluding spaces)
LINE	A text string, including spaces; no other parameters can follow this parameter
IFNAME	Interface name whose format varies depending on the platform; examples are: eth0 , Ethernet0 , ethernet0 , xe0
A.B.C.D	IPv4 address
A.B.C.D/M	IPv4 address and mask/prefix
X:X::X:X	IPv6 address
X:X::X:X/M	IPv6 address and mask/prefix
HH:MM:SS	Time format
AA:NN	BGP community value

Table 3. Variable placeholders (continued)

Token	Description
XX:XX:XX:XX:XX:XX	MAC address
<1-5> <1-65535> <0-2147483647> <0-4294967295>	Numeric range

Command Description Format

The [Table 4](#) table explains the sections used to describe each command in this reference.

Table 4. Command descriptions

Section	Description
Command Name	The name of the command, followed by what the command does and when should it be used
Command Syntax	The syntax of the command
Parameters	Parameters and options for the command
Default	The state before the command is executed
Command Mode	The mode in which the command runs; see Command Modes (page 27)
Applicability	The command introduced in a specific release version and modified or updated in subsequent versions.
Example	An example of the command being executed

Keyboard Operations

The [Table 5](#) table lists the operations you can perform from the keyboard.

Table 5. Keyboard operations

Key combination	Operation
Left arrow or Ctrl+b	Moves one character to the left. When a command extends beyond a single line, you can press left arrow or Ctrl+b repeatedly to scroll toward the beginning of the line, or you can press Ctrl+a to go directly to the beginning of the line.
Right arrow or Ctrl-f	Moves one character to the right. When a command extends beyond a single line, you can press right arrow or Ctrl+f repeatedly to scroll toward the end of the line, or you can press Ctrl+e to go directly to the end of the line.
Esc, b	Moves back one word
Esc, f	Moves forward one word
Ctrl+e	Moves to end of the line

Table 5. Keyboard operations (continued)

Key combination	Operation
Ctrl+a	Moves to the beginning of the line
Ctrl+u	Deletes the line
Ctrl+w	Deletes from the cursor to the previous whitespace
Alt+d	Deletes the current word
Ctrl+k	Deletes from the cursor to the end of line
Ctrl+y	Pastes text previously deleted with Ctrl+k, Alt+d, Ctrl+w, or Ctrl+u at the cursor
Ctrl+t	Transposes the current character with the previous character
Ctrl+c	Ignores the current line and redisplay the command prompt
Ctrl+z	Ends configuration mode and returns to exec mode
Ctrl+l	Clears the screen
Up Arrow or Ctrl+p	Scroll backward through command history
Down Arrow or Ctrl+n	Scroll forward through command history

Show Command Modifiers



Note: The show command output included in the guides is for illustration purposes only. Based on the combination of features enabled and ongoing enhancements made to the commands, the output for these commands may vary. For instance, the actual command output may differ depending on the software version, configuration, and platform. Field names, values, and formats are subject to change.

You can use two tokens to modify the output of a **show** command. Enter a question mark to display these tokens:

```
# show users ?
| Output modifiers
> Output redirection
```

You can type the | (vertical bar character) to use output modifiers. For example:

```
> show rsvp | ?
begin      Begin with the line that matches
exclude    Exclude lines that match
include    Include lines that match
last       Last few lines
redirect   Redirect output
```

Begin Modifier

The **begin** modifier displays the output beginning with the first line that contains the input string (everything typed after the **begin** keyword). For example:

```
# show running-config | begin xe1
...skipping
interface xe1
ipv6 address fe80::204:75ff:fee6:5393/64
!
interface xe2
```

```

ipv6 address fe80::20d:56ff:fe96:725a/64
!
line con 0
login
!
end

```

You can specify a regular expression after the **begin** keyword. This example begins the output at a line with either “xe2” or “xe4”:

```

# show running-config | begin xe[2-4]

...skipping
interface xe2
 shutdown
!
interface xe4
 shutdown
!
interface svlan0.1
 no shutdown
!
route-map myroute permit 2
!
route-map mymap1 permit 10
!
route-map rmap1 permit 2
!
line con 0
 login
line vty 0 4
 login
!
end

```

Include Modifier

The **include** modifier includes only those lines of output that contain the input string. In the output below, all lines containing the word “input” are included:

```

# show interface xe1 | include input
  input packets 80434552, bytes 2147483647, dropped 0, multicast packets 0
  input errors 0, length 0, overrun 0, CRC 0, frame 0, fifo 1, missed 0

```

You can specify a regular expression after the **include** keyword. This examples includes all lines with “input” or “output”:

```

#show interface xe0 | include (in|out)put
  input packets 597058, bytes 338081476, dropped 0, multicast packets 0
  input errors 0, length 0, overrun 0, CRC 0, frame 0, fifo 0, missed 0
  output packets 613147, bytes 126055987, dropped 0
  output errors 0, aborted 0, carrier 0, fifo 0, heartbeat 0, window 0

```

Exclude Modifier

The **exclude** modifier excludes all lines of output that contain the input string. In the following output example, all lines containing the word “input” are excluded:

```

# show interface xe1 | exclude input
Interface xe1
 Scope: both
 Hardware is Ethernet, address is 0004.75e6.5393
 index 3 metric 1 mtu 1500 <UP,BROADCAST,RUNNING,MULTICAST>

```

```
VRF Binding: Not bound
Administrative Group(s): None
DSTE Bandwidth Constraint Mode is MAM
inet6 fe80::204:75ff:fee6:5393/64
  output packets 4438, bytes 394940, dropped 0
  output errors 0, aborted 0, carrier 0, fifo 0, heartbeat 0, window 0
  collisions 0
```

You can specify a regular expression after the **exclude** keyword. This example excludes lines with “output” or “input”:

```
show interface xe0 | exclude (in|out)put
Interface xe0
  Scope: both
  Hardware is Ethernet   Current HW addr: 001b.2139.6c4a
  Physical:001b.2139.6c4a Logical:(not set)
  index 2 metric 1 mtu 1500 duplex-full arp ageing timeout 3000
  <UP,BROADCAST,RUNNING,MULTICAST>
  VRF Binding: Not bound
  Bandwidth 100m
  DHCP client is disabled.
  inet 10.1.2.173/24 broadcast 10.1.2.255
  VRRP Master of :   VRRP is not configured on this interface.
  inet6 fe80::21b:21ff:fe39:6c4a/64
  collisions 0
```

Redirect Modifier

The **redirect** modifier writes the output into a file. The output is not displayed.

```
# show cli history | redirect /var/frame.txt
```

The output redirection token (>) does the same thing:

```
# show cli history >/var/frame.txt
```

Last Modifier

The **last** modifier displays the output of last few number of lines (As per the user input). The last number ranges from 1 to 9999.

For example:

```
#show running-config | last 10
```

String Parameters

The restrictions in [Table 6](#) apply for all string parameters used in OcNOS commands, unless some other restrictions are noted for a particular command.

Table 6. String parameter restrictions

Restriction	Description
Input length	1965 characters or less
Restricted special characters	“?”, “,”, “>”, “ ”, and “=” The “ ” character is allowed only for the description command in interface mode.

Command Modes

Commands are grouped into modes arranged in a hierarchy. Each mode has its own set of commands. The table below lists the command modes common to all protocols.

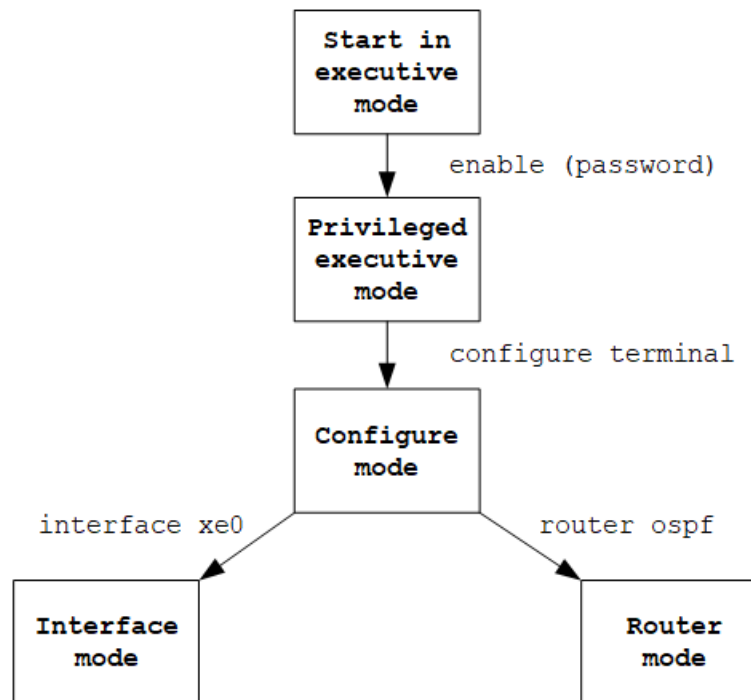
Table 7. Common Command Modes

Name	Description
Execution mode	Also called <i>view</i> mode, this is the first mode to appear after you start the CLI. It is a base mode from where you can perform basic commands such as show, exit, quit, help, and enable.
Privileged execution mode	Also called <i>enable</i> mode, in this mode you can run additional basic commands such as debug, write, and show.
Configure mode	Also called <i>configure terminal</i> mode, in this mode you can run configuration commands and go into other modes such as interface, router, route map, key chain, and address family. Configure mode is single user. Only one user at a time can be in configure mode.
Interface mode	In this mode you can configure protocol-specific settings for a particular interface. Any setting you configure in this mode overrides a setting configured in router mode.
Router mode	This mode is used to configure router-specific settings for a protocol such as BGP or OSPF.

Command Mode Tree

The diagram below shows the common command mode hierarchy.

Figure 1. Common command modes



To change modes:

1. Enter privileged executive mode by entering **enable** in Executive mode.
2. Enter configure mode by entering **configure terminal** in Privileged Executive mode.

The example below shows moving from executive mode to privileged executive mode to configure mode and finally to router mode:

```
> enable mypassword
# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
(config)# router ospf
(config-router)#
```



Note: Each protocol can have modes in addition to the common command modes. See the command reference for the respective protocol for details.

Transaction-based Command-line Interface

The OcNOS command line interface is transaction based:

- Any changes done in configure mode are stored in a separate *candidate* configuration that you can view with the `show transaction current` command.
- When a configuration is complete, apply the candidate configuration to the running configuration with the `commit` command.

- If a `commit` fails, no configuration is applied as the entire transaction is considered failed. You can continue to change the candidate configuration and then retry the `commit`.
- Discard the candidate configuration with the `abort transaction` command.
- Check the last aborted transaction with the `show transaction last-aborted` command.
- Multiple configurations cannot be removed with a single `.` You must remove each configuration followed by a `commit`.



Note: All commands MUST be executed only in the default CML shell (`cm1sh`). If you log in as root and start `imish`, then the system configurations will go out of sync. The `imish` shell is not supported and should not be started manually.

STREAMING TELEMETRY

Overview

Streaming telemetry allows users to monitor network health by efficiently streaming operational data of interest from OcNOS devices. This structured data is transmitted to remote management systems for proactive network monitoring and understanding CPU and memory usage in managed devices for troubleshooting.

Users can create a database with telemetry data to establish a baseline for normal network operation and predict or mitigate network issues.

In OcNOS various gRPC Network Management Interface (gNMI) Subscription Modes, Telemetry Modes, and Encoding Types are supported, providing efficient network management capabilities.



Note: Streaming telemetry supports connections that come through an IPv6 interface in Dial-in mode but not supported in dial-out mode.

Feature Characteristics

In OcNOS various gRPC Network Management Interface (gNMI) Subscription Modes, Telemetry Modes, and Encoding Types are supported, providing efficient network management capabilities.

gNMI Subscription Modes

Streaming Telemetry Dial-In Mode

In [Streaming Telemetry Dial-In Mode \(page 99\)](#), the collector initiates a connection to the target device (OcNOS) and subscribes to receive telemetry data from OcNOS devices.

Streaming Telemetry Dial-Out Mode (Persistent Subscriptions)

In [Streaming Telemetry Dial-Out Mode \(page 133\)](#), the target (OcNOS) initiates the gRPC tunnel connection to the collector. Once the connection is established, the collector invokes the "Publish" RPC on the target. Subscriptions configured on the target are then streamed on that connection at the specified sample interval. These subscriptions remain active on OcNOS devices as long as the corresponding configuration on the target exists. If the gRPC tunnel connection is interrupted or the target reboots, the gNMI server on the target re-establishes the connection to the gNMI collector, ensuring continued streaming.

gNMI In-Band Support

OcNOS supports streaming telemetry data transmission across multiple VRF instances, enabling users to manage data for up to four VRFs simultaneously. If users do not define a VRF, the system automatically allows streaming telemetry in the default VRF.

This improves efficiency and monitoring capabilities within the network.

Streaming Telemetry Modes

Stream Mode

Enables continuous and real-time transmission of telemetry data from OcNOS devices to the monitoring system. OcNOS supports **sample** and **on-change** streaming modes under the gNMI Stream subscription type, which define how updates are delivered to the collector.

Both streaming modes deliver data continuously once the subscription is active, enabling real-time operational visibility and efficient data collection from OcNOS systems.

Sample Streaming Mode

[Sample Stream Mode \(page 101\)](#) sends telemetry updates at regular, configured intervals, regardless of whether the monitored data values have changed. This mode is suitable for continuous performance monitoring where periodic sampling is required.



Notes:

- The SAMPLE stream mode applies to both Dial-in and Dial-out gNMI subscription types.
- Sample Streaming mode does not support leaf-level paths and supports only container-level paths.

On-Change Streaming Mode

[On-Change Stream Mode \(page 103\)](#) sends telemetry updates only when the value of the subscribed data item changes. This event-driven approach reduces network and system load and provides real-time visibility into state changes.



Notes:

- The on-change stream mode is supported only for Dial-in subscription mode. The on-change stream mode is not supported for dial-out subscription mode.
- The on-change streaming mode does not support OpenConfig sensor paths.

Poll Mode

Poll mode subscriptions allow for on-demand data retrieval through a long-lived RPC. Subscribers initiate this mode by sending a Subscribe request message, followed by sending an empty Poll message to receive the desired data.



Note: The system supports **Poll mode** only in Dial-in subscription mode.

Once Mode

In Once mode subscription, the OcNOS device responds to a subscribe request with a one-time data retrieval, similar to a get request. Upon receiving the Once mode subscribe request, the device sends back the subscribe response for all subscriptions in the list and terminates the RPC.



Note: The system supports **Once mode** only in Dial-in subscription mode.

Encoding Types



Note: OcNOS supports the protobuf, JSON, and JSON-IETF encoding types for both the dial-in and dial-out gNMI subscription modes.

Protocol Buffers (protobuf)

Offers a compact binary serialization format for efficient encoding and transmission of structured telemetry data. Protobuf is optimized for performance and bandwidth efficiency.

JavaScript Object Notation

Provides a human-readable data interchange format commonly used for telemetry data representation. JavaScript Object Notation (JSON) encoding facilitates interoperability and ease of integration with various applications and tools. It adheres to the JSON specification outlined in RFC7159, employing relevant quoting. Consequently, string values are quoted while number values remain unquoted.

JSON-IETF

This variant of JSON encoding adheres to the IETF standards, ensuring consistency and compatibility with industry specifications. `JSON_IETF` encoded data conforms the rules outlined in RFC7951 for JSON serialization.

Encoding Limitations (Protobuf)

- Union (oneof) types are not supported in the Protobuf encoding.
- Map types with complex (user-defined) keys are not supported in the Protobuf encoding.

These limitations mean that if the user's YANG model (or data schema) uses `oneof` or `maps` keyed by complex types (e.g., composite objects), telemetry data under Protobuf encoding will not properly represent those constructs. Use JSON or JSON-IETF encoding as an alternative for the paths mentioned above where Protobuf encoding is not supported.

gnmic Installation

gNMI Specification can be found at: <https://github.com/openconfig/reference/blob/master/rpc/gnmi/gnmi-specification.md>.

gNMI Collector Tool

- For dial-in subscription mode, except when using "proto" encoding, use the open-source gNMI collector tool (gnmic). Install the open-source gNMI collector tool (gnmic) with the command:

```
bash -c "$(curl -sL https://get-gnmic.openconfig.net)"
```

- For dial-out subscription mode or when "proto" encoding is needed, use the gnmic tool from the gNMI collector package. It is delivered with the OcNOS installer, named `OcNOS-<SKU NAME>-<version>-telemetry-client-bin.tar`, and includes the gNMI Client collector application (gnmic) and the `IPI_OC.proto` files.

Support for IPI Native Data Models and OpenConfig Data Models

Streaming Telemetry Data Models: OcNOS supports [IPI native data models](#) and [OpenConfig data models](#), providing standardized representations of network configurations and telemetry data. This support enhances interoperability and facilitates consistent management across heterogeneous network environments.

Wildcard Support in Sensor Paths

OcNOS supports wildcard characters in sensor paths (XPath) to simplify subscription requests and minimize the number of XPath needed to monitor multiple instances. The following wildcard types are supported:

Explicit Wildcard for Key Names

Allows selecting all instances of a keyed list.

Example

The XPath below explicitly uses asterisk (*) for the name key in the interface list, which means it retrieves counters for all interfaces regardless of their names. This is useful when user do not need to specify individual interface names and want to subscribe to all available interfaces.

```
ipi:/interfaces/interface[name=*/state/counters
```

Implicit Wildcard (Omission of Key Name)

Automatically selects all instances when a key is not explicitly mentioned.

Example

Here, the name key is completely omitted, which implies that the query applies to all interfaces. This method functions similarly to using an explicit wildcard (*), but it assumes that the key name is optional, applying to all list instances automatically.

```
ipi:/interfaces/interface/state/counters
```

Partial Wildcard for Key Name

Matches instances with a key name that starts with a given prefix.

Example

The wildcard * is applied at the end of the key name, meaning this XPath matches all interfaces whose names start with xe. For instance, it will match xe0, xe1, xe100, etc. However, it will not match eth0, ge1, etc. This is useful for filtering a subset of interfaces with a common prefix, reducing the number of specific XPath required.

```
ipi:/interfaces/interface[name=xe*/state
```

Partial Wildcard for Multiple Keys

Partial wildcard applies to the first key when multiple keys exist.

Valid Example

This example allows retrieving information from all CMIS components while still applying filters for specific lanes and flags.

```
ipi:/components/component[name=CMIS*]/transceiver/cmisis-module/media-monitors/lanes/lane
[number=2]/flags/flag[id=*]/state
```

- **component[name=CMIS*]** : Matches all components where the name starts with "CMIS" (e.g., CMIS-1, CMIS-module-10, etc).
- **lane[number=2]** : Applies only to lane number 2.
- **flag[id=*]** : Retrieves all flags within lane number 2.

Invalid Example

The wildcard is at the beginning of the key (*CMIS), which is not supported. Only suffix-based (CMIS*) wildcarding is allowed.

```
ipi:/components/component[name=*CMIS]/transceiver/cmisis-module/media-monitors/lanes/lane
[number=2]/flags/flag[id=*]/state
```

Use case 1: Wildcard Support in Dial-In Mode

In this example, the explicit wildcard `name=*` in `ipi:/components/component[name=*/state/memory` XPath allows real-time monitoring of memory usage for all components without needing to specify individual component names. The `gnmic` command subscribes to this data stream to retrieve available and utilized memory for components like **HARD-DISK** and **RAM** from the target at `10.12.162.22:9339`. With a `90-seconds` sampling interval, the system collects data efficiently while minimizing the complexity of manual configuration. This approach simplifies network monitoring by dynamically including all relevant components, making it easier to track system performance in real time.

```
OcNOS# ./gnmic -a 10.12.162.22:9339 -u admin -p admin --insecure --mode STREAM --stream-mode sample -
-sample-interval 90s sub --path '/components/component[name=*/state/memory' --encoding json_ietf
{
  "source": "10.12.162.22:9339",
  "subscription-name": "default-1729755066",
  "timestamp": 1729774623040087176,
  "time": "2024-10-24T12:57:03.040087176Z",
  "updates": [
    {
      "Path": "components/component[name=\"HARD-DISK\"]/state/memory",
      "values": {
        "components/component/state/memory": {
          "available": 118183952384,
          "utilized": 5681184768
        }
      }
    }
  ]
}
{
  "source": "10.12.162.22:9339",
  "subscription-name": "default-1729755066",
  "timestamp": 1729774623040734590,
  "time": "2024-10-24T12:57:03.04073459Z",
  "updates": [
    {
      "Path": "components/component[name=\"RAM\"]/state/memory",
      "values": {
        "components/component/state/memory": {
```

```

        "available": 33637269504,
        "utilized": 1130364928
    }
}
]
}

```

Use case 2: Wildcard Support in Dial-Out Mode

This example uses a partial wildcard for key names in Dial-Out mode to subscribe to telemetry data for all components whose names start with `PORT`, eliminating the need to list them individually. The XPath `ipi:/components/component[name=PORT*]/state` ensures the system automatically monitors all port-related components, such as `PORT-SFP-5`, `PORT-SFP-7`, and `PORT-SFP-11`. The system sends telemetry data to the target at `10.12.66.160:11161` every 90 seconds, dynamically retrieving information on memory, board FRU, and temperature for matching components.

```

OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
!
sensor-group interface vrf management
  sensor-path ipi:/components/component[name=PORT*]/state
!
destination-group tunnel-1 vrf management
  tunnel-server ip 10.12.66.160 port 11161
!
subscription-name sub-1 vrf management
  destination-group tunnel-1
  sensor-group interface sample-interval 90
!
!

```

```

OcNOS#show streaming-telemetry

Number of telemetry instances : 1 (management)
Platform type                 : High range
Maximum sensor-paths          : 100
Minimum sample-interval       : 10
CPU monitoring                 : ENABLED (NORMAL)
CPU monitoring threshold       : 40
Number of active sensor-paths : 30 (Dial-In : 0, Dial-out : 30)

SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path   : Sensor Path

1. Subscription Details (VRF-Name: default):
~~~~~
Port         : 9339
TLS          : Disabled
insecure-tls : False

Dial-Out Subscription Details:
~~~~~
1. Subscription-name      : sub-1
   Status                 : ACTIVE
   Enc-Type               : JSON
   Tunnel-server details:
   ~~~~~
   Tunnel-server Retry-interval : Default-60 (seconds)

Destination-group      Status      Tunnel-IP:Port

```

```

-----
tunnel-1          ACTIVE          10.12.66.160:11161
Sensor-group details:
~~~~~
Sensor-group      SI              Origin:Path
-----
interface         90              ipi:/components/component[name=PORT*]/state
                                     [*]ipi:/components/component[name=PORT*]/state/memory
                                     [*]ipi:/components/component[name=PORT*]/state/board-fru
                                     [*]ipi:/components/component[name=PORT*]/state/temperature

```

[*]-> Indicates child path learnt from parent config, not configured by user

gnmic Output

The `gnmic` output confirms that telemetry updates include firmware, hardware version, location, operational status, and parent chassis details for each matching port component.

By using a partial wildcard, the system improves scalability by automatically incorporating new port components without modifying the sensor path configuration, reducing manual effort and ensuring real-time network monitoring.

```

#./gnmic --config abc.yaml --use-tunnel-server publish --insecure
{
  "source": "e8:c5:7a:8f:98:26",
  "subscription-name": "sub-1",
  "timestamp": 1725361959730514173,
  "time": "2024-09-03T11:12:39.730514173Z",
  "updates": [
    {
      "Path": "ipi:components/component[name=\"PORT-SFP-5\"]/state",
      "values": {
        "components/component/state": {
          "description": "NA",
          "empty": false,
          "firmware-version": "NA",
          "hardware-version": "NA",
          "location": "17",
          "mfg-name": "NA",
          "name": "PORT-SFP-17",
          "oper-status": "NA",
          "parent": "CHASSIS",
          "part-no": "NA",
          "product-name": "NA",
          "removable": false,
          "serial-no": "NA",
          "software-version": "NA",
          "type": "port"
        }
      }
    }
  ]
}
{
  "source": "e8:c5:7a:8f:98:26",
  "subscription-name": "sub-1",
  "timestamp": 1725361959731082952,
  "time": "2024-09-03T11:12:39.731082952Z",
  "updates": [
    {
      "Path": "ipi:components/component[name=\"PORT-SFP-7\"]/state",
      "values": {
        "components/component/state": {
          "description": "NA",
          "empty": false,
          "firmware-version": "NA",
          "hardware-version": "NA",

```

```

        "location": "5",
        "mfg-name": "NA",
        "name": "PORT-SFP-5",
        "oper-status": "NA",
        "parent": "CHASSIS",
        "part-no": "NA",
        "product-name": "NA",
        "removable": false,
        "serial-no": "NA",
        "software-version": "NA",
        "type": "port"
    }
}
]
}
{
    "source": "e8:c5:7a:8f:98:26",
    "subscription-name": "sub-1",
    "timestamp": 1725361959731795490,
    "time": "2024-09-03T11:12:39.73179549Z",
    "updates": [
        {
            "Path": "ipi:components/component[name=\"PORT-SFP-11\"]/state",
            "values": {
                "components/component/state": {
                    "description": "NA",
                    "empty": false,
                    "firmware-version": "NA",
                    "hardware-version": "NA",
                    "location": "7",
                    "mfg-name": "NA",
                    "name": "PORT-SFP-7",
                    "oper-status": "NA",
                    "parent": "CHASSIS",
                    "part-no": "NA",
                    "product-name": "NA",
                    "removable": false,
                    "serial-no": "NA",
                    "software-version": "NA",
                    "type": "port"
                }
            }
        }
    ]
}
{
    "source": "e8:c5:7a:8f:98:26",
    "subscription-name": "sub-1",
    "timestamp": 1725361959732153620,
    "time": "2024-09-03T11:12:39.73215362Z",
    "updates": [
        {
            "Path": "ipi:components/component[name=\"PORT-SFP-13\"]/state",
            "values": {
                "components/component/state": {
                    "description": "NA",
                    "empty": false,
                    "firmware-version": "NA",
                    "hardware-version": "NA",
                    "location": "11",
                    "mfg-name": "NA",
                    "name": "PORT-SFP-11",
                    "oper-status": "NA",
                    "parent": "CHASSIS",
                    "part-no": "NA",
                    "product-name": "NA",
                    "removable": false,

```

```

        "serial-no": "NA",
        "software-version": "NA",
        "type": "port"
    }
}
]
}
{
    "source": "e8:c5:7a:8f:98:26",
    "subscription-name": "sub-1",
    "timestamp": 1725361959731446131,
    "time": "2024-09-03T11:12:39.731446131Z",
    "updates": [
        {
            "Path": "ipi:components/component[name=\"PORT-SFP-9\"]/state",
            "values": {
                "components/component/state": {
                    "description": "NA",
                    "empty": false,
                    "firmware-version": "NA",
                    "hardware-version": "NA",
                    "location": "13",
                    "mfg-name": "NA",
                    "name": "PORT-SFP-13",
                    "oper-status": "NA",
                    "parent": "CHASSIS",
                    "part-no": "NA",
                    "product-name": "NA",
                    "removable": false,
                    "serial-no": "NA",
                    "software-version": "NA",
                    "type": "port"
                }
            }
        }
    ]
}
{
    "source": "e8:c5:7a:8f:98:26",
    "subscription-name": "sub-1",
    "timestamp": 1725361959731621187,
    "time": "2024-09-03T11:12:39.731621187Z",
    "updates": [
        {
            "Path": "ipi:components/component[name=\"PORT-SFP-10\"]/state",
            "values": {
                "components/component/state": {
                    "description": "NA",
                    "empty": false,
                    "firmware-version": "NA",
                    "hardware-version": "NA",
                    "location": "14",
                    "mfg-name": "NA",
                    "name": "PORT-SFP-14",
                    "oper-status": "NA",
                    "parent": "CHASSIS",
                    "part-no": "NA",
                    "product-name": "NA",
                    "removable": false,
                    "serial-no": "NA",
                    "software-version": "NA",
                    "type": "port"
                }
            }
        }
    ]
}

```

XPath Formatting Rules for Streaming Telemetry

OcNOS Streaming Telemetry uses XPath expressions to subscribe to YANG-modeled data. Properly formatting XPath ensures accurate and consistent collection of telemetry data, regardless of whether users configure Dial-In, Dial-Out, or GET RPC modes.

XPath Formatting Rules for gnmic Subscriptions

OcNOS enforces specific formatting rules for XPath in gNMIc subscription commands.

1. **String Key Formatting:** Xpath with string keys must be enclosed in double quotes ("").

Example:

```
--path '/components/component[name="TEMPERATURE-MAC"]/state'
--path "/components/component[name=\"TEMPERATURE-MAC\"]/state"
```

2. **Integer Key Formatting:** Xpath with integer keys must be provided without double quotes.

Example:

```
--path "ipi:/bgp/bgp-instances/bgp-instance[bgp-as=100]/peers/peer[peer-address=\"1.1.1.1\"]/state"
--path 'ipi:/bgp/bgp-instances/bgp-instance[bgp-as=100]/peers/peer[peer-address="1.1.1.1"]/state'
```

3. **Implicit Wildcard Keys:** Xpath with implicit wildcard keys can be provided with or without single quotes.

Example:

```
--path '/components/component/state'
--path /components/component/state
```

4. **Key Order in Sensor Paths:** When using multiple keys in sensor paths, key-value pairs must be configured in the same order as defined by the [IPI data model sensor path](#) list. Incorrect ordering may cause subscription failures or unexpected behavior in telemetry data collection.



Note: This key ordering is applicable only for Dial-Out operations.

Example: Incorrect Order (Invalid Configuration)

In this example, "vrf-name" appears before "local-discriminator", which does not match the expected order.

```
ipi:/bfd/sessions/session[vrf-name="default"][local-discriminator="2050"]/state/counters/packets/ipv4
```

Example: Correct Order (Valid Configuration)

In this example, "vrf-name" appears after "local-discriminator", which matches the expected order.

```
ipi:/bfd/sessions/session[local-discriminator="2050"][vrf-name="default"]/state/counters/packets/ipv4
```

XPath Format Support by Telemetry Mode

Dial-In XPath Formats

XPath Examples	Command Line (CLI) Support	YAML Support	Comments
"ipi:/interfaces/interface [name=\"eth0\"]/state"	Yes	Yes	Valid path
'ipi:/interfaces/interface [name="eth0"]/state'	Yes	Yes	Valid path
ipi:/interfaces/interface [name=\"eth0\"]/state	Yes	No	Valid path for CLI and invalid path for YAML
ipi:/interfaces/interface [name="eth0"]/state	No	Yes	Invalid path for CLI and valid path for YAML
'ipi:/interfaces/interface [name=\"eth0\"]/state'	No	No	Invalid path

Dial-Out XPath Formats

XPath Examples	Command Line (CLI) Support	Comments
ipi:/interfaces/interface [name="eth0"]/state	Yes	Valid path
/interfaces/interface [name="eth0"]/state	Yes	Valid path (OpenConfig)
/interfaces/interface [name=eth0]/state	Yes	Valid path (OpenConfig)
"ipi:/interfaces/interface [name=\"eth0\"]/state"	No	Invalid path
'ipi:/interfaces/interface [name="eth0"]/state'	No	Invalid path
ipi:/interfaces/interface [name=\"eth0\"]/state	No	Invalid path

Get RPC XPath Formats

XPath Examples	Command Line (CLI) Support	YAML Support	Comments
ipi:/interfaces/interface [name=eth0]/state	Yes	Yes	Valid path
ipi:/interfaces/interface [name="eth0"]/state	Yes	Yes	Valid path
'ipi:/interfaces/interface [name="eth0"]/state'	Yes	Yes	Valid path
'ipi:/interfaces/interface [name=eth0]/state'	Yes	Yes	Valid path
"ipi:/interfaces/interface [name=\"eth0\"]/state"	Yes	Yes	Valid path
/interfaces/interface [name=eth0]/state	Yes	Yes	Valid path (OpenConfig)
/interfaces/interface [name="eth0"]/state	Yes	Yes	Valid path (OpenConfig)
'ipi:/interfaces/interface [name=\"eth0\"]/state'	No	No	Invalid path



Note: The Get RPC response for string key values is returned without double quotes (" "), regardless of how the key values were specified in the requested XPath. The response below returns without double quotes (" ") for the po1 interface in the Path field: "Path": "ipi:interfaces/interface [name=po1]".

```
./gnmic -a 10.12.162.22:9339 -u admin -p admin --insecure get --path 'ipi:/interfaces/interface
[name="po1"]' --encoding json_ietf --type config --timeout 120s
[
  {
    "source": "10.12.162.22:9339",
    "timestamp": 1730122009406462625,
    "time": "2024-10-28T13:26:49.406462625Z",
    "updates": [
      {
        "Path": "ipi:interfaces/interface[name=po1]",
        "values": {
          "interfaces/interface": {
            "interfaces": {
              "interface": [
                {
                  "config": {
                    "enable-switchport": "",
                    "mtu": "300",
                    "name": "po1"
                  },
                  "name": "po1"
                }
              ]
            }
          }
        }
      }
    ]
  }
]
```

Scale and Minimum Sample Interval Supported

To limit the impact of telemetry on critical features of the OcNOS target device, certain limits have been implemented for different platform types.

High End Platforms: A system is considered high range if it has eight or more CPU cores and is not based on an "Intel Atom" processor.

Standard Range Platforms: A system is considered standard range if it has fewer than eight CPU cores or is based on an "Intel Atom" processor.

**Notes:**

- If telemetry subscribe paths are not explicitly configured using the command [telemetry maximum-subscribe-paths \(page 84\)](#), the system sets them to 100 **sensor paths for high-end platforms** and 50 **sensor paths for standard platforms**.
- If telemetry minimum sample intervals are not explicitly configured using the command [telemetry minimum-sample-interval \(page 85\)](#), the system sets them to 10 **seconds for high-end platforms** and 90 **seconds for standard platforms**.
- The total count of sensor paths includes the child paths of a subscribe request. For instance, if a subscribe request has four child paths, the total sensor paths count equals five (the given path plus four child paths). Use the [show streaming-telemetry \(page 66\)](#) command to display the minimum sample interval and the maximum number of sensor paths configured.

Scale Scenarios

New Subscribe RPC Request Makes Total Paths To Not Exceed Max Allowed

When new paths are added to the existing paths already handled by the gNMI server, the total number does not exceed the [Default \(page 84\)](#) limit or the user-configured value. Consequently, the gNMI server accepts this subscribe request and proceeds with the processing.

New Subscribe RPC Request Makes Total Paths To Reach Allowed Max:

With the new Subscribe RPC Request, the total paths handled would be exactly equal to its [Default \(page 84\)](#) or the user-configured values. When the gNMI server accepts the new subscribe request, it processes it but logs a warning that the maximum number of paths has been reached. This warning indicates that it will not handle any new subscribe RPC stream mode requests until the number of currently handled paths drops below 100 or below the user-configured subscribe path values.

New Subscribe RPC Request Makes Total Paths To Exceed Allowed Max

With the new Subscribe RPC request, the gNMI server returns an error if the total paths exceed its [Default \(page 84\)](#) or the user-configured values. The RPC request is not closed but will be accepted and responded to when the total number of paths handled drops to a level that can accommodate this RPC request.

Minimum Sample Interval

Any sampling mode request with a sample interval of less than the minimum allowed will result in an error. However, if a sample interval is 0, it defaults to the minimum sample interval supported by the gNMI server for that platform type.

gNMI Server Cache Optimization

The gNMI server optimizes cache updates to reduce CPU usage and scale efficiently with higher sensor path counts.

Cache Update Mechanism

To optimize telemetry throughput and minimize latency, the gNMI server implements a high-performance caching layer. Upon receiving raw JSON data from the Redis database, the system deserializes the JSON payloads into native GoStructs. These structures are then indexed within a high-speed hash map, using the XPath string as the unique key.

Staggering Sensor-path Processing

To reduce CPU spikes caused by processing multiple sensor-paths back-to-back, the telemetry service introduces a few milliseconds delay between processing two sensor-paths. This staggering helps distribute processing load more evenly across the sampling interval.

Wildcard paths: Processing of translated paths will be staggered anywhere between 5 milliseconds and 30 milliseconds, depending on how many paths the wildcard sensor-path translates to. This reduces CPU spikes and prevents back-to-back data processing from these paths.

Key Benefits

- Reduces CPU consumption during telemetry streaming.
- Storing data in a hash map enables O(1) retrieval speeds, ensuring constant-time lookups.
- Supports large telemetry scale efficiently with smooth operation.
- Prevents gNMI stream disconnections caused by backend overload.
- Dynamically smooths CPU spikes using intelligent delay between sensor-paths.
- Ensures latest data is streamed with minimal processing overhead.

Streaming Telemetry Commands

This section lists the telemetry commands.

crypto pki load source-interface	45
crypto pki generate rsa common-name	46
debug cml	48
debug telemetry gnmi	49
destination-group	51
destination-group GRPC	52
encoding	54
feature streaming-telemetry	55
grpc-tunnel-server retry-interval	57
port	58
sensor-group	60
sensor-group sample-interval	61
sensor-path	63

show crypto csr	64
show streaming-telemetry	66
show streaming-telemetry dynamic-subscriptions	70
show streaming-telemetry persistent-subscriptions	73
show running-config streaming-telemetry	76
subscription-name	77
suppress-threshold	78
telemetry cpu-monitor	80
telemetry maximum-subscribe-paths	84
telemetry minimum-sample-interval	85
tls tls-port	86
tunnel-server	89

crypto pki load source-interface

Use this command to copy the server certificate (cert.pem) and CA certificate (ca.pem) from an external source to OcNOS.



Note: If the certificate is already present on the OcNOS device but not located in the standard directory, the "file:" option can be used to copy the `cert.pem` or `ca.pem` files to the standard location.

Command Syntax

```
crypto pki load (source-interface IFNAME|) WORD
```

Parameters

WORD

Path to certificate file. Supported formats:

- `http://your-server-ip/path/to/file/cert.pem` (or `ca.pem`)
- `https://your-server-ip/path/to/file/cert.pem` (or `ca.pem`)
- `ftp://your-server-ip/path/to/file/cert.pem` (or `ca.pem`)
- `tftp://your-server-ip/path/to/file/cert.pem` (or `ca.pem`)
- `file:///mnt-point/usb/path/to/file/cert.pem` (or `ca.pem`)

source-interface IFNAME

Source interface used for certificate transfer.

Default

None

Command Mode

Exec mode

Applicability

Introduced in OcNOS version 7.0.0.

Example

This command loads the specified certificate from the given external URL into the device certificate store.

```
OcNOS#crypto pki load ftp://root:root@10.14.105.105/ca.pem
crypto pki load http://root:root@10.14.105.105/cert.pem
OcNOS#crypto pki load source-interface eth0 http://root:root123@10.14.105.213/cert.pem
```

crypto pki generate rsa common-name

Use this command to generate a private RSA key and a corresponding Certificate Signing Request (CSR) which are required for OcNOS using an IP address as the Common Name (CN). This key or CSR pair enables the device to establish TLS connections for both NetConf clients and gNMI-based telemetry subscriptions.

Command Syntax

```
crypto pki generate rsa common-name ipv4 IPADDR
```

Parameters

IPADDR

IPv4 or IPv6 addresses to be used as the Common Name in the CSR. Example format: 192.168.1.5 or 10::10:10/112

Default

None

Command Mode

Privileged execution mode

Applicability

This command was introduced in OcNOS version 5.0.

Examples

- The CSR appears when the user run the [show crypto csr \(page 64\)](#) command.
- Later: Submit the CSR to a CA, receive the signed certificate, and load it onto the device as part of a TLS deployment for NetConf or gNMI.
- For telemetry sessions using gNMI : The device may use this certificate for server identity; clients must validate it when connecting over TLS.
- Always ensure the CN (the IP address) matches the device's identity as seen by the client, or incorporate the address in the SAN if required by the user CA policy.

```
#crypto pki generate rsa common-name ipv4 7.7.7.7
#show crypto csr
-----BEGIN CERTIFICATE REQUEST-----
MIICVzCCAT8CAQAwEjEQMA4GA1UEAwHNy43LjcuNzCCASIwDQYJKoZIhvcNAQEB
BQADggEPADCCAQoCggEBAMkzIZaxNYPd8PW0hexecUFKq9pJn5IJzJkOQDtoVFOT
zeLPRxBaOt1NVd+1EF+wy3AgnGMw004g4AP7qaE+SSX1vKGAjagtfh/gfDAPDUtM
CpYLMCACM7n76OmyP9eUpkMbOSPkZDIBZfjUMxDTFwkzCBH+BF6SkSxtA24NUA9z
5heCIb1ArXYjdlIeB+9FfiVdOZ5yxQsLY8604ONL7Up1766SArGQo6oZ1dJ+bc91
sQVCEpF40SdCnN+Uw3R0cPfQF81BJD4H0EHf1VnHtYJwQ1yax6qc5ghT9R/rABDa
BFB3R09QpjV4Ihd/MyrdQmEIoxHeNNvSGDj9+eiEpksCAwEAAaAAMA0GCSqGSIb3
DQEBChUAA4IBAQAwXkQmNf3yiL+pmpwvE+gU8KVp3i4cvD13Vjh7IQMkCT47WPam
DUiYgwK+dPVAI+iWzq4qTUNn6xahOyN5rnkTz9eipsQ1YHPpZB7hj5fimWwzJws
m4Tun0GZieEBcROqUpbuW+6QDvtR3XSzHhdGGSIteZv9cYyKhNu007okwr67c2Ea
11B7Pcu1tOb4wj3xjqao/ENDG+nmdUPaIKZrAwf2fEOarOaHgKwcl1AHHbusbJWL
qH0fA1OyVgfvG/WuCPP6Peg/Cpla7bDWqeGYt9vFTtekKoQMQLzJw16oINbtBCcw
DZJpeaQpUhFm+ZOjwibZ5NGPBRSTuYncp5xJ
```

```
-----END CERTIFICATE REQUEST-----
#

OcNOS#crypto pki generate rsa common-name ipv4 10::10:10/112
OcNOS#show crypto csr
-----BEGIN CERTIFICATE REQUEST-----
MIICXTCCAUAUQAQAwGDEWMBQGA1UEAwNMNTA6OjEwOjEwLzExMjCCASIwDQYJKoZI
hvcNAQEBBQADggEPADCCAQoCggEBALk8PXeYrU+c/I3DCXAzJ1ZiXCH+JsS2ssh5
E2W8WrsDIz92Xe1zVFdc6Fd1QFg7d3gLubi1N5Y9MIAvDMnimPZym2tIj9B5c1Xy
Z89YAMlHq5TuIvAlSxNJG1GvZsEUWVKV8ti7AQvuyw9fJ7pIkqaFNm5sH2LW6pAL
eg+1fNqMXpd5O5HI9p0SPevqNWvoxTb2PqK+XZY0ITi7Hi5P8teXswhFBsOWlrIH
09Q4hFvPlbIHHQAE5GSWmPyXotQArbVHJmIQyYHE3cYTXwBRUUX1lRzbs2k0gAIJ
9rKuLPAILz4FQCXuBnCDfzwEMhZJ2SmwKuUw9V2V6r60LXBGSScCAwEAAaAAMA0G
CSqGSIb3DQEBChUAA4IBAQBR4SOH6M+2r8SveEt6vTHpW2k33aEZpod9dw/+Qxd/
OMCOF/dCHyana00ZiKzTkyd8iEe60KRStt0X7m7B3wctBf14oVgioUuLYe77D18
s52T65ojLEPLTCiNANHpiGttZqd0LUL4HdD3Tm6lNQLIkMQsEA6KQP9d4jei0shs
G1kR8t7IuwinZU55On2Yg1RiGe4ulZW9YEi0h2vPiONRZMdsW4gVja3SrfGN3Xt0
NoBA43zf/zzECm3YsHT+ikXXDbqedQLmTGlniuUVS0/WlmH0fVCk9YaVxII1jMtp
Mx/R4Y0uROl3UGZveWTlTLzONeIyj/hxUgBLOACa5vx4
-----END CERTIFICATE REQUEST-----
```

debug cml

Use this command to enable or disable debugging information for CML streaming telemetry.

Command Syntax

```
debug cml enable telemetry
debug cml disable telemetry
```

Parameters

None

Default

By default, debugging information is disabled.

Command Mode

Exec Mode

Applicability

This command was introduced in OcNOS version 6.4.1.

Examples

The following example illustrates how to enable and disable the telemetry debugging information.

```
OcNOS#debug cml enable telemetry
OcNOS#debug cml disable telemetry
```

debug telemetry gnmi

Use this command to enable or disable gNMI server debugging logs with severity levels.

Command Syntax

```
debug telemetry gnmi (enable) (severity (debug|info|warning|error|fatal|panic|d-panic) |)
debug telemetry gnmi (disable) (severity (debug|info|warning|error|fatal|panic|d-panic) |)
```

Parameters

debug

Logs a message at debug level

info

Logs a message at info level

warning

Logs a message at warning level

error

Logs a message at error level

fatal

Logs a message and causes the program to exit with return code 1.

panic

Logs a message and triggers the program to generate a traceback.

d-panic

Logs at the Panic level

d-panic

Logs at the Panic level

d-panic

Logs at the Panic level

Default

Disabled. The gNMI server debugging level in the disabled state is set to the Error level.

Command Mode

Configure mode

Applicability

Introduced in OcNOS version 6.4.1 and added the `vrf (NAME|management)` parameter in the OcNOS version 6.5.2.

Removed the `vrf (NAME|management)` parameter in the OcNOS version 6.6.0.

Examples

The following example illustrates how to enable and disable the telemetry debug logs and their corresponding show output.

```
OcNOS(config)#feature streaming-telemetry
OcNOS(feature-telemetry-config)#commit
OcNOS(feature-telemetry-config)#exit
OcNOS(config)#debug telemetry gnmi enable severity warning
OcNOS(config)#commit
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry
debug telemetry gnmi enable severity warning
!
OcNOS(config)#debug telemetry gnmi disable severity warning
OcNOS(config)#commit
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry
!
```

destination-group

Use this command to create a destination-group for persistent subscriptions on the OcNOS device. The VRF parameter must match the VRF specified in the [feature streaming-telemetry \(page 55\)](#) command. Can create and attach multiple destination-groups to activate streaming telemetry subscriptions.

Use the no form of this command to delete a destination-group.

Command Syntax

```
destination-group TUNNEL-NAME (vrf (management|NAME) |)  
no destination-group TUNNEL-NAME (vrf (management|NAME) |)
```

Parameters

TUNNEL-NAME

Specify the name assigned to the tunnel server or collector endpoint used for telemetry data transmission.

vrf NAME

(Optional) Creates a destination-group for persistent subscriptions in a user-defined VRF.

vrf management

(Optional) Creates a destination-group for persistent subscriptions in the management VRF.

Default

None

Command Mode

Configure mode

Applicability

Introduced in OcNOS version 6.5.2.

Example

The following example creates a destination group named `tunnel-1` in a default VRF for transmitting telemetry data.

```
OcNOS(config)#destination-group tunnel-1  
OcNOS(telemetry-grpc-tunnel-group)#commit
```

destination-group GRPC

Use this command to add a destination-group under subscriptions. Can create multiple destination-groups within a subscription mode.

Use `no` parameter of this command to remove the destination-groups.



Note: Ensure that the GRPC-GROUP-NAME is configured in the device's configuration mode before adding it to a subscription mode.

Command Syntax

```
destination-group GRPC-GROUP-NAME
no destination-group GRPC-GROUP-NAME
```

Parameters

GRPC-GROUP-NAME

Specify the name assigned to the tunnel server or collector endpoint used for telemetry data transmission.

Default

None

Command Mode

Telemetry-subscription Mode

Applicability

Introduced in OcNOS version 6.5.2.

Example

Ensure that the GRPC-GROUP-NAME (`tunnel-1`) is already configured in the current configuration mode.

```
OcNOS#configure terminal
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry
  grpc-tunnel-server retry-interval 60
!
sensor-group stream-1
  sensor-path ipi:/interfaces/interface[name="eth0"]/state/counters
!
destination-group tunnel-1
  tunnel-server ip 10.12.66.160 port 11163
!
subscription-name sub-1
  sensor-group stream-1 sample-interval 1000
!
!
```

The following commands illustrates how to add a destination group (tunnel-1) under subscription mode (sub-1) and verify the configuration using the show command output.

```
OcNOS(config)#subscription-name sub-1
OcNOS(telemetry-subscription)#destination-group tunnel-1
OcNOS(telemetry-subscription)#commit
OcNOS(telemetry-subscription)#exit
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry
  grpc-tunnel-server retry-interval 60
!
sensor-group stream-1
  sensor-path ipi:/interfaces/interface[name="eth0"]/state/counters
!
destination-group tunnel-1
  tunnel-server ip 10.12.66.160 port 11163
!
subscription-name sub-1
  destination-group tunnel-1
  sensor-group stream-1 sample-interval 1000
!
!
```

encoding

Use this command to specify or modify encoding types for subscriptions in streaming telemetry.

Use `no` parameter of this command to remove the encoding option.



Note: Modifying the encoding type is not allowed for active subscriptions.

Command Syntax

```
encoding (json-ietf|json|proto)
no encoding
```

Parameters

json-ietf

Specifies the JSON encoding based on the IETF draft standard.

json

Specifies the default JSON encoding type.

proto

Specifies the Protocol Buffers v3 encoding type.

Default

None

Command Mode

Telemetry-subscription Mode

Applicability

Introduced in OcNOS version 6.5.2.

Example

The following commands demonstrate how to create a telemetry subscription named `sub-3` using the JSON encoding type.

```
OcNOS#configure terminal
OcNOS(config)#subscription-name sub-3
OcNOS(telemetry-subscription)#encoding json
OcNOS(telemetry-subscription)#commit
```

feature streaming-telemetry

Use this command to enable the streaming telemetry and, upon configuration, to start the gNMI server. The gNMI server initiates listening for incoming gRPC connections on port 9339 if a custom [port \(page 58\)](#) value is not configured.



Notes:

- OcNOS supports streaming telemetry data transmission across multiple VRF instances, enabling users to manage data for up to four VRFs simultaneously. If users do not define a VRF, the system automatically allows streaming telemetry in the default VRF.
- After configuring the `feature streaming-telemetry` command, the system enters the feature telemetry configuration mode.

Use the `no` parameter of this command to disable the streaming telemetry, it will stop the gNMI server.

Command Syntax

```
feature streaming-telemetry (vrf (NAME|management)|)
no feature streaming-telemetry (vrf (NAME|management)|)
```

Parameters

vrf NAME

(Optional) Defines streaming telemetry in a user-defined VRF. Specify the VRF instance name.

vrf management

(Optional) Defines streaming telemetry in the management VRF.

Default

By default, the streaming-telemetry feature is disabled.

Command Mode

Configure mode

Applicability

Introduced in OcNOS version 6.4.1 and added the `vrf (NAME|management)` parameter in the OcNOS version 6.5.2. Introduces multiple VRFs support in the OcNOS version 6.6.0.

Examples

The following example illustrates how to enable the streaming telemetry on the default, management, user-defined VRFs, and multiple VRFs.

Default VRF

```
OcNOS#configure terminal
```

```
OcNOS(config)#feature streaming-telemetry
OcNOS(feature-telemetry-config)#commit
OcNOS(feature-telemetry-config)#exit
```

Management VRF

```
OcNOS#configure terminal
OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#commit
OcNOS(feature-telemetry-config)#exit
```

User-defined VRF

```
OcNOS#configure terminal
OcNOS(config)#ip vrf VRF1
OcNOS(config-vrf)#exit
OcNOS(config)#feature streaming-telemetry vrf VRF1
OcNOS(feature-telemetry-config)#commit
OcNOS(feature-telemetry-config)#exit
```

Multiple VRFs

```
OcNOS(config)#ip vrf management
OcNOS(config-vrf)#exit
OcNOS(config)#ip vrf user1
OcNOS(config-vrf)#exit
OcNOS(config)#ip vrf user2
OcNOS(config-vrf)#exit

OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#port 32768
OcNOS(feature-telemetry-config)#exit
OcNOS(config)#feature streaming-telemetry
OcNOS(feature-telemetry-config)#exit
OcNOS(config)#feature streaming-telemetry vrf user1
OcNOS(feature-telemetry-config)#port 42768
OcNOS(feature-telemetry-config)#exit
OcNOS(config)#feature streaming-telemetry vrf user2
OcNOS(feature-telemetry-config)#port 52768
OcNOS(feature-telemetry-config)#commit
OcNOS(feature-telemetry-config)#exit

OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry
!
feature streaming-telemetry vrf management
  port 32768
!
feature streaming-telemetry vrf user1
  port 42768
!
feature streaming-telemetry vrf user2
  port 52768
!
!
```

grpc-tunnel-server retry-interval

Use this command to set the interval for retry attempts when establishing a connection for the GNMI server to the tunnel-server.

Use `no` parameter of this command to unset the retry-interval timer.

Command Syntax

```
grpc-tunnel-server retry-interval <30-3000>  
no grpc-tunnel-server retry-interval
```

Parameters

retry-interval <30-3000>

Specifies the duration between retry attempts. The default retry-interval is 60 seconds.

Default

None

Command Mode

Feature telemetry configure mode

Applicability

Introduced in the OcNOS version 6.5.2. Changed the command mode support from configure mode to feature telemetry configure mode (`feature-telemetry-config`) and removed the VRF parameters in OcNOS version 6.6.0.

Example

The following configuration illustrates how to set the retry-interval timer for the gNMI server to the tunnel-server with a value of 80 seconds in a default VRF.

```
OcNOS#configure terminal  
OcNOS(config)#feature streaming-telemetry  
OcNOS(feature-telemetry-config)#grpc-tunnel-server retry-interval 80  
OcNOS(feature-telemetry-config)#commit
```

port

Use this command to configure a non-TLS port for streaming-telemetry.

Use the no parameter of this command to reset the non-TLS port to its default value.

Command Syntax

```
port <1024-65535>
no port
```

Parameters

port <1024-65535>

Specifies the port number range for the insecure TLS gRPC connection.

Default

The non-TLS port is set to 9339.

Command Mode

Feature telemetry configure mode

Applicability

Introduced in OcNOS version 6.6.0. Updated the port range from <32768-60999> to <1024-65535> to allow flexibility with the default port configuration in OcNOS version 7.0.0.

Examples

```
OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#port 54321
OcNOS(feature-telemetry-config)#commit

OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
  port 54321
!
```



Note: The same port number can be configured across multiple VRF instances of streaming-telemetry.

```
OcNOS#show runn streaming-telemetry
!
feature streaming-telemetry vrf management
  port 40000
!
feature streaming-telemetry vrf user1
  port 40000
!
feature streaming-telemetry vrf user2
  port 40000
!
```

```
feature streaming-telemetry vrf user3
port 40000
!
!
!
```



Note: User can configure the default port number like other port values, and the [show](#) command displays the default port number.

```
OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#port 9339
OcNOS(feature-telemetry-config)#commit
2025 Aug 29 04:49:09.158 : OcNOS : CML : CRITI : Default port configured 9339
OcNOS(feature-telemetry-config)#
OcNOS(feature-telemetry-config)#
OcNOS(feature-telemetry-config)#exit
OcNOS(config)#
OcNOS(config)#
OcNOS(config)#
OcNOS(config)#
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
port 9339
!
debug telemetry gnmi enable severity debug
!
!
!
```

sensor-group

Use this command to create a sensor group for persistent subscriptions in an OcNOS device. Multiple sensor groups can be created to specify the paths of interest for streaming telemetry. The VRF parameter must match the VRF specified in the [feature streaming-telemetry \(page 55\)](#) command. These sensor groups are attached to subscriptions to activate streaming telemetry.

Use `no` parameter of this command to remove a created sensor group.

Command Syntax

```
sensor-group SENSOR-NAME (vrf (management|NAME) |)
no sensor-group SENSOR-NAME (vrf (management|NAME) |)
```

Parameters

SENSOR-NAME

Specifies the name of the sensor group.

vrf management

(Optional) Creates a sensor group in the management VRF.

vrf NAME

(Optional) Creates a sensor group in a user-defined VRF.

Default

None

Command Mode

Configure mode

Applicability

Introduced in OcNOS version 6.5.2.

Example

The following commands demonstrate how to create a sensor group named `stream-1` for persistent telemetry subscriptions in a default VRF on an OcNOS device:

```
OcNOS#configure terminal
OcNOS(config)#sensor-group stream-1
OcNOS(telemetry-sensor-group)#commit
OcNOS(telemetry-sensor-group)#exit
```

sensor-group sample-interval

Use this command to associate a sensor group with a specific sampling interval under subscriptions for activating streaming telemetry. Multiple sensor groups can be created.

Use `no` parameter of this command to remove the sensor-groups from a subscription.



Note: Before adding a SENSOR-GROUP-NAME to a subscription, ensure the sensor group is already configured in the configuration mode.

Command Syntax

```
sensor-group SENSOR-GROUP-NAME sample-interval <10-3600>
no sensor-group SENSOR-GROUP-NAME
```

Parameters

SENSOR-GROUP-NAME

Specifies the name of the sensor group to be associated with the subscription.

sample-interval <10-3600>

Defines the sampling interval in seconds for the sensor group. The interval can range from 10 to 3600 seconds.

Default

None

Command Mode

Telemetry-subscription Mode

Applicability

Introduced in OcNOS version 6.5.2.

Example

Ensure that the SENSOR-GROUP-NAME (`stream-1`) is already configured in the current configuration mode.

```
OcNOS#configure terminal
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry
  grpc-tunnel-server retry-interval 60
!
sensor-group stream-1
  sensor-path ipi:/interfaces/interface[name="eth0"]/state/counters
!
subscription-name sub-1
!
!
```

The following commands illustrates how to add a sensor group (`stream-1`) under subscription mode (`sub-1`) and verify the configuration using the `show` command output.

```
OcNOS(config)#subscription-name sub-1
OcNOS(telemetry-subscription)#sensor-group stream-1 sample-interval 1000
OcNOS(telemetry-subscription)#commit
OcNOS(telemetry-subscription)#exit
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry
  grpc-tunnel-server retry-interval 60
!
sensor-group stream-1
  sensor-path ipi:/interfaces/interface[name="eth0"]/state/counters
!
subscription-name sub-1
  sensor-group stream-1 sample-interval 1000
!
!
```

sensor-path

Use this command to add sensor paths under sensor-groups. Can add multiple sensor paths to a single sensor group.

Use `no` parameter of this command to remove sensor paths.

Command Syntax

```
sensor-path SENSOR-PATH
no sensor-path SENSOR-PATH
```

Parameters

SENSOR-PATH

Specifies the path of the telemetry data to include in the sensor group.

Default

None

Command Mode

Telemetry-sensor-group Mode

Applicability

Introduced in OcNOS version 6.5.2.

Example

The following example demonstrates how to configure a sensor group (`stream-1`) and add multiple sensor paths to it for streaming telemetry.

```
OcNOS#configure terminal
OcNOS(config)#sensor-group stream-1
OcNOS(telemetry-sensor-group)#sensor-path ipi:/interfaces/interface[name="eth0"]/state/counters
OcNOS(telemetry-sensor-group)#sensor-path /interfaces/interface[name="xe2"]/state/counters
OcNOS(telemetry-sensor-group)#sensor-path openconfig:/interfaces/interface[name="xe3"]/state/counters
OcNOS(telemetry-sensor-group)#commit
OcNOS(telemetry-sensor-group)#exit
```

show crypto csr

Use this command to display the Certificate Signing Request (CSR) that was generated with the [crypto pki generate rsa common-name \(page 46\)](#) command. The CSR is used in both NetConf and gNMI telemetry TLS workflows to request a certificate from a CA and validate the device identity.



Note: Manually execute the `show crypto csr` command on the console, as NetConf support for it is not available.

Command Syntax

```
show crypto csr
```

Parameters

None

Default

None

Command Mode

Privileged execution mode

Applicability

This command was introduced in OcNOS version 5.0.

Example

- After running [show crypto csr](#) command, copy the full CSR output to a file (for example `ServerCert.csr`) and submit it to a CA for signing.
- In gNMI telemetry deployments, the certificate returned via the CSR may include Subject Alternative Name (SAN) fields to match the server identity.
- Ensure that the Common Name (CN) and SAN values match the device's expected identity to avoid TLS validation failures from clients.

```
#crypto pki generate rsa common-name ipv4 7.7.7.7
#show crypto csr
-----BEGIN CERTIFICATE REQUEST-----
MIICVzCCAT8CAQAwEjEQMA4GA1UEAwHNy43LjcuNzCCASIwDQYJKoZIhvcNAQEB
BQADggEPADCCAQoCggEBAMkzIZaxNYPd8PW0hexecUFKq9pJn5IJzJkOQDtoVFOT
zeLPRxBaOt1NVd+1EF+wy3AgnGMw004g4AP7qaE+S5X1vKGAjagtfh/gfDAPDUTM
CpYLMCACM7n76OmyP9eUpkMbOSPkZDIBZfjUMxDTFwkzCBH+BF6SkSxtA24NUA9z
5heCIb1ArXYjdlIeB+9FfiVdOZ5yxQsLY8604ONL7Upl766SARgQo6oZ1dJ+bc91
sQVCEpF40SdCnN+Uw3R0cPfQF81BJD4H0EHf1VnHtYJwQ1yax6qc5ghT9R/rABDa
BFB3R09QpjV4Ihd/MyrdQmEIoxHeNNvSGDj9+eiEpksCAwEAaAAMA0GCSqGSIb3
DQEBBwUAA4IBAQAwwXkQmNf3yiL+pmpwvE+gU8KVp3i4cvD13Vjh7IQMkCT47WPam
DUiYgwk+dPVAI+iWZq4qTvUNn6xahOyN5rnkTz9eipsQ1YHPpZB7hj5fimWwzJws
m4Tun0GZieEBCROqUpbuW+6QDvtR3XSzHhdGGSIteZv9cYyKhNu007okwr67c2Ea
11B7PcultOb4wj3xjqao/ENDG+nmdUPaIKZrAwf2fEOarOaHgKwcl1AHHbusbJWL
```

```
qH0fA1OyVgfvq/WuCPP6Peg/Cpla7bDWqeGYt9vFTtekKoOMQLzJwl6oINbtBCcw  
DZJpeaQpUhFm+ZOjwibZ5NGPBRSTuYncp5xJ  
-----END CERTIFICATE REQUEST-----
```

show streaming-telemetry

Use this command to display the streaming-telemetry details of persistent (dial-out) and dynamic (dial-in) subscription connection details, including the POLL mode subscriptions per VRF.

The `show streaming-telemetry` and all its sub-commands also shows the maximum sensor-paths and minimum sample-interval for that platform.

Command Syntax

```
show streaming-telemetry (vrf (NAME|management) |)
```

Parameters

vrf NAME

(Optional) Defines streaming telemetry in a user-defined VRF. Specify the VRF instance name.

vrf management

(Optional) Defines streaming telemetry in the management VRF.

Command Mode

Execution mode

Applicability

Introduced in OcNOS version 6.5.2 and added the `vrf (NAME|management)` parameters in the OcNOS version 6.6.0. Introduced two fields, "CPU monitoring" and "CPU monitoring threshold", in all the `show streaming-telemetry` command output in the OcNOS Version 6.6.1.

Examples

The following example displays the streaming telemetry details.

```
OcNOS#show streaming-telemetry

Number of telemetry instances : 3 (default,VRF1,management)
Platform type                 : High range
Maximum sensor-paths         : 100
Minimum sample-interval      : 10
CPU monitoring                : ENABLED (NORMAL)
CPU monitoring threshold      : 40
Number of active sensor-paths : 6 (Dial-In : 0, Dial-out : 6)

SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path   : Sensor Path

1. Subscription Details (VRF-Name: default):
~~~~~
Port         : 9339
TLS          : Disabled
insecure-tls : False

Dial-Out Subscription Details:
~~~~~
1. Subscription-name : storage
```

```

Status                : ACTIVE
Enc-Type              : JSON
Tunnel-server details:
~~~~~
Tunnel-server Retry-interval : Default-60 (seconds)

Destination-group      Status      Tunnel-IP:Port
-----
Collector1             ACTIVE      10.12.101.72:11161
Sensor-group details:
~~~~~
Sensor-group           SI           Origin:Path
-----
Platform              10           ipi:/components/component[name="RAM"]/ram/state
                      ipi:/components/component[name="HARD-DISK"]/storage/state

```

2. Subscription Details (VRF-Name: VRF1):

```
~~~~~
```

```

Port      : 50000
TLS       : Disabled
insecure-tls : False

```

Dial-Out Subscription Details:

```
~~~~~
```

1. Subscription-name : storage

```

Status      : ACTIVE
Enc-Type    : JSON
Tunnel-server details:
~~~~~

```

```
Tunnel-server Retry-interval : Default-60 (seconds)
```

```

Destination-group      Status      Tunnel-IP:Port
-----
Collector3             ACTIVE      10.21.3.4:11123

```

Sensor-group details:

```
~~~~~
```

```

Sensor-group           SI           Origin:Path
-----
Platform              95

```

```

ipi:/components/component[name="RAM"]/ram/state
ipi:/components/component[name="HARD-DISK"]/storage/state

```

3. Subscription Details (VRF-Name: management):

```
~~~~~
```

```

Port      : 60000
TLS       : Disabled
insecure-tls : False

```

Dial-Out Subscription Details:

```
~~~~~
```

1. Subscription-name : storage2

```

Status      : ACTIVE
Enc-Type    : JSON
Tunnel-server details:
~~~~~

```

```
Tunnel-server Retry-interval : Default-60 (seconds)
```

```

Destination-group      Status      Tunnel-IP:Port
-----
Collector2             ACTIVE      10.21.3.4:11123

```

Sensor-group details:

```
~~~~~
```

```

Sensor-group           SI           Origin:Path
-----
Platform              95

```

```

ipi:/interfaces/interface/state
[*]ipi:/interfaces/interface/state/counters

```

[*]-> Indicates child path learnt from parent config, not configured by user

The below table explains the output fields.

Table 8. show streaming-telemetry output details

Field	Description
Number of telemetry instances	Displays the total telemetry instances configured, including VRFs like management, user-defined, and default.
Platform type	Displays the platform type is standard or high range.
Maximum sensor-paths	Shows the maximum number of sensor paths configured. For more details, refer to the telemetry maximum-subscribe-paths (page 84) command.
Minimum sample-interval	Indicates the minimum sampling interval in seconds. For more details, refer to the telemetry minimum-sample-interval (page 85) command.
CPU monitoring	Displays the current operational state of CPU-based telemetry control. It shows: • ENABLED (NORMAL) – when telemetry is enabled and the current CPU usage is below the configured threshold. • ENABLED (PAUSED) – when telemetry is enabled and the CPU usage exceeds the configured threshold, causing telemetry streams to pause. • DISABLED - when telemetry CPU monitoring is explicitly disabled via configuration.
CPU monitoring threshold	Displays the active CPU threshold value (in percentage) configured to trigger the pause or resume logic for telemetry streaming.
Number of active sensor-paths	Shows the total number of active sensor paths for Dial-In and Dial-Out subscriptions.
SI	Represents the sampling interval (SI) in seconds at which telemetry data is collected.
Enc-Type	Indicates the encoding type (Enc-type) used for each subscription.
Origin:Path	Displays the origin and path of the data being monitored.
Port	Specifies the port (page 58) number range for the TLS gRPC connection.
TLS	Indicates whether the TLS connection is enabled or disabled.
insecure-tls	Indicates the TLS connection is secure (false) or not (true).

Table 9. persistent-subscription output details

Field	Description
Subscription-name	Shows the name of the Dial-Out subscription.
Status	Indicates whether the subscription is ACTIVE or INACTIVE.
Tunnel-server details	Provides details about the tunnel server, including destination group, status, tunnel-server retry interval, and tunnel-IP:Port.
Tunnel-server Retry-interval	Displays the duration between retry attempts in seconds.
Sensor-group details	Show the details about the sensor group, including the sampling interval (SI) and origin:path.
Destination Group (DG)	Define the tunnel server settings to which telemetry data is sent for dial-out

Table 9. persistent-subscription output details (continued)

Field	Description
	subscriptions.
Sensor Group (SG)	Sensor group associated with the subscription.

show streaming-telemetry dynamic-subscriptions

Use this command to display the streaming telemetry dial-in configurations.

Command syntax

```
show streaming-telemetry (vrf (NAME|management)) dynamic-subscriptions
```

Parameters

vrf NAME

(Optional) Defines streaming telemetry in a user-defined VRF. Specify the VRF instance name.

vrf management

(Optional) Defines streaming telemetry in the management VRF.

Command Mode

Execution mode

Applicability

This command was introduced in OcNOS version 6.4.1. Added the `vrf (NAME|management)` parameter in the OcNOS version 6.6.0. Introduced two fields, "CPU monitoring" and "CPU monitoring threshold", in all the show streaming-telemetry command output in the OcNOS Version 6.6.1.

Examples

The following example displays the streaming telemetry dial-in configuration output.

```
OcNOS#show streaming-telemetry vrf management dynamic-subscriptions
```

```
Number of telemetry instances : 1 (management)
Platform type                 : High range
Maximum sensor-paths         : 100
Minimum sample-interval      : 10
CPU monitoring                : ENABLED (NORMAL)
CPU monitoring threshold      : 40
Number of active sensor-paths : 3 (Dial-In : 3, Dial-out : 0)
```

```
SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path  : Sensor Path
```

```
1. Subscription Details (VRF-Name: management):
```

```
~~~~~
Port          : 60000
TLS           : Disabled
insecure-tls  : False
```

```
Dial-In STREAM Mode Subscription Details:
```

```
~~~~~
```

ClientIP:Port	ID	SI	Enc-Type	Origin:Path
10.16.12.10:48290	16525	91	JSON_IETF	openconfig:/components/component
[name="TEMPERATURE-HWM_Heater"]/state				
openconfig:/components/component				
[name="TEMPERATURE-HWM_Heater"]/state/temperature				

```
[name="TEMPERATURE-HWM_Heater"]/state/memory
```

```
openconfig:/components/component
```

Here is the explanation of the output fields.

Table 10. show streaming-telemetry output details

Field	Description
Number of telemetry instances	Displays the total telemetry instances configured, including VRFs like management, user-defined, and default.
Platform type	Displays the platform type is standard or high range.
Maximum sensor-paths	Shows the maximum number of sensor paths configured. For more details, refer to the telemetry maximum-subscribe-paths (page 84) command.
Minimum sample-interval	Indicates the minimum sampling interval in seconds. For more details, refer to the telemetry minimum-sample-interval (page 85) command.
CPU monitoring	Displays the current operational state of CPU-based telemetry control. It shows: • ENABLED (NORMAL) – when telemetry is enabled and the current CPU usage is below the configured threshold. • ENABLED (PAUSED) – when telemetry is enabled and the CPU usage exceeds the configured threshold, causing telemetry streams to pause. • DISABLED - when telemetry CPU monitoring is explicitly disabled via configuration.
CPU monitoring threshold	Displays the active CPU threshold value (in percentage) configured to trigger the pause or resume logic for telemetry streaming.
Number of active sensor-paths	Shows the total number of active sensor paths for Dial-In and Dial-Out subscriptions.
SI	Represents the sampling interval (SI) in seconds at which telemetry data is collected.
Enc-Type	Indicates the encoding type (Enc-type) used for each subscription.
Origin:Path	Displays the origin and path of the data being monitored.
Port	Specifies the port (page 58) number range for the TLS gRPC connection.
TLS	Indicates whether the TLS connection is enabled or disabled.
insecure-tls	Indicates the TLS connection is secure (false) or not (true).

Table 11. Dynamic-subscriptions output details

Field	Description
Dial-In Subscription Details	Check the Dial-in subscription details.
ClientIP: Port	Verify that the client IP and port listed matches the client that should be receiving telemetry data.
SI: Sampling-interval	Confirm that the sampling interval matches the desired frequency at which data is collected and sent.

Table 11. Dynamic-subscriptions output details (continued)

Enc-type: Encoding-type	Ensure that the encoding type (e.g., JSON_IETF) matches the expected format for telemetry data.
Origin:Path	Review the sensor paths to ensure that they correspond to the specific data sources or paths of interest.

show streaming-telemetry persistent-subscriptions

Use this command to display a brief summary of the streaming-telemetry dial-out configurations. This command provides a concise view of the persistent subscription settings configured on the device.

Command Syntax

```
show streaming-telemetry (vrf (NAME|management)) persistent-subscriptions brief
show streaming-telemetry (vrf (NAME|management)) persistent-subscriptions details (SUBSCRIPTION-NAME|)
```

Parameters

SUBSCRIPTION-NAME

Displays detailed configuration information specific to the named persistent subscription.

vrf NAME

(Optional) Defines streaming telemetry in a user-defined VRF. Specify the VRF instance name.

vrf management

(Optional) Defines streaming telemetry in the management VRF.

Default

None

Command Mode

Execution mode

Applicability

Introduced in OcNOS version 6.5.2. Added the `vrf (NAME|management)` parameter in the OcNOS version 6.6.0. Introduced two fields, "CPU monitoring" and "CPU monitoring threshold", in all the `show streaming-telemetry` command output in the OcNOS Version 6.6.1.

Example

The command output lists each persistent subscription with its associated details.

```
OcNOS#show streaming-telemetry persistent-subscriptions details

Number of telemetry instances : 1 (default)
Platform type                 : High range
Maximum sensor-paths          : 100
Minimum sample-interval       : 10
CPU monitoring                 : ENABLED (NORMAL)
CPU monitoring threshold       : 40
Number of active sensor-paths : 2 (Dial-In : 0, Dial-out : 2)

SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path   : Sensor Path

1. Subscription Details (VRF-Name: default):
~~~~~
Port           : 9339
```

```

TLS           : Disabled
insecure-tls  : False

Dial-Out Subscription Details:
~~~~~
1. Subscription-name      : storage
   Status                 : ACTIVE
   Enc-Type               : JSON
   Tunnel-server details:
   ~~~~~
   Tunnel-server Retry-interval : Default-60 (seconds)

   Destination-group      Status      Tunnel-IP:Port
   -----
   Collector1             ACTIVE      10.12.101.72:11161
Sensor-group details:
~~~~~
Sensor-group      SI      Origin:Path
-----
Platform          10      ipi:/components/component[name="RAM"]/ram/state
                    ipi:/components/component[name="HARD-DISK"]/storage/state

```

```
OcNOS#show streaming-telemetry vrf VRF1 persistent-subscriptions brief
```

```

Number of telemetry instances : 3 (default,VRF1,management)
Platform type                 : High range
Maximum sensor-paths          : 100
Minimum sample-interval       : 10
CPU monitoring                 : ENABLED (NORMAL)
CPU monitoring threshold       : 40
Number of active sensor-paths : 27 (Dial-In : 3, Dial-out : 24)

DG      : Destination Group
SG      : Sensor Group
SI      : Sampling Interval in seconds
Enc-Type : Encoding type

1. Subscription Details (VRF-Name: VRF1):
~~~~~
Port      : 50000
TLS       : Disabled
insecure-tls : False

Dial-out subscription in brief:
~~~~~
Tunnel-server Retry-interval : Default-60 (seconds)

Subscription-Name  Status      Enc-Type      DG      SG-SI
-----
storage           ACTIVE      JSON          Collector3  Platform - 95

```

Here is the explanation of the output fields.

Table 12. show streaming-telemetry output details

Field	Description
Number of telemetry instances	Displays the total telemetry instances configured, including VRFs like management, user-defined, and default.
Platform type	Displays the platform type is standard or high range.
Maximum sensor-paths	Shows the maximum number of sensor paths configured. For more details, refer to the telemetry maximum-subscribe-paths (page 84) command.
Minimum sample-interval	Indicates the minimum sampling interval in seconds. For more details, refer to

Table 12. show streaming-telemetry output details (continued)

Field	Description
	the telemetry minimum-sample-interval (page 85) command.
CPU monitoring	Displays the current operational state of CPU-based telemetry control. It shows: - ENABLED (NORMAL) – when telemetry is enabled and the current CPU usage is below the configured threshold. - ENABLED (PAUSED) – when telemetry is enabled and the CPU usage exceeds the configured threshold, causing telemetry streams to pause. - DISABLED - when telemetry CPU monitoring is explicitly disabled via configuration.
CPU monitoring threshold	Displays the active CPU threshold value (in percentage) configured to trigger the pause or resume logic for telemetry streaming.
Number of active sensor-paths	Shows the total number of active sensor paths for Dial-In and Dial-Out subscriptions.
SI	Represents the sampling interval (SI) in seconds at which telemetry data is collected.
Enc-Type	Indicates the encoding type (Enc-type) used for each subscription.
Origin:Path	Displays the origin and path of the data being monitored.
Port	Specifies the port (page 58) number range for the TLS gRPC connection.
TLS	Indicates whether the TLS connection is enabled or disabled.
insecure-tls	Indicates the TLS connection is secure (false) or not (true).

Table 13. persistent-subscription output details

Field	Description
Subscription-name	Shows the name of the Dial-Out subscription.
Status	Indicates whether the subscription is ACTIVE or INACTIVE.
Tunnel-server details	Provides details about the tunnel server, including destination group, status, tunnel-server retry interval, and tunnel-IP:Port.
Tunnel-server Retry-interval	Displays the duration between retry attempts in seconds.
Sensor-group details	Show the details about the sensor group, including the sampling interval (SI) and origin:path.
Destination Group (DG)	Define the tunnel server settings to which telemetry data is sent for dial-out subscriptions.
Sensor Group (SG)	Sensor group associated with the subscription.

show running-config streaming-telemetry

Use this command to display streaming telemetry status in the running configuration.

Command Syntax

```
show running-config streaming-telemetry
```

Parameters

None

Command Mode

Execution mode and Configure mode

Applicability

This command was introduced in OcNOS version 6.4.1.

Examples

The following example shows the streaming telemetry status in the `show running-config` output.

```
OcNOS#configure terminal
OcNOS(config)#feature streaming-telemetry
OcNOS(config)#commit
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry
!
OcNOS(config)#exit
```

subscription-name

Use this command to create named subscriptions for persistent telemetry configurations in an OcNOS device. The VRF parameter must match the VRF specified in the [feature streaming-telemetry \(page 55\)](#) command. Multiple subscriptions can be created. These subscriptions are essential for activating streaming telemetry, as they define specific settings such as associated destination groups and sensor groups.

Use `no` parameter of this command to delete a subscription.

Command Syntax

```
subscription-name NAME (vrf (management|NAME)|)
no subscription-name NAME (vrf (management|NAME)|)
```

Parameters

subscription-name NAME

Specifies the unique name to the persistent subscription.

vrf NAME

(Optional) Creates named subscriptions in a user-defined VRF.

vrf management

(Optional) Creates named subscriptions in the management VRF.

Default

None

Command Mode

Configure mode

Applicability

Introduced in OcNOS version 6.5.2.

Example

The following command demonstrates configuring a subscription (`sub-1`) on an OcNOS device. The subscription remains `in-active` because the sensor groups and destination groups have not been added to it.

```
OcNOS#configure terminal
OcNOS(config)#subscription-name sub-1
OcNOS(telemetry-subscription)#commit
Subscription sub-1 is "in-active": sensor-group(s) and destination-group(s) are not configured.
OcNOS(telemetry-subscription)#exit
```

```
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry
!
subscription-name sub-1
!
```

suppress-threshold

Use this command to set a custom CPU usage threshold for triggering the pause of streaming telemetry operations. When the 5-minute average CPU usage goes above the configured threshold and stays above the threshold for at least a minute, OcNOS will suppress telemetry activity to protect control plane resources.

Use the `no` parameter of this command to remove the custom threshold and revert to the default value of 40%.

Command Syntax

```
suppress-threshold <20-80>
no suppress-threshold
```

Parameters

<20-80>

Specifies the CPU usage percentage threshold for pausing telemetry. Valid range: 20–80. The default value is 40.

Default

Disabled

Command Mode

Telemetry CPU monitor mode

Applicability

Introduced in OcNOS version 6.6.1.

Example

Set a Custom CPU Threshold

Define a threshold (e.g., 50%) for CPU usage before pausing telemetry activity when CPU usage exceeds 50%, allowing headroom for normal operation:

```
OcNOS(config)#telemetry cpu-monitor enable
OcNOS (telemetry-cpu-monitor)#suppress-threshold 50
OcNOS (telemetry-cpu-monitor)#commit
```

View the Active Configuration

Verify the active CPU monitoring configuration, including the set threshold:

```
OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry
  grpc-tunnel-server retry-interval 60
!
telemetry cpu-monitor enable
  suppress-threshold 50
!
```

Reset to Default Threshold

Delete the custom threshold and revert to the default value (40%):

```
OcNOS (telemetry-cpu-monitor) #no suppress-threshold  
OcNOS (telemetry-cpu-monitor) #commit
```

telemetry cpu-monitor

Use this command to enable or disable CPU monitoring for streaming telemetry. This mechanism ensures telemetry subscriptions pause automatically when CPU load exceeds a configured threshold.

Use the `no` parameter of this command to set the CPU monitoring to its default behavior (enabled).

Command Syntax

```
telemetry cpu-monitor (enable | disable)
no telemetry cpu-monitor
```

Parameters

enable

Turns on CPU monitoring for telemetry.

disable

Turns off CPU monitoring; telemetry will not be paused due to high CPU load.

Default

Enabled

Command Mode

Configure mode

Applicability

Introduced in OcNOS version 6.6.1.

Example

Use this command to check whether CPU monitoring is currently enabled or disabled in the telemetry configuration:

```
OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry
  grpc-tunnel-server retry-interval 60
!
telemetry cpu-monitor disable
!
!
```



```
OcNOS#sh streaming-telemetry dynamic-subscriptions

Number of telemetry instances : 3 (vrfl,management,default)
Platform type                 : High range
Maximum sensor-paths          : 100
Minimum sample-interval       : 10
CPU monitoring                 : DISABLED
CPU monitoring threshold       : 40
Number of active sensor-paths : 70 (Dial-In : 4, Dial-out : 66)

SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path   : Sensor Path
```

```

1. Subscription Details (VRF-Name: vrf1):
~~~~~
Port      : 9339
TLS       : Disabled
insecure-tls : False

2. Subscription Details (VRF-Name: management):
~~~~~
Port      : 35000
TLS       : Disabled
insecure-tls : False

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
10.16.99.109:46682  35379  90      JSON_IETF      ipi:/interfaces/interface[name="eth0"]/state
                                                           ipi:/interfaces/interface
[name="eth0"]/state/counters

3. Subscription Details (VRF-Name: default):
~~~~~
Port      : 36000
TLS       : Disabled
insecure-tls : False

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
40.1.1.2:49598     20535  10      JSON_IETF      ipi:/interfaces/interface[name="eth0"]/state
                                                           ipi:/interfaces/interface
[name="eth0"]/state/counters

```

Enable CPU monitoring to let the system automatically pause telemetry during high CPU load:

```

OcNOS#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
OcNOS(config)#telemetry cpu-monitor enable
OcNOS(telemetry-cpu-monitor)#commit
OcNOS(telemetry-cpu-monitor)#exit
OcNOS(config)#exit

OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry vrf vrf1
  grpc-tunnel-server retry-interval 30
!
feature streaming-telemetry vrf management
  port 35000
  grpc-tunnel-server retry-interval 30
!
feature streaming-telemetry
  port 36000
  grpc-tunnel-server retry-interval 30
!
telemetry cpu-monitor enable
!
!

OcNOS#show streaming-telemetry dynamic-subscriptions

Number of telemetry instances : 3 (vrf1,management,default)
Platform type                  : High range
Maximum sensor-paths           : 100

```

```

Minimum sample-interval      : 10
CPU monitoring               : ENABLED (NORMAL)
CPU monitoring threshold     : 40
Number of active sensor-paths : 70 (Dial-In : 4, Dial-out : 66)

SI       : Sampling Interval in seconds
Enc-Type : Encoding type
Origin:Path : Sensor Path

1. Subscription Details (VRF-Name: vrf1):
~~~~~
Port      : 9339
TLS       : Disabled
insecure-tls : False

2. Subscription Details (VRF-Name: management):
~~~~~
Port      : 35000
TLS       : Disabled
insecure-tls : False

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
10.16.99.109:46682  35379  90      JSON_IETF      ipi:/interfaces/interface[name="eth0"]/state
                                         ipi:/interfaces/interface
                                         [name="eth0"]/state/counters

3. Subscription Details (VRF-Name: default):
~~~~~
Port      : 36000
TLS       : Disabled
insecure-tls : False

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
40.1.1.2:49598      20535  10      JSON_IETF      ipi:/interfaces/interface[name="eth0"]/state
                                         ipi:/interfaces/interface
                                         [name="eth0"]/state/counters

```

Disable CPU monitoring if telemetry should run without interruption, regardless of CPU load:

```

OcNOS(config)#telemetry cpu-monitor disable
OcNOS(config)#commit
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry
  grpc-tunnel-server retry-interval 60
!
telemetry cpu-monitor disable
!
!

```

Remove the CPU monitor configuration entirely:

```

OcNOS(config)#telemetry cpu-monitor enable
OcNOS(telemetry-cpu-monitor)#commit
OcNOS(telemetry-cpu-monitor)#show running-config streaming-telemetry
!
feature streaming-telemetry
  grpc-tunnel-server retry-interval 60
!
!
telemetry cpu-monitor enable

```

```
!  
!  
  
OcNOS(config)#no telemetry cpu-monitor  
OcNOS(config)#commit  
OcNOS(config)#show running-config streaming-telemetry  
!  
feature streaming-telemetry  
  grpc-tunnel-server retry-interval 60  
!  
!  
!
```

telemetry maximum-subscribe-paths

Use this command to set the maximum number of telemetry subscription paths. Users can control how many sensor paths they can subscribe to at a time.

Use no form of the command to reset the telemetry subscribe path count to its default value.

Command Syntax

```
telemetry maximum-subscribe-paths <10-1000>
no telemetry maximum-subscribe-paths
```

Parameters

maximum-subscribe-paths <10-1000>

Specifies the range of supported telemetry subscription paths to configure across all VRFs.

Default

If telemetry subscribe paths are not explicitly configured, the system sets it to 100 **sensor paths for high-end platforms** and 50 **sensor paths for standard platforms**.

Command Mode

Configure mode

Applicability

Introduced in OcNOS version 6.6.0

Examples

The show command output below displays the available configuration on a device.

```
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
!
!
```

Here, the maximum subscription paths are set to 200, and the show command output confirms the configuration.

```
OcNOS(config)#telemetry maximum-subscribe-paths 200
OcNOS(config)#commit
```

```
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
telemetry maximum-subscribe-paths 200
!
!
```

telemetry minimum-sample-interval

Use this command to set the minimum sample interval in seconds between telemetry data samples. Prevents excessive network and system resource consumption by ensuring telemetry updates are not sent too frequently.

Use no form of the command to reset the minimum sample interval to its default value.

Command Syntax

```
telemetry minimum-sample-interval <10-3600>
no telemetry minimum-sample-interval
```

Parameters

minimum-sample-interval <10-3600>

Specifies the range in seconds for the minimum sampling interval across all VRFs.

Default

If telemetry minimum sample intervals are not explicitly configured, the system sets it to 10 seconds for high-end platforms and 90 seconds for standard platforms.

Command Mode

Configure mode

Applicability

Introduced in OcNOS version 6.6.0

Examples

This example sets the telemetry minimum sampling interval to 12 seconds, and the show command output confirms the configuration.

```
OcNOS(config)#telemetry minimum-sample-interval 12
OcNOS(config)#commit
```

```
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
telemetry minimum-sample-interval 12
!
!
```

tls tls-port

Use this command to enable secure or insecure TLS connection for streaming-telemetry.

Use the no parameter of this command to disable the secure or insecure TLS and restart the telemetry with a non-TLS connection.



Note: In OcNOS, streaming telemetry over TLS secures incoming packets for dial-in connections. Transport Layer Security (TLS) is not supported for dial-out mode subscriptions.

Command Syntax

```
tls tls-port <1024-65535>
no tls tls-port

tls tls-port <1024-65535> insecure
no tls tls-port <1024-65535> insecure
no insecure
```

Parameters

tls-port <32768-60999>

Specifies the port number range for the secure TLS gRPC connection.

insecure

Disables certificate validation in a TLS-enabled connection.

Default

Disabled

Command Mode

Feature telemetry configure mode

Applicability

Introduced in OcNOS version 6.6.0. Updated the port range from <32768-60999> to <1024-65535> to allow flexibility with the default port configuration in OcNOS version 7.0.0.

Examples

Secure TLS

Enable or disable the TLS connection on the desired port.

To verify the TLS connection status, check the `TLS` and `insecure-tls` fields in the show output. If the `TLS` field shows `enabled`, the TLS connection is active. If the `insecure-tls` field is marked as `false`, it means that the provided certificates are validated.

```
OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#tls tls-port 34567
OcNOS(feature-telemetry-config)#commit
```

```
OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
tls tls-port 34567
!

OcNOS#show streaming-telemetry vrf management

Number of telemetry instances : 1 (management)
Platform type                  : High range
Maximum sensor-paths          : 100
Minimum sample-interval       : 10
CPU monitoring                 : ENABLED (NORMAL)
CPU monitoring threshold       : 40
Number of active sensor-paths : 1 (Dial-In : 1, Dial-out : 0)

SI          : Sampling Interval in seconds
Enc-Type    : Encoding type
Origin:Path  : Sensor Path

1. Subscription Details (VRF-Name: management):
~~~~~
Port        : 34567
TLS         : Enabled
insecure-tls : False

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port   ID   SI   Enc-Type   Origin:Path
-----
10.12.42.10:49828 53207 90   JSON       ipi:/interfaces/interface[name="eth0"]/state

OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#no tls tls-port 34567
OcNOS(feature-telemetry-config)#commit
```

Insecure TLS

Enable or disable insecure TLS connection on the desired port. In the show output fields, if the `insecure-tls` field is marked as `true`, it means that the provided certificates are not validated.

```
OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#tls tls-port 34567 insecure
OcNOS(feature-telemetry-config)#commit

OcNOS(config)#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
tls tls-port 34567 insecure
!
!

OcNOS#show streaming-telemetry vrf management

Number of telemetry instances : 1 (management)
Platform type                  : High range
Maximum sensor-paths          : 100
Minimum sample-interval       : 10
CPU monitoring                 : ENABLED (NORMAL)
CPU monitoring threshold       : 40
Number of active sensor-paths : 2 (Dial-In : 2, Dial-out : 0)

SI          : Sampling Interval in seconds
Enc-Type    : Encoding type
Origin:Path  : Sensor Path
```

1. Subscription Details (VRF-Name: management):

~~~~~

```

Port      : 34567
TLS       : Enabled
insecure-tls : True

```

## Dial-In STREAM Mode Subscription Details:

~~~~~

ClientIP:Port	ID	SI	Enc-Type	Origin:Path
-----	-----	----	-----	-----
10.14.105.105:47938	13085	90	JSON	ipi:/interfaces/interface[name="eth0"]/state ipi:/interfaces/interface [name="eth0"]/state/counters

```

OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#no tls tls-port 34567 insecure
OcNOS(feature-telemetry-config)#commit

```

OR

```

OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#no insecure
OcNOS(feature-telemetry-config)#commit

```

tunnel-server

Use this command to add tunnel-servers under destination groups. Can create multiple tunnel servers within a destination group.

Use `no` parameter of this command to remove a tunnel server from the destination group.

Command Syntax

```
tunnel-server ip A.B.C.D port <1-65535>  
no tunnel-server ip A.B.C.D port <1-65535>
```

Parameters

ip A.B.C.D

Specifies the tunnel server IP address.

port <1-65535>

Specifies the tunnel server port-number.

Default

None

Command Mode

Telemetry-GRPC-tunnel-group Mode

Applicability

Introduced in OcNOS version 6.5.2.

Example

The following command demonstrates how to add a tunnel server within the destination group.

```
OcNOS#configure terminal  
OcNOS(config)#destination-group tunnel-1  
OcNOS(telemetry-grpc-tunnel-group)#tunnel-server ip 10.12.66.160 port 11163  
OcNOS(telemetry-grpc-tunnel-group)#commit  
OcNOS(telemetry-grpc-tunnel-group)#exit
```

Troubleshooting

Follow the below troubleshooting steps, to debug telemetry related issues:

Verify Collector (gnmic) Command Options: Verify the input parameters, such as the sensor path, prefix and origin "ipi:".

Check the Encoding Method Compatibility: Check that the request conforms to the supported encoding methods.

Ensure Proper Connectivity: Validate the connectivity between the router and the remote management system. This involves verifying network settings, ports, firewalls, and any potential disruptions in communication.

Collector: If `gnmic` does not receive a response or not receiving expected response, restart the request using the "--log" option. If more verbose debug output is needed, consider adding the "--debug" option as well. The `gnmic` tool displays the possible cause for any error, which helps in debugging the issue.



Note: When no updates are available for a subscribed XPath in `gnmic`, the client does not return a NULL or empty response. Instead, it remains in a waiting (hang) state until the device sends a new update that matches the subscribed path.

```
gnmic -a 10.12.91.111:9339 -u ocnos -p ocnos --encoding json_ietf --insecure --mode STREAM --stream-mode sample --sample-interval 10s sub --path "ipi:/ldp/peers/peer[peer-address=\"6.6.6.6\"]/state"
```

In this example, the subscription is monitoring the LDP peer state for 6 . 6 . 6 . 6.

- If the LDP session is active, telemetry updates will be sent every 10 seconds.
- If the LDP session goes down, the subscribed path becomes non-existent in the telemetry database.
- In such cases, no gNMI update is sent at the configured sample interval, and the client appears to "hang" (wait) until the session comes back up or another matching update is generated.

gNMI Server: If the issue is on server side, follow the steps below to troubleshoot telemetry issues on the OcNOS target. Enable debug and verify the logs in `/var/log/messages` file.

1. In configure mode, enable debug with a specific severity level either "info" or "debug" level, using the [debug telemetry gnmi \(page 49\)](#) command.



Note: To disable the debug telemetry, configure `debug telemetry gnmi (disable)` command.

2. In Exec mode, enable telemetry related debugs, using the [debug cml \(page 48\)](#) command.



Note: To disable telemetry related debugs, configure "debug cml disable telemetry" command.

3. To check the state of streaming telemetry, collect the output of the following commands based on the telemetry mode:

- For Dial-in mode, use: [show streaming-telemetry dynamic-subscriptions \(page 70\)](#).

- For Dial-out mode, use: [show streaming-telemetry persistent-subscriptions \(page 73\)](#).

**Notes:**

- For Dial-out mode, Subscription status could become inactive for the following reasons:
 - Sensor group(s) and destination group(s) are not configured
 - Destination group(s) are not configured
 - Sensor group(s) are not configured
 - Sensor-group(s) doesn't have any sensor-path(s) configured, and destination-group(s) doesn't have any tunnel-server(s) configured.
 - Destination-group(s) doesn't have any tunnel-server(s) configured
 - Sensor-group(s) doesn't have any sensor-path(s) configured
- If telemetry is in “disabled” state, then telemetry feature need to enabled.

4. Collect the output of the **show techsupport gnmi** command to gather diagnostic information and the logs in `/var/log/messages` file, to triage further.
5. If telemetry is not working, verify that CPU monitoring is ENABLED and the gNMI server is in the PAUSE state. The server enters the PAUSE state when CPU usage exceeds the configured threshold and resumes normal operation once the CPU usage drops below the threshold.

| GNMI GET RPC MODE

Overview

The gNMI Get RPC in OcNOS enables on-demand retrieval of network configuration, state, or operational data. It allows clients to fetch real-time state or configuration snapshots without requiring continuous monitoring.



Notes:

- The system supports IPI and OpenConfig (OC) XPaths and uses `JSON_IETF` encoding for responses.
- Implicit wildcard paths (e.g., `/interfaces/interface/state`) are supported, simplifying data retrieval, but explicit wildcard paths are not.

Feature Characteristics

The [Figure 2. Sample Get RPC Request \(page 92\)](#) and [Figure 3. gNMI Get Mode Data Flow \(page 93\)](#) illustrates the gNMI Get RPC workflow in OcNOS, where a gNMI client requests specific telemetry data from a gNMI server (OcNOS target), which then processes the request and retrieves data from the Centralized Management and Logging Daemon (CMLd) and Protocol Modules (PM) or SQL Database. The response is converted into `JSON_IETF` format and sent back to the client.

Figure 2. Sample Get RPC Request

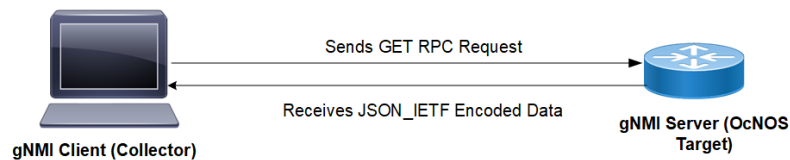
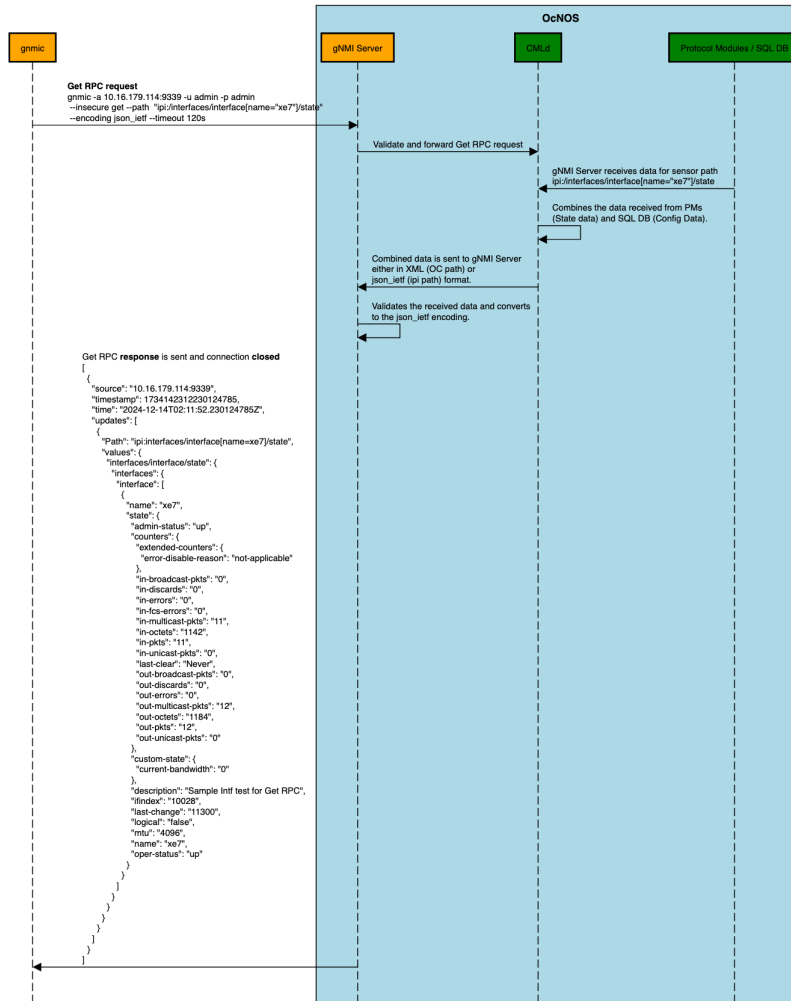


Figure 3. gNMI Get Mode Data Flow



1. The gNMI client sends a Get RPC request to the OcNOS device with the required sensor path, data type (State, Configuration, or All), and encoding type (JSON_IETF).
2. The gNMI server validates the request and forwards it to CMLd. It performs validations on XPath correctness, encoding type (JSON_IETF), requested data type (State, Configuration, or All). Once validated, the gNMI server forwards the request to CMLd.
3. CMLd fetches state data from PMs and configuration data from the SQL database. The retrieved data is combined before being sent back to the gNMI server.
4. The gNMI server processes the response, converts it into JSON_IETF format, and sends it to the gNMI client (gnmic).
5. The Get RPC response is received, and the connection is closed.

Benefits

Reduced Network Overhead: Fetches only requested data, minimizing unnecessary telemetry traffic.

On-Demand Data Access: Eliminates the need for continuous monitoring while providing real-time insights.

Configuration

This section explains how to send and receive Get RPC requests for three use cases: [Configuration data](#), [State data](#), and [All data](#) types.

Prerequisites

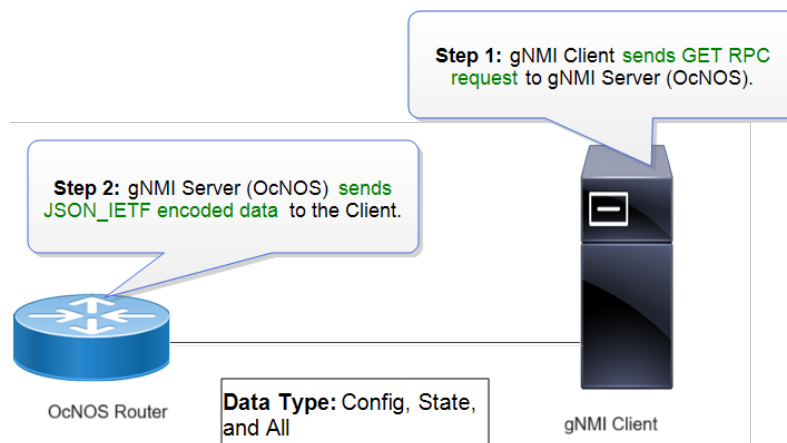
Before configuring streaming telemetry with TLS, ensure the following:

- A supported OcNOS router running a compatible release.
- Access to the management interface of the router.
- Any gNMI client that complies with gNMI specifications can be used as a client.
- Download and install the gNMI collector package by referring to the [gnmic Installation \(page 32\)](#) section.
- Generate the server and client certificates following the [Certificate Management for OcNOS and gNMI \(page 152\)](#) process to enable secure communication.

Topology

The [Figure 4. Get RPC Connection \(page 94\)](#) illustrates how the gNMI client connects to the OcNOS router to send all data type Get RPC request.

Figure 4. Get RPC Connection



Note: Before configuring, meet all [Prerequisites \(page 94\)](#).

Use Case 1: Get RPC Requests for Configuration Data Type

The `gnmic` command retrieves configuration data from the specified device. The `--type config` flag specifies that the data is of type configuration. The response includes configuration settings for the interface named `po1`, such as the `MTU` value and the `enable-switchport` setting, which are part of the device's configuration.

```
./gnmic -a 10.12.162.22:9339 -u admin -p admin --insecure get --path 'ipi:/interfaces/interface
[name="pol"]' --encoding json_ietf --type config --timeout 120s
[
  {
    "source": "10.12.162.22:9339",
    "timestamp": 1730122009406462625,
    "time": "2024-10-28T13:26:49.406462625Z",
    "updates": [
      {
        "Path": "ipi:interfaces/interface[name=pol]",
        "values": {
          "interfaces/interface": {
            "interfaces": {
              "interface": [
                {
                  "config": {
                    "enable-switchport": "",
                    "mtu": "300",
                    "name": "pol"
                  },
                  "name": "pol"
                }
              ]
            }
          }
        }
      }
    ]
  }
]
```

Use Case 2: Get RPC Requests for State Data Type

The `gnmic` command retrieves `state` data from the specified device. The `--type state` flag specifies that the data being retrieved is of type `state`. The response includes various operational details for the interface named `ge1`, such as its `admin-status`, `oper-status`, and various packet counters, which reflect the current state of the interface. This data provides information on the interface's operational condition, such as whether it is up or down, and details like `in-packets`, `out-packets`, and `error-disable-reason`, which monitors and troubleshoots the interface's performance.

```
./gnmic -a 10.12.162.22:9339 -u admin -p admin --insecure get --path "ipi:/interfaces/interface
[name=\"ge1\"]/state" --encoding json_ietf --type state --timeout 120s
[
  {
    "source": "10.12.162.22:9339",
    "timestamp": 1730123321680355567,
    "time": "2024-10-28T13:48:41.680355567Z",
    "updates": [
      {
        "Path": "ipi:interfaces/interface[name=ge1]/state",
        "values": {
          "interfaces/interface/state": {
            "interfaces": {
              "interface": [
                {
                  "name": "ge1",
                  "state": {
                    "admin-status": "up",
                    "counters": {
                      "extended-counters": {
                        "error-disable-reason": "not-applicable"
                      },
                      "in-broadcast-pkts": "0",
                      "in-discards": "0",
                      "in-errors": "0",

```

```

        "in-fcs-errors": "0",
        "in-multicast-pkts": "0",
        "in-octets": "0",
        "in-pkts": "0",
        "in-unicast-pkts": "0",
        "last-clear": "2024 Oct 28 11:59:43 (01:48:58 ago)",
        "out-broadcast-pkts": "0",
        "out-discards": "0",
        "out-errors": "0",
        "out-multicast-pkts": "0",
        "out-octets": "0",
        "out-pkts": "0",
        "out-unicast-pkts": "0"
      },
      "custom-state": {
        "current-bandwidth": "0"
      },
      "enable-switchport": "",
      "ifindex": "5001",
      "last-change": "103900",
      "logical": "false",
      "name": "ge1",
      "oper-status": "down"
    }
  }
}
]

```

Use Case 3: Get RPC Requests for All Data Types

The `gnmic` command retrieves all data types for the specified BGP instance. In this case, the `--type` flag is not used, meaning that the command will retrieve both configuration and state data related to the BGP instance with AS number 100. The response includes the configuration and state information for the BGP instance and its peers, such as:

- **Configuration Data:**

- a. `bgp-as: 100` confirms the AS number for the BGP instance.
- b. `peer-address: 4.4.4.1` and `peer-as: 100` show the configuration of BGP peers.

- **State Data:**

- a. `bgp-peer-state: idle` indicates the state of the BGP peer (idle in this case).
- b. The counters, such as `notification-in: 0`, `update-message-in: 0`, and `update-message-out: 0`, reflect the number of BGP notifications and update messages received and sent.
- c. `total-prefixes: 0` indicates that no prefixes are being exchanged yet.

```

# ./gnmic -a 10.12.162.22:9339 -u admin -p admin --insecure get --path "ipi:/bgp/bgp-instances/bgp-
instance[bgp-as=100]" --encoding json_ietf --timeout 120s
[
  {
    "source": "10.12.162.22:9339",
    "timestamp": 1730120826528664430,
    "time": "2024-10-28T13:07:06.52866443Z",

```

```

"updates": [
  {
    "Path": "ipi:bgp/bgp-instances/bgp-instance[bgp-as=100]",
    "values": {
      "bgp/bgp-instances/bgp-instance": {
        "bgp": {
          "bgp-instances": {
            "bgp-instance": [
              {
                "bgp-as": "100",
                "config": {
                  "bgp-as": "100"
                },
                "peers": {
                  "peer": [
                    {
                      "config": {
                        "peer-address": "4.4.4.1",
                        "peer-as": "100"
                      },
                      "peer-address": "4.4.4.1",
                      "state": {
                        "bgp-peer-state": "idle",
                        "counters": {
                          "notification-in": "0",
                          "notification-out": "0",
                          "update-message-in": "0",
                          "update-message-out": "0"
                        },
                        "dynamically-configured": "false",
                        "peer-address": "4.4.4.1",
                        "peer-as": "100",
                        "peer-type": "ibgp"
                      }
                    }
                  ],
                  "config": {
                    "peer-address": "4.4.4.5",
                    "peer-as": "100"
                  },
                  "peer-address": "4.4.4.5",
                  "state": {
                    "bgp-peer-state": "idle",
                    "counters": {
                      "notification-in": "0",
                      "notification-out": "0",
                      "update-message-in": "0",
                      "update-message-out": "0"
                    },
                    "dynamically-configured": "false",
                    "peer-address": "4.4.4.5",
                    "peer-as": "100",
                    "peer-type": "ibgp"
                  }
                }
              }
            ]
          },
          "rib": {
            "address-family": [
              {
                "afi": "link-state",
                "safi": "link-state",
                "state": {
                  "afi": "link-state",
                  "safi": "link-state"
                }
              }
            ]
          }
        }
      }
    }
  ]
}

```

```
    },  
    "state": {  
      "bgp-as": "100",  
      "router-run-time-ip-address": "0.0.0.0",  
      "scan-remain-time": "35",  
      "table-version": "1",  
      "total-prefixes": "0",  
      "version": "4"  
    }  
  }  
]  
}  
}  
}  
}  
}  
]  
}  
]  
]
```

STREAMING TELEMETRY DIAL-IN MODE

Overview

Dial-in mode in streaming telemetry enables collectors to initiate connections with OcNOS routers to receive operational data of interest. In this mode, the collector sends a Subscribe Remote Procedure Call (RPC) request to the gNMI server (OcNOS target device), specifying the data paths to monitor. The server then streams the requested telemetry data to the collector, facilitating proactive network monitoring and troubleshooting.

Feature Characteristics

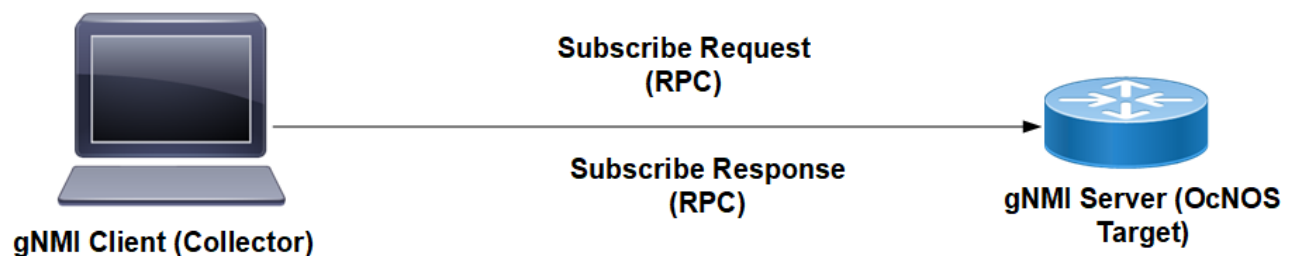
The gNMI-based Dial-in mode telemetry for the management plane supports three types of telemetry subscriptions: **Poll, Once, and Stream**.

The gNMI-based collector connects to the OcNOS target device and invokes the Subscribe RPC, specifying the set of path(s) of interest. Two key components are involved in this process:

- **gNMI Server (OcNOS Target):** The gNMI server operates within the OcNOS device, serving as the source of telemetry data. It supports the gNMI protocol, allowing gNMI-based clients (collectors) to request and receive streaming data. The server streams the requested data to the client according to the specified parameters.
- **gNMI Client (Collector):** The gNMI client, also known as the collector, runs outside the OcNOS target device and is responsible for receiving and gathering telemetry data. In this context, it is the entity that connects to the OcNOS target device to collect data using the gNMI protocol. The collector initiates the Subscribe RPC to specify the data of interest.

[Figure 5](#) illustrates the gNMI client's (Collector) Subscribe request and response (RPC) interaction with the gNMI server (OcNOS Target).

Figure 5. Sample Subscribe Request



The gNMI-based Dial-in mode telemetry enables the "STREAM" type subscription with [Sample Stream Mode \(page 101\)](#) and [On-Change Stream Mode \(page 103\)](#) for the Subscribe RPC.

Benefits

Proactive Network Monitoring: Obtain real-time insights into network health and performance, and how to enable quicker response to issues.

Resource Utilization Monitoring: Monitor CPU and memory utilization to optimize resource allocation and performance.

Predictive Troubleshooting: Identify patterns and potential issues before they impact the network, reducing downtime.

Automation and Resilience: Use telemetry data to automate network management tasks and design a more resilient network.

Prerequisites

Before configuring Dial-In mode, ensure that:

- A supported OcNOS router running a compatible release.
- Access to the management interface of the router.
- Any gNMI client that complies with gNMI specifications can be used as a client.
- Refer to the [gnmic Installation \(page 32\)](#) to download the gNMI collector package.

gNMI Subscription Limits

OcNOS enforces subscription limits to protect system resources and ensure fair allocation across multiple clients.

Global Subscription Limit

Limit: 128 concurrent Subscribe RPCs (aggregate)

This parameter defines the maximum number of active gNMI subscriptions the gNMI server permits across all connected clients.

- In standard deployment patterns, a single Subscribe RPC is typically used to multiplex multiple sensor paths of a similar sensor type. Consequently, a 128-subscription limit is more than sufficient for the majority of network monitoring use cases.
- This is a “safety-first” threshold. Each active subscription requires the server to maintain a stateful stream, dedicated goroutines, and data caches. Without this cap, the system could experience critical memory exhaustion and CPU spikes.

Per-Client Subscription Limit

Limit: 64 concurrent Subscribe RPCs (per connection)

This constraint ensures that no single gNMI client can consume the entire global subscription pool.

- By capping individual connections at 64 RPCs, the system guarantees that even if one client hits its local limit, at least 50% of the global capacity remains available for other collectors.
- This limit encourages collectors to bundle sensor paths efficiently within a single RPC rather than opening redundant streams.

Sample Stream Mode

The gNMI-based Dial-in mode telemetry enables the "STREAM" type subscription with "SAMPLE" mode for the Subscribe RPC.

Sampling Stream Mode Data Flow Description: Subscribe Request and Response

[Figure 6](#) illustrates a sample gnmic Subscribe Request and Subscribe Response between the collector and the OcNOS target device.

Step 1: Subscription Request Initiation

- The gnmic collector server initiates a Subscribe Request by sending a Subscribe RPC in Stream type.
- This subscription request aims explicitly to gather data related to interface state counters and CPU state.
- A fixed 30/45-second sampling interval is set for data collection.

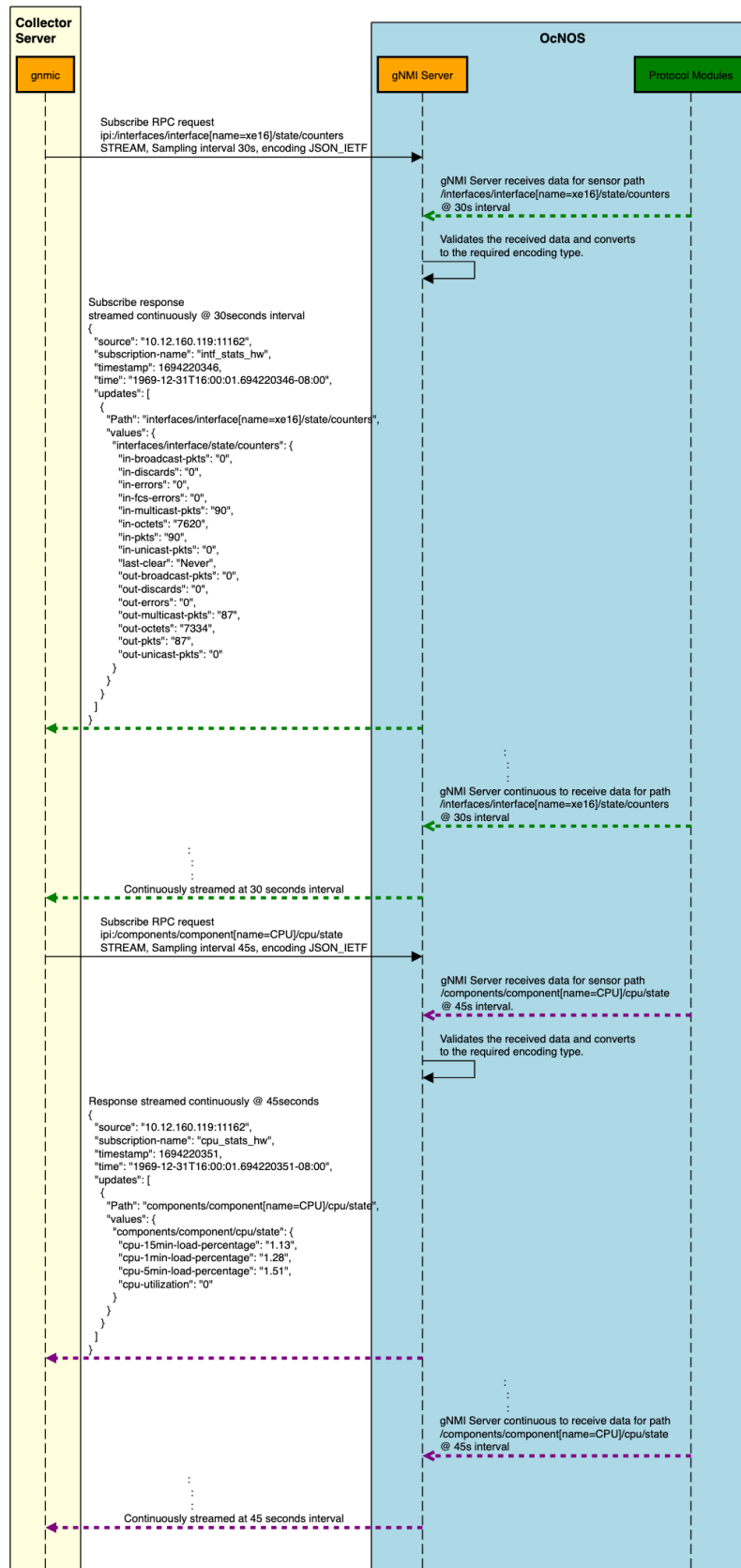
Step 2: Data Collection and Processing

- The gNMI server, within the OcNOS router, is responsible for data collection.
- At regular 30/45-second intervals, it retrieves data from the sensor path, focusing on interface state counters and CPU State.
- The received data undergoes a validation process, and the data is transformed into the required encoding type.

Step 3: Continuous Subscription Response Streaming

- The gNMI Server responds to the subscription request by continuously streaming Subscribe Response data.
- This streaming process maintains the same 30/45-second interval as the data collection.
- The collected data is streamed in real-time to the gnmic collector server.

Figure 6. Sampling Stream Mode Message Flow: Subscribe Request and Response



Sample Stream Mode Benefits

For "counters" type attributes, use a cadence-based sampling mode. This approach enables efficient data push from the target to the collector and smoothly accommodates multiple collectors while minimizing CPU cycles.

On-Change Stream Mode

The gNMI-based Dial-in mode telemetry enables the "STREAM" type subscription with "On-Change" mode for the Subscribe RPC. The gNMI-based Dial-in mode telemetry enables the STREAM type subscription with the ON_CHANGE mode for the Subscribe RPC. This mode provides an event-driven data streaming mechanism where updates are sent only when subscribed data values change, optimizing bandwidth and CPU usage compared to periodic streaming.

On-Change Stream Mode Data Flow Description

[Figure 7](#) illustrates a sample gnmic Subscribe Request and Subscribe Response message flow between the gNMI client (collector) and the OcNOS target device when the on-change stream mode is used.

Step 1: Subscription Request

The gNMI client sends a Subscribe Request message to the OcNOS gNMI Server with mode set to `on-change`, specifying the sensor path(s) and an optional heartbeat interval.

Step 2: Subscription Initialization

The OcNOS gNMI Server forwards this request to the subscribed data objects.

Step 3: Initial Data Transmission

- The OcNOS target sends a Subscribe Response containing the initial data set for all subscribed paths to the client.
- A heartbeat timer is started to manage optional periodic refreshes.

Step 4: Monitoring Phase

The OcNOS gNMI Server continuously monitors subscribed data items. Whenever any of these data items change, an event notification is triggered. Each notification includes the `timestamp` of when the updated path's value changed at source (protocol module).

Step 5: Data Change Detection and Notification Delivery

- Upon detecting a change, the OcNOS gNMI Server compiles the updated values reports from the hash map based internal database.
- It immediately sends a gNMI Notification containing the new data to the client.
- The heartbeat timer is reset each time a notification is sent.

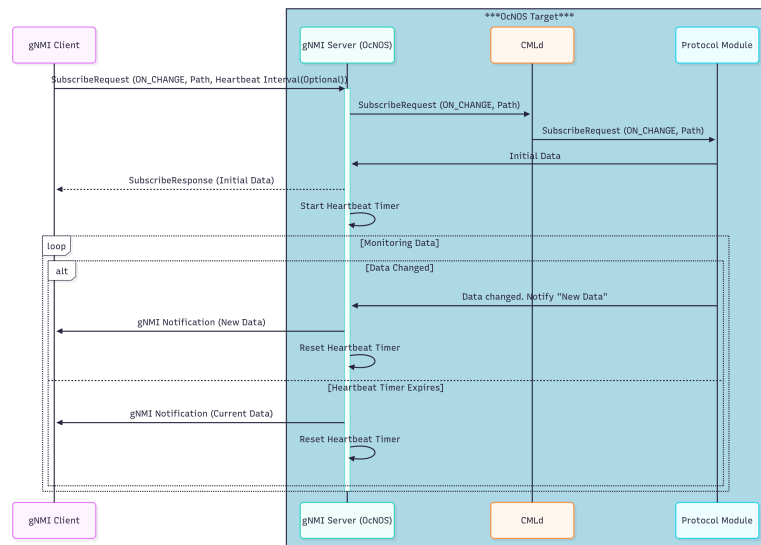
Step 6: Heartbeat Trigger

If no data change occurs and the heartbeat timer expires, the OcNOS gNMI server sends a current data notification to confirm the session remains active. The timestamp in this notification reflects the last data state change, as no new updates have occurred.

Step 7: Delete Notification

If any subscribed node (e.g., VLAN, interface) is deleted, a gNMI notification with a `delete` field is sent, containing the path of the removed node.

Figure 7. On-Change Stream Mode Message Flow



Note: Resource Usage: Minimal resource usage compared to SAMPLE mode; not paused even under CPU load threshold.

Supported Sensor Path Types in On-Change Mode

- The On-Change stream mode in OcNOS supports two categories of sensor paths—container-level and leaf-level. The wildcard sensor path type is applicable to both categories, allowing flexible monitoring and notification of data changes across YANG-modeled objects.
- The On-Change stream mode provides flexible subscription granularity. Depending on the operational requirement, clients can subscribe at the container or leaf level, with optional wildcard sensor paths to extend the scope of change detection within those levels.
- See the [On-change Supported Sensor Paths \(page 274\)](#) section for the complete list of supported on-change telemetry sensor paths.



Note: The on-change streaming mode does not support OpenConfig sensor paths.

Sensor Path Type	Description	Example Path	Behavior
Container-level sensor path	Subscribe request specifies a container-level path. Any data item under this container, when changed, triggers a gNMI update notification.	/interfaces/interface/state	If any child node (e.g., admin-status, oper-status) changes, OcNOS sends an update for that leaf.
Leaf-level sensor path	Subscribe request specifies a direct leaf node. OcNOS sends a gNMI update only when this specific attribute changes.	/interfaces/interface/state/oper-status	Update sent only when the operational status changes (e.g., from up to down).
Wildcard sensor path	Subscribe request uses wildcard (*) to match multiple elements.  Note: OcNOS supports full wildcards (implicit or explicit), but not partial wildcards.	/interfaces/interface [name=]/state/oper-status	Sends updates for all matching interface instances when any of their values change.

On-Change Stream Mode Benefits

- **Reduced Network Traffic:** Transmits data only when actual changes occur, minimizing telemetry volume.
- **Real-Time Change Visibility:** Enables instant awareness of state transitions (e.g., link up or down).
- **Lower CPU Utilization:** Fewer updates reduce overhead on both OcNOS and the collector.
- **Efficient Storage and Analytics:** Downstream collectors store fewer redundant samples.
- **Ideal for Event-Driven Monitoring:** Suited for operational events such as BGP peer state, interface status, or system alarms.

Configuration

In this example, streaming telemetry with OcNOS is demonstrated, using 'gnmic' as the gNMI Client.



Note: To install the gnmic tool for managing network devices using gNMI, refer to the [gnmic Installation \(page 32\)](#)

Figure 8. Dial-In Streaming Telemetry Topology

Note: Before configuring Dial-In, meet all [Prerequisites \(page 100\)](#).

Enable streaming telemetry in a default VRF on OcNOS:

```
OcNOS#configure terminal
OcNOS(config)#feature streaming-telemetry
OcNOS(feature-telemetry-config)#commit
OcNOS(feature-telemetry-config)#exit
```

Telemetry Subscription Request via gnmic Command

The gnmic client is a command-line tool used to interact with the OcNOS gNMI Server for telemetry operations. It allows users to establish, manage, and test telemetry subscriptions directly from the command line or using a configuration file.

Telemetry subscriptions define how and what data the OcNOS device streams to the collector. The gnmic subscribe command is used to initiate a subscription request from the collector (client) to the OcNOS gNMI target (server).

Using this command, users can:

- Specify subscription type (STREAM, ONCE, or POLL)
- Select stream mode (sample or on-change)
- Configure encoding format (json, json_ietf, or proto)
- Provide sensor paths for data collection (via YAML or command-line options)
- Optionally define parameters such as sample intervals or heartbeat intervals

The command can be executed in two ways:

- Using a YAML input file for multiple sensor paths
- Using a single path option for direct subscription testing

Telemetry Subscription Request via gnmic Command and YAML Input

Use this command to initiate multiple telemetry subscriptions at once, with all sensor paths and parameters defined in a YAML configuration file.

```
gnmic -a <ipaddress:port> -u <UserName> -p <Password> --insecure --config <path to config file>
subscribe
```

Telemetry Subscription Request via gnmic Command with a Single Path Option

Use the below gnmic command with a single path option to request a telemetry subscription for a specific data path.

- Use this command to start a streaming telemetry session in `SAMPLE` mode, where data is sent at regular intervals based on the specified sample interval.

```
gnmic -a <ipaddress:port> -u <UserName> -p <Password> --encoding [json, json_ietf] --insecure --
mode STREAM --stream-mode sample --sample-interval sample-interval-value sub --path <path>
```

- Use this command to perform a one-time (`ONCE`) or on-demand (`POLL`) telemetry query for the specified path.

```
gnmic -a <ipaddress:port> -u <UserName> -p <Password> --encoding [json, json_ietf] --insecure --
mode [POLL, ONCE] sub --path <path>
```

- Use this command to start a `SAMPLE` mode streaming session using Protobuf encoding, referencing the `IPI_OC.proto` file for data structure definitions.
- Use this command to initiate an `on-change` stream using Protobuf encoding, where telemetry updates are sent only when subscribed data values change. However, proto encoding does not support paths with complex or union key types.

```
gnmic -a <ipaddress:port> -u <UserName> -p <Password> --encoding proto --insecure --mode STREAM -
-stream-mode sample --sample-interval sample-interval-value sub --path <path> --proto-file IPI_
OC.proto
```

```
gnmic -a <ipaddress:port> -u <UserName> -p <Password> --encoding proto --insecure --mode STREAM -
-stream-mode on-change sub --path <path> --proto-file IPI_OC.proto
```

- Use this command to initiate an `on-change` stream using `JSON` or `JSON-IETF` encoding for real-time change-based telemetry updates.
- Use this command to initiate an `on-change` stream with a configured heartbeat interval, ensuring periodic updates even when no data changes occur.

```
gnmic -a <ipaddress:port> -u <UserName> -p <Password> --encoding [json, json_ietf] --insecure --
mode STREAM --stream-mode on-change sub --path <path>
```

```
gnmic -a <ipaddress:port> -u <UserName> -p <Password> --encoding [json, json_ietf] --insecure --
mode STREAM --stream-mode on-change --heartbeat-interval <value> sub --path <path>
```

Supported gnmic Options

The following table explains the supported fields and their usage.

Table 14. gnmic Option Details

Option	Description
<code>--encoding</code>	Specifies the encoding format as either <code>json</code> , <code>proto</code> , or <code>json_ietf</code> . The default encoding format is <code>json</code> .
<code>--mode</code>	Sets the mode of operation. Supported modes are <code>STREAM</code> , <code>POLL</code> , and <code>ONCE</code> .
<code>--insecure</code>	Allows insecure gRPC or TLS connections to the OcNOS gNMI target.
<code>--stream-mode</code>	Defines the stream mode under the <code>STREAM</code> type. Supported values are <code>sample</code> and <code>on-</code>

Table 14. gnmic Option Details (continued)

Option	Description
	change.
--sample-interval	Sets the data sampling interval (for <code>SAMPLE</code> mode only).  Note: Recommended value is 10s or greater.
--config	Specifies the YAML configuration file path (for multiple subscription paths). Example: <code>input_path.yaml</code> .
--path	Sets the path to subscribe to specific data (Example: <code>'ipi:/interfaces/interface[name]/state'</code>).  Note: Multiple paths can be specified using repeated <code>--path</code> options.
--prefix	Defines a common prefix for all specified paths (Example: <code>'ipi:/interfaces'</code>).
--proto-file	Specifies the path to the <code>.proto</code> file for Protobuf encoding. Example: <code>IPI_OC.proto</code> .
--heartbeat-interval	(Applicable for on-change mode only) Specifies the interval, in seconds, for sending periodic updates even when no data change occurs. This acts as a keepalive mechanism, ensuring that the client continues to receive updates confirming session health and data continuity. Example: <code>--heartbeat-interval 30s</code> .

Invoking Subscribe RPC with gnmic

This section provides various examples of using the Dial-in subscribe RPC with the gnmic command, as listed.

Use Case 1: Monitoring Interface State with Single Path Option

In this use case, gnmic subscribes to a specific path using the Subscribe RPC, monitoring the state of an interface with the path `'ipi:/interfaces/interface[name="ce51"]/state'`.

```
#gnmic -a 10.12.91.111:9339 -u ocnos -p ocnos --encoding json_ietf --insecure --mode STREAM --stream-mode sample --sample-interval 10s sub --path 'ipi:/interfaces/interface[name="ce51"]/state'
```

```
{
  "source": "10.12.91.111:9339",
  "subscription-name": "default-1695368813",
  "timestamp": 1550833401338910123,
  "time": "2019-02-22T11:03:21.388930123Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"ce51\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": "0",
            "in-discards": "0",
            "in-errors": "0",
            "in-fcs-errors": "0",
            "in-multicast-pkts": "23",
            "in-octets": "2126",
            "in-pkts": "23",
            "in-unicast-pkts": "0",
```

```

        "last-clear": "Never",
        "out-broadcast-pkts": "0",
        "out-discards": "0",
        "out-errors": "0",
        "out-multicast-pkts": "28",
        "out-octets": "2552",
        "out-pkts": "28",
        "out-unicast-pkts": "0"
      },
      "ifindex": 10051,
      "last-change": 15500,
      "logical": false,
      "oper-status": "up"
    }
  }
}
]
}

```

The output of the Subscribe RPC includes the following information:

Table 15. Subscribe RPC Output details

Option	Description
source	The source IP address and port of the gNMI server.
subscription-name	The name of the subscription.
timestamp	Indicates the exact time when the source (protocol modules) collects the telemetry data, not when the gNMI server sends the response packet (for <code>sampling stream mode</code>).
time	The timestamp in a human-readable format.
updates	An array of updates, each containing Path and Values.
Path	The path to the subscribed data.
values	The values of the subscribed data.

Validation

The below show command provides details about the subscriptions that have been established, including the client ID, sampling interval, encoding type, and the sensor paths that are being monitored.

```

OcNOS#show streaming-telemetry dynamic-subscriptions

Number of telemetry instances : 1 (default)
Platform type                 : High range
Maximum sensor-paths          : 100
Minimum sample-interval       : 10
CPU monitoring                 : ENABLED (NORMAL)
CPU monitoring threshold       : 40
Number of active sensor-paths : 2 (Dial-In : 2, Dial-out : 0)

SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path   : Sensor Path

1. Subscription Details (VRF-Name: default):
~~~~~
Port         : 9339

```

```

    TLS           : Disabled
    insecure-tls  : False

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
10.12.43.165:59304  4148  10      JSON_IETF      ipi:interfaces/interface
[name="ce51"]/state/counters

                                ipi:interfaces/interface[name="ce51"]/state

```

Use Case 2: Monitoring Interface State with Multiple Path Option

In this use case, gnmic subscribes to a specific path using the Subscribe RPC, monitoring the state of an interface with the multiple path 'ipi:/interfaces/interface[name="ce51"]/state' and 'ipi:/interfaces/interface[name="ce52"]/state'.

```

#gnmic -a 10.12.91.111:9339 -u ocnos -p ocnos --encoding json_ietf --insecure --mode STREAM --
stream-mode sample --sample-interval 11s sub --path 'ipi:/interfaces/interface[name="ce51"]/state' --
path 'ipi:/interfaces/interface[name="ce52"]/state'

{
  "source": "10.12.91.111:9339",
  "subscription-name": "default-1695377304",
  "timestamp": 1550833401384910124,
  "time": "2019-02-22T11:03:21.388940124Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"ce51\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": "0",
            "in-discards": "0",
            "in-errors": "0",
            "in-fcs-errors": "0",
            "in-multicast-pkts": "10",
            "in-octets": "1060",
            "in-pkts": "10",
            "in-unicast-pkts": "0",
            "last-clear": "Never",
            "out-broadcast-pkts": "0",
            "out-discards": "0",
            "out-errors": "0",
            "out-multicast-pkts": "10",
            "out-octets": "1020",
            "out-pkts": "10",
            "out-unicast-pkts": "0"
          },
          "ifindex": 10051,
          "last-change": 22500,
          "logical": false,
          "oper-status": "up"
        }
      }
    }
  ]
}

{
  "source": "10.12.91.111:9339",
  "subscription-name": "default-1695377304",
  "timestamp": 1550833401385910125,
  "time": "2019-02-22T11:03:21.388950125Z",

```

```

"updates": [
  {
    "Path": "ipi:interfaces/interface[name=\"ce52\"]/state",
    "values": {
      "interfaces/interface/state": {
        "admin-status": "up",
        "counters": {
          "in-broadcast-pkts": "0",
          "in-discards": "0",
          "in-errors": "0",
          "in-fcs-errors": "0",
          "in-multicast-pkts": "13",
          "in-octets": "1664",
          "in-pkts": "13",
          "in-unicast-pkts": "0",
          "last-clear": "Never",
          "out-broadcast-pkts": "0",
          "out-discards": "0",
          "out-errors": "0",
          "out-multicast-pkts": "10",
          "out-octets": "1020",
          "out-pkts": "10",
          "out-unicast-pkts": "0"
        },
        "ifindex": 10052,
        "last-change": 22500,
        "logical": false,
        "oper-status": "up"
      }
    }
  }
]
}

```

Validation

The below show command provides details about the subscriptions that have been established, including the client ID, sampling interval, encoding type, and the sensor paths that are being monitored.

```
OcNOS#show streaming-telemetry dynamic-subscriptions
```

```

Number of telemetry instances : 1 (default)
Platform type                  : High range
Maximum sensor-paths          : 100
Minimum sample-interval       : 10
CPU monitoring                 : ENABLED (NORMAL)
CPU monitoring threshold       : 40
Number of active sensor-paths : 4 (Dial-In : 4, Dial-out : 0)

```

```

SI          : Sampling Interval in seconds
Enc-Type    : Encoding type
Origin:Path  : Sensor Path

```

```
1. Subscription Details (VRF-Name: default):
```

```

~~~~~
Port      : 9339
TLS       : Disabled
insecure-tls : False

```

```
Dial-In STREAM Mode Subscription Details:
```

```
~~~~~
```

ClientIP:Port	ID	SI	Enc-Type	Origin:Path
10.12.43.145:59334	42000	11	JSON_IETF	ipi:interfaces/interface
[name="ce52"]/state/counters				ipi:interfaces/interface[name="ce52"]/state

```
[name="ce51"]/state/counters
```

```
ipi:interfaces/interface
```

```
ipi:interfaces/interface[name="ce51"]/state
```

Use Case 3: Monitoring Interface State Using Proto Encoding for IPI Xpath

In this use case, gnmic subscribes to the specified path using the Subscribe RPC, monitoring the state of an interface 'ipi:/interfaces/interface[name="eth0"]/state' using the proto encoding.

```
./gnmic -a 10.12.160.119:9339 -u admin -p admin --insecure --mode STREAM --stream-mode sample --
sample-interval 10s subscribe --path 'ipi:/interfaces/interface[name="eth0"]/state' --encoding proto
--proto-file IPI_OC.proto
```

```
{
  "source": "10.12.160.119:9339",
  "subscription-name": "default-1713864599",
  "timestamp": 1550833401388910124,
  "time": "2019-02-22T11:03:21.388910124Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state",
      "values": {
        "interfaces/interface/state": {
          "adminStatus": "up",
          "counters": {
            "inMulticastPkts": "159435",
            "inOctets": "902863924",
            "inPkts": "732970",
            "lastClear": "Never",
            "outOctets": "8931839",
            "outPkts": "105457"
          },
          "ifindex": 3,
          "lastChange": 8000,
          "operStatus": "up"
        },
        "ifindex": 3,
        "lastChange": 8000,
        "operStatus": "up"
      }
    }
  ]
}
```

Validation

The below show command provides details about the subscriptions that have been established, including the client ID, sampling interval, encoding type, and the sensor paths that are being monitored.

```
OcNOS#show streaming-telemetry dynamic-subscriptions

Number of telemetry instances : 1 (default)
Platform type                 : High range
Maximum sensor-paths         : 100
Minimum sample-interval      : 10
CPU monitoring                : ENABLED (NORMAL)
CPU monitoring threshold     : 40
Number of active sensor-paths : 2 (Dial-In : 2, Dial-out : 0)

SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path  : Sensor Path

1. Subscription Details (VRF-Name: default):
~~~~~
Port        : 9339
```

```

    TLS           : Disabled
    insecure-tls  : False

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
10.12.66.120:53246  14087  10      PROTO      ipi:/interfaces/interface[name="eth0"]/state
                                         ipi:/interfaces/interface
[name="eth0"]/state/counters

```

Use Case 4: Monitoring Interface State Using JSON Encoding for IPI Xpath

In this use case, gnmic subscribes to the specified path using the Subscribe RPC, monitoring the state of an interface 'ipi:/interfaces/interface[name="eth0"]/state' using the JSON encoding.

```
./gnmic -a 10.12.160.119:9339 -u admin -p admin --insecure --mode STREAM --stream-mode sample --
sample-interval 10s subscribe --path 'ipi:/interfaces/interface[name="eth0"]/state' --encoding json
```

```

{
  "source": "10.12.160.119:9339",
  "subscription-name": "default-1713864619",
  "timestamp": 1550833421055660410,
  "time": "2019-02-22T11:03:41.05566041Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": 0,
            "in-discards": 0,
            "in-errors": 0,
            "in-multicast-pkts": 159470,
            "in-octets": 902867237,
            "in-pkts": 733016,
            "in-unicast-pkts": 0,
            "last-clear": "Never",
            "out-broadcast-pkts": 0,
            "out-discards": 0,
            "out-errors": 0,
            "out-multicast-pkts": 0,
            "out-octets": 8938196,
            "out-pkts": 105490,
            "out-unicast-pkts": 0
          },
          "ifindex": 3,
          "last-change": 8000,
          "logical": false,
          "oper-status": "up"
        }
      }
    }
  ]
}

```

Validation

The below show command provides details about the subscriptions that have been established, including the client ID, sampling interval, encoding type, and the sensor paths that are being monitored.

```
OcNOS#show streaming-telemetry dynamic-subscriptions
```

```

Number of telemetry instances : 1 (default)
Platform type                 : High range
Maximum sensor-paths          : 100
Minimum sample-interval       : 10
CPU monitoring                 : ENABLED (NORMAL)
CPU monitoring threshold       : 40
Number of active sensor-paths : 2 (Dial-In : 2, Dial-out : 0)

```

```

SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path  : Sensor Path

```

1. Subscription Details (VRF-Name: default):

```

~~~~~
Port          : 9339
TLS           : Disabled
insecure-tls  : False

```

Dial-In STREAM Mode Subscription Details:

```

~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
10.12.66.120:53340 50687   10      JSON          ipi:/interfaces/interface[name=eth0]/state
                                         ipi:/interfaces/interface
[name=eth0]/state/counters

```

Use Case 5: Monitoring Interface State Using JSON Encoding for OpenConfig Xpath

In this use case, gnmic subscribes to the specified path using the Subscribe RPC, monitoring the state of an interface `/interfaces/interface[name="eth0"]/state` using the JSON encoding for OpenConfig Xpath.

```

./gnmic -a 10.12.160.119:9339 -u admin -p admin --insecure --mode STREAM --stream-mode sample --
sample-interval 10s subscribe --path '/interfaces/interface[name="eth0"]/state' --encoding json

```

```

{
  "source": "10.12.160.119:9339",
  "subscription-name": "default-1713864712",
  "timestamp": 1550833514789102094,
  "time": "2019-02-22T11:05:14.789102094Z",
  "updates": [
    {
      "Path": "interfaces/interface[name=\"eth0\"]/state",
      "values": {
        "interfaces/interface/state": {
          "AdminStatus": "UP",
          "Counters": {
            "InBroadcastPkts": 0,
            "InDiscards": 0,
            "InErrors": 0,
            "InFcsErrors": null,
            "InMulticastPkts": 159643,
            "InOctets": 902872585,
            "InPkts": 733096,
            "InUnicastPkts": 0,
            "LastClear": 0,
            "OutBroadcastPkts": 0,
            "OutDiscards": 0,
            "OutErrors": 0,
            "OutMulticastPkts": 0,
            "OutOctets": 8944684,
            "OutPkts": 105520,
            "OutUnicastPkts": 0
          }
        }
      }
    }
  ]
}

```

```

        "Ifindex": 3,
        "LastChange": 8000,
        "Logical": false,
        "Name": "eth0",
        "OperStatus": "UP"
    }
}
]
}

```

Validation

The below show command provides details about the subscriptions that have been established, including the client ID, sampling interval, encoding type, and the sensor paths that are being monitored.

```
OcNOS#show streaming-telemetry dynamic-subscriptions
```

```

Number of telemetry instances : 1 (default)
Platform type                 : High range
Maximum sensor-paths         : 100
Minimum sample-interval      : 10
CPU monitoring                : ENABLED (NORMAL)
CPU monitoring threshold      : 40
Number of active sensor-paths : 2 (Dial-In : 2, Dial-out : 0)

```

```

SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path   : Sensor Path

```

```
1. Subscription Details (VRF-Name: default):
```

```

~~~~~
Port       : 9339
TLS        : Disabled
insecure-tls : False

```

```
Dial-In STREAM Mode Subscription Details:
```

```

~~~~~
ClientIP:Port      ID    SI    Enc-Type    Origin:Path
-----
10.12.66.120:53390 16340 10    JSON        openconfig:/interfaces/interface
[name='eth0']/state
                                openconfig:/interfaces/interface
[name='eth0']/state/counters

```

Use Case 6: On-Change Stream Mode Behavior for BGP Operational State

When `on-change` stream mode is enabled for a BGP sensor-path, OcNOS monitors specific operational state parameters under the BGP container and sends gNMI notifications only when a value changes.

Initial Device Configuration

The following example shows the initial running configuration of the OcNOS device before enabling or modifying BGP attributes:

```

OcNOS#sh running-config
!
feature streaming-telemetry
!
!

```

```

!
!
service password-encryption
!
snmp-server enable traps link linkDown
snmp-server enable traps link linkUp
!
qos enable
!
errdisable cause stp-bpdu-guard
feature dns relay
ip dns relay
ipv6 dns relay
!
ip vrf management
!
interface eth11
!
interface eth10
!
interface eth9
!
interface eth8
!
interface eth7
!
interface eth6
!
interface eth5
!
interface eth4
!
interface eth3
!
interface eth2
 ip address 192.168.10.10/24
!
interface eth1
!
interface eth0
 ip address 172.16.0.16/24
!
interface lo
 ip address 127.0.0.1/8
 ipv6 address ::1/128
!
exit
!
router bgp 10
 neighbor 192.168.10.11 remote-as 11
!
 address-family ipv4 unicast
 neighbor 192.168.10.11 activate
 exit-address-family
!
exit
!
!
end

!

```

Configuration Change: Add and Remove Local-AS

In this step, a `local-as` value is configured for the BGP neighbor and then removed. This change in the `local-as` attribute triggers an on-change notification from OcNOS to the gNMI client.

```

router bgp 10
 neighbor 192.168.10.11 local-as 222
commit

router bgp 10
 no neighbor 192.168.10.11 local-as 222
commit

```

gNMI Subscription Request

Use the following gnmic command to subscribe to the specific BGP path in on-change stream mode. This command requests notifications whenever the `local-as` value changes for the specified BGP neighbor.

```

$ gnmic -a 172.16.0.16:9339 -u ocnos -p ocnos --insecure --mode STREAM --stream-mode on-change sub --
path 'ipi:/bgp/bgp-instances/bgp-instance[bgp-as=10]/peers/peer[peer-
address="192.168.10.11"]/state/local-as' --encoding json_ietf
{
  "source": "172.16.0.16:9339",
  "subscription-name": "default-1756953095",
  "timestamp": 1756953092055491455,
  "time": "2025-09-03T23:31:32.055491455-03:00",
  "updates": [
    {
      "Path": "ipi:bgp/bgp-instances/bgp-instance[bgp-as=10]/peers/peer[peer-
address=\"192.168.10.11\"]/state/local-as",
      "values": {
        "bgp/bgp-instances/bgp-instance/peers/peer/state/local-as": {
          "local-as": 10
        }
      }
    }
  ]
}
{
  "sync-response": true
}

{
  "source": "172.16.0.16:9339",
  "subscription-name": "default-1756953095",
  "timestamp": 1756953099494562310,
  "time": "2025-09-03T23:31:39.49456231-03:00",
  "updates": [
    {
      "Path": "ipi:bgp/bgp-instances/bgp-instance[bgp-as=10]/peers/peer[peer-
address=\"192.168.10.11\"]/state/local-as",
      "values": {
        "bgp/bgp-instances/bgp-instance/peers/peer/state/local-as": {
          "local-as": 222
        }
      }
    }
  ]
}
{
  "sync-response": true
}

{
  "source": "172.16.0.16:9339",
  "subscription-name": "default-1756953095",
  "timestamp": 1756953112436537202,
  "time": "2025-09-03T23:31:52.436537202-03:00",
  "updates": [
    {
      "Path": "ipi:bgp/bgp-instances/bgp-instance[bgp-as=10]/peers/peer[peer-

```

```
address=\"192.168.10.11\"]/state/local-as\",
  \"values\": {
    \"bgp/bgp-instances/bgp-instance/peers/peer/state/local-as\": {
      \"local-as\": 10
    }
  }
}
]
}
{
  \"sync-response\": true
}
```

Initial Notification from OcNOS

When the subscription is initiated, OcNOS sends the current state of the `local-as` value for the subscribed path. This represents the initial sync response.

```
{
  \"source\": \"172.16.0.16:9339\",
  ...
  \"timestamp\": 1756953092055491455,
  \"time\": \"2025-09-03T23:31:32.055491455-03:00\",
  ....
  \"local-as\": 10
}
```

Update Notification When Local-AS Changes

When the configured `local-as` changes from 10 to 222, OcNOS immediately sends an update notification reflecting the new value. The `timestamp` field of this message indicates the time when the value of the updated path was collected from the protocol module.

```
{
  \"source\": \"172.16.0.16:9339\",
  ...
  \"timestamp\": 1756953099494562310,
  \"time\": \"2025-09-03T23:31:39.49456231-03:00\",
  ....
  \"local-as\": 222
}
```

Update Notification When Local-AS Reverts

When the `local-as` is removed and reverts to the value 10, another update notification is sent.

```
{
  \"source\": \"172.16.0.16:9339\",
  ...
  \"timestamp\": 1756953112436537202,
  \"time\": \"2025-09-03T23:31:52.436537202-03:00\",
  ....
  \"local-as\": 10
}
```

Use Case 7: Dial-In Telemetry Connection over IPv6 Interface

This example illustrates how streaming telemetry works over an IPv6 interface in Dial-In mode using [Figure 8](#).

Configuration on Node 1 (gNMI Server)

```
OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
!
telemetry minimum-sample-interval 10
debug telemetry gnmi enable severity debug
!
!
!
```

Interface Configuration

```
OcNOS#show running-config interface xe16
!
interface xe16
 ip vrf forwarding management
 ip address 5.5.5.5/24
 ipv6 address 2a02:5501:31:801::1a/64
!
```

Verification on Node 1 (gNMI Server)

```
OcNOS#show streaming-telemetry

Number of telemetry instances : 1 (management)
Platform type                  : Standard range
Maximum sensor-paths          : 50
Minimum sample-interval       : 10
CPU monitoring                 : ENABLED (NORMAL)
CPU monitoring threshold      : 40
Number of active sensor-paths : 1 (Dial-In : 1, Dial-out : 0)

SI          : Sampling Interval in seconds
Enc-Type    : Encoding type
Origin:Path  : Sensor Path

1. Subscription Details (VRF-Name: management):
~~~~~
Port        : 9339
TLS         : Disabled
insecure-tls : False

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
[2a02:5501:31:801::19]:62452  30784  30      JSON_IETF     ipi:/interfaces/in
terface[name="eth0"]/state/counters
```

Configuration on Node 2 (gNMI Client)

```
OcNOS#show running-config interface xe16
!
interface xe16
 ipv6 address 2a02:5501:31:801::19/64
!
```

gNMI client Response

The client establishes a successful IPv6-based gNMI subscription to OcNOS and receives telemetry updates as shown below:

```
./gnmic -a 2a02:5501:31:801::1a --port 9339 -u ocnos -p ocnos --insecure -e json_ietf --mode STREAM
--stream-mode sample --sample-interval 30s sub --path "ipi:/interfaces/interface
[name=\"eth0\"]/state/counters" --log
```

```
{
  "source": "2a02:5501:31:801::1a",
  "subscription-name": "default-1755631437",
  "timestamp": 1755631321493278525,
  "time": "2025-08-19T19:22:01.493278525Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state/counters",
      "values": {
        "interfaces/interface/state/counters": {
          "in-broadcast-pkts": "0",
          "in-discards": "0",
          "in-errors": "0",
          "in-multicast-pkts": "4111",
          "in-octets": "269755",
          "in-pkts": "3547",
          "in-unicast-pkts": "0",
          "last-clear": "Never",
          "out-broadcast-pkts": "0",
          "out-discards": "0",
          "out-errors": "0",
          "out-multicast-pkts": "0",
          "out-octets": "10130",
          "out-pkts": "93",
          "out-unicast-pkts": "0"
        }
      }
    }
  ]
}
```

```
{
  "source": "2a02:5501:31:801::1a",
  "subscription-name": "default-1755631437",
  "timestamp": 1755631350496850538,
  "time": "2025-08-19T19:22:30.496850538Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state/counters",
      "values": {
        "interfaces/interface/state/counters": {
          "in-broadcast-pkts": "0",
          "in-discards": "0",
          "in-errors": "0",
          "in-multicast-pkts": "4136",
          "in-octets": "271197",
          "in-pkts": "3568",
          "in-unicast-pkts": "0",
          "last-clear": "Never",
          "out-broadcast-pkts": "0",
          "out-discards": "0",
          "out-errors": "0",
          "out-multicast-pkts": "0",
          "out-octets": "10130",
          "out-pkts": "93",
          "out-unicast-pkts": "0"
        }
      }
    }
  ]
}
```

```

        "out-unicast-pkts": "0"
      }
    }
  ]
}

{
  "source": "2a02:5501:31:801::1a",
  "subscription-name": "default-1755631437",
  "timestamp": 1755631380500095865,
  "time": "2025-08-19T19:23:00.500095865Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state/counters",
      "values": {
        "interfaces/interface/state/counters": {
          "in-broadcast-pkts": "0",
          "in-discards": "0",
          "in-errors": "0",
          "in-multicast-pkts": "4160",
          "in-octets": "273459",
          "in-pkts": "3591",
          "in-unicast-pkts": "0",
          "last-clear": "Never",
          "out-broadcast-pkts": "0",
          "out-discards": "0",
          "out-errors": "0",
          "out-multicast-pkts": "0",
          "out-octets": "10130",
          "out-pkts": "93",
          "out-unicast-pkts": "0"
        }
      }
    }
  ]
}

```

YAML File Input for Multiple Path Subscription

Use Case 1: Configuring One Subscription Requests with Multiple Path Option

This use case illustrates the configuration of a subscription request with multiple paths using a YAML file input. It streamlines the subscription setup process by specifying the desired paths and subscription parameters directly in the YAML file.

YAML File Content (single_request.yaml)

```

#cat single_request.yaml
subscriptions:                                     #Container for subscriptions
  RAM_stats_hw:                                    #A named subscription for RAM statistics
    prefix: "ipi:"                                 #Common prefix for paths in this subscription
    paths: "/components/component[name=\"RAM\"]/ram/state" #List of subscription paths for the
RAM_stats_hw subscription
    stream-mode: sample                            #Stream mode for RAM statistics
    sample-interval: 11s                           #Sampling interval for RAM statistics (e.g.,
11 seconds)
    encoding: json_ietf                            #Encoding format for RAM statistics (e.g.,
JSON_IETF)

    intf-tray_stats_hw:                            #A named subscription for interface tray
statistics

```

```

    prefix: "ipi:"                                #Common prefix for paths in this
subscription
    paths:                                         #List of subscription paths for the intf-tray_
stats_hw subscription
    "ipi:/interfaces/interface[name=\"xe1\"]/state"
    "ipi:/interfaces/interface[name=\"vlan1.8\"]/state"

    stream-mode: sample                          #Stream mode for interface tray statistics
    sample-interval: 14s                         #Sampling interval for interface tray
statistics (e.g., 14 seconds)
    encoding: json_ietf                          #Encoding format for interface tray
statistics (e.g., JSON_IETF)

```

gnmic Command

```

# gnmic -a 10.12.91.111:9339 -u ocnos -p ocnos --insecure --config single_request.yaml subscribe

{
  "source": "10.12.91.111:9339",
  "subscription-name": "interface_stats_hw",
  "timestamp": 1550833401388910121,
  "time": "2019-02-22T11:03:21.388910184Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"xe1\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": "0",
            "in-discards": "0",
            "in-errors": "0",
            "in-fcs-errors": "0",
            "in-multicast-pkts": "0",
            "in-octets": "0",
            "in-pkts": "0",
            "in-unicast-pkts": "0",
            "last-clear": "Never",
            "out-broadcast-pkts": "0",
            "out-discards": "0",
            "out-errors": "0",
            "out-multicast-pkts": "2",
            "out-octets": "164",
            "out-pkts": "2",
            "out-unicast-pkts": "0"
          },
          "ifindex": 10001,
          "last-change": 0,
          "logical": false,
          "oper-status": "down"
        }
      }
    }
  ]
}

{
  "source": "10.12.91.111:9339",
  "subscription-name": "interface_stats_hw",
  "timestamp": 1550833401388910129,
  "time": "2019-02-22T11:03:21.388110124Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"vlan1.10\"]/state",
      "values": {
        "interfaces/interface/state": {

```

```

    "admin-status": "up",
    "counters": {
      "in-broadcast-pkts": "0",
      "in-discards": "0",
      "in-errors": "0",
      "in-fcs-errors": "0",
      "in-multicast-pkts": "0",
      "in-octets": "0",
      "in-pkts": "0",
      "in-unicast-pkts": "0",
      "last-clear": "Never",
      "out-broadcast-pkts": "0",
      "out-discards": "0",
      "out-errors": "0",
      "out-multicast-pkts": "0",
      "out-octets": "0",
      "out-pkts": "0",
      "out-unicast-pkts": "0"
    },
    "ifindex": 25010,
    "last-change": 22500,
    "logical": false,
    "oper-status": "up"
  }
}
]
}

```

Validation

The below show command provides details about the subscriptions that have been established, including the client ID, sampling interval, encoding type, and the sensor paths that are being monitored.

```
OcNOS#show streaming-telemetry dynamic-subscriptions
```

```

Number of telemetry instances : 1 (default)
Platform type                 : High range
Maximum sensor-paths          : 100
Minimum sample-interval       : 10
CPU monitoring                 : ENABLED (NORMAL)
CPU monitoring threshold       : 40
Number of active sensor-paths : 4 (Dial-In : 4, Dial-out : 0)

```

```

SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path  : Sensor Path

```

```
1. Subscription Details (VRF-Name: management):
```

```

~~~~~
Port          : 9339
TLS           : Disabled
insecure-tls  : False

```

```
Dial-In STREAM Mode Subscription Details:
```

```
~~~~~
```

ClientIP:Port	ID	SI	Enc-Type	Origin:Path
-----	-----	----	-----	-----
10.12.43.135:58208	45333	12	JSON_IETF	ipi:interfaces/interface
[name="xe1"]/state/counters				ipi:interfaces/interface[name="xe1"]/state
				ipi:interfaces/interface
[name="vlan1.10"]/state/counters				

```
[name="vlan1.10"]/state
```

```
ipi:interfaces/interface
```

Use Case 2: Configuring Multiple Subscription Requests with Multiple Path Option

This use case illustrates the configuration of multiple subscription request with multiple paths using a YAML file input. It streamlines the subscription setup process by specifying the desired paths and subscription parameters directly in the YAML file.

YAML File Content (multiple_subs.yaml)

```
#cat multiple_subs.yaml
subscriptions:                                     # Container for subscriptions

RAM_stats_hw:                                     # A named subscription for RAM
statistics

paths: "ipi:/components/component[name=\"RAM\"]/ram/state"          # List of
subscription paths for the RAM_stats_hw subscription

stream-mode: sample                               # Stream mode for RAM
statistics

sample-interval: 11s                              # Sampling interval for RAM
statistics (e.g., 11 seconds)

encoding: json_ietf                               # Encoding format for RAM
statistics (e.g., JSON_IETF)

storage_stats_hw:                                 # A named subscription for
storage statistics

paths: "ipi:/components/component[name=\"HARD-DISK\"]/storage/state"  # List of
subscription paths for the storage_stats_hw subscription

stream-mode: sample                               # Stream mode for storage
statistics

sample-interval: 12s                              # Sampling interval for
storage statistics (e.g., 12 seconds)

encoding: json_ietf                               # Encoding format for
storage statistics (e.g., JSON_IETF)

power-supply_stats_hw:                             # A named subscription for
power supply statistics

paths:                                              # List of subscription paths for
the power-supply_stats_hw subscription
  "ipi:/components/component[name=\"PSU-1\"]/power-supply/state"
  "ipi:/components/component[name=\"PSU-2\"]/power-supply/state"

stream-mode: sample                               # Stream mode for power
supply statistics

sample-interval: 13s                              # Sampling interval for power
supply statistics (e.g., 13 seconds)

encoding: json_ietf                               # Encoding format for power
supply statistics (e.g., JSON_IETF)

intf-tray_stats_hw:                               # A named subscription for
interface tray statistics
```

```

paths:                                     # List of subscription paths for
the intf-tray_stats_hw subscription
  "ipi:/interfaces/interface[name=\"xe1\"]/state"
  "ipi:/interfaces/interface[name=\"vlan1.8\"]/state"

stream-mode: sample                        # Stream mode for interface
tray statistics

sample-interval: 14s                      # Sampling interval for
interface tray statistics (e.g., 14 seconds)

encoding: json_ietf                       # Encoding format for
interface tray statistics (e.g., JSON_IETF)

```

gnmic Command

```
# gnmic -a 10.12.91.111:9339 -u ocnos -p ocnos --insecure --config multiple_subs.yaml subscribe
```

```

{
  "source": "10.12.91.111:9339",
  "subscription-name": "ram_stats_hw",
  "timestamp": 1550833401388910128,
  "time": "2019-02-22T11:03:21.388910128Z",
  "updates": [
    {
      "Path": "ipi:components/component[name=\"RAM\"]/ram/state",
      "values": {
        "components/component/ram/state": {
          "available-high-memory": "0",
          "available-memory": "14743",
          "buffers": "15",
          "current-process-count": 232,
          "free-swap": "0",
          "shared-memory": "8",
          "total-high-memory": "0",
          "total-memory": "16012",
          "total-swap": "0",
          "used-memory": "1269"
        }
      }
    }
  ]
}

{
  "source": "10.12.91.111:9339",
  "subscription-name": "storage_stats_hw",
  "timestamp": 1550833401388910127,
  "time": "2019-02-22T11:03:21.388910127Z",
  "updates": [
    {
      "Path": "ipi:components/component[name=\"HARD-DISK\"]/storage/state",
      "values": {
        "components/component/storage/state": {
          "free-memory": "16908",
          "total-memory": "30208",
          "used-memory": "5020"
        }
      }
    }
  ]
}

```

```

"source": "10.12.91.111:9339",
"subscription-name": "power-supply_stats_hw",
"timestamp": 1550833401388910126,
"time": "2019-02-22T11:03:21.388910126Z",
"updates": [
  {
    "Path": "ipi:components/component[name=\"PSU-1\"]/power-supply/state",
    "values": {
      "components/component/power-supply/state": {
        "capacity": "650",
        "fan1-rpm": 24288,
        "operational-status": "not-present",
        "output-current": "8.28",
        "output-voltage": "12.07",
        "power-consumption": "99",
        "temperature-sensor1": "22",
        "temperature-sensor2": "28",
        "temperature-sensor3": "24"
      }
    }
  }
]
}

{
  "source": "10.12.91.111:9339",
  "subscription-name": "power-supply_stats_hw",
  "timestamp": 1550833401388910125,
  "time": "2019-02-22T11:03:21.388910125Z",

  "updates": [
    {
      "Path": "ipi:components/component[name=\"PSU-2\"]/power-supply/state",
      "values": {
        "components/component/power-supply/state": {
          "operational-status": "running",
          "temperature-sensor1": "0",
          "temperature-sensor2": "0",
          "temperature-sensor3": "0"
        }
      }
    }
  ]
}

{
  "source": "10.12.91.111:9339",
  "subscription-name": "intf-tray_stats_hw",
  "timestamp": 1550833401388910123,
  "time": "2019-02-22T11:03:21.388910123Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"xe1\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": "0",
            "in-discards": "0",
            "in-errors": "0",
            "in-fcs-errors": "0",
            "in-multicast-pkts": "0",
            "in-octets": "0",
            "in-pkts": "0",
            "in-unicast-pkts": "0",
            "last-clear": "Never",
            "out-broadcast-pkts": "0",
            "out-discards": "0",

```

```

        "out-errors": "0",
        "out-multicast-pkts": "5",
        "out-octets": "410",
        "out-pkts": "5",
        "out-unicast-pkts": "0"
    },
    "ifindex": 10001,
    "last-change": 0,
    "logical": false,
    "oper-status": "down"
}
}
]
}

{
  "source": "10.12.91.111:9339",
  "subscription-name": "intf-tray_stats_hw",
  "timestamp": 1550833401388910122,
  "time": "2019-02-22T11:03:21.388910122Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"vlan1.8\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": "0",
            "in-discards": "0",
            "in-errors": "0",
            "in-fcs-errors": "0",
            "in-multicast-pkts": "0",
            "in-octets": "0",
            "in-pkts": "0",
            "in-unicast-pkts": "0",
            "last-clear": "Never",
            "out-broadcast-pkts": "0",
            "out-discards": "0",
            "out-errors": "0",
            "out-multicast-pkts": "0",
            "out-octets": "0",
            "out-pkts": "0",
            "out-unicast-pkts": "0"
          },
          "ifindex": 25008,
          "last-change": 22500,
          "logical": false,
          "oper-status": "up"
        }
      }
    }
  ]
}

```

Validation

The below show command provides details about the subscriptions that have been established, including the client ID, sampling interval, encoding type, and the sensor paths that are being monitored.

```
OcNOS#show streaming-telemetry dynamic-subscriptions
```

```

Number of telemetry instances : 1 (default)
Platform type                  : High range
Maximum sensor-paths          : 100
Minimum sample-interval       : 10

```

```
CPU monitoring           : ENABLED (NORMAL)
CPU monitoring threshold : 40
Number of active sensor-paths : 8 (Dial-In : 8, Dial-out : 0)

SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path  : Sensor Path

1. Subscription Details (VRF-Name: management):
~~~~~
Port        : 9339
TLS         : Disabled
insecure-tls : False

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
10.12.43.155:58267  9453   14    JSON_IETF     ipi:interfaces/interface
[name="xe1"]/state/counters
                                     ipi:interfaces/interface[name="xe1"]/state
                                     ipi:interfaces/interface
[name="vlan1.8"]/state/counters
                                     ipi:interfaces/interface
[name="vlan1.8"]/state
10.12.43.155:58114  31533  11    JSON_IETF     ipi:components/component
[name="RAM"]/ram/state
10.12.43.155:58345  3374   12    JSON_IETF     ipi:components/component[name="HARD-
DISK"]/storage/state
10.12.43.155:58222  35994  13    JSON_IETF     ipi:components/component[name="PSU-
1"]/power-supply/state
                                     ipi:components/component[name="PSU-
2"]/power-supply/state
```

Use Case 3: Configuring Multiple Subscription Requests with Prefix Option

This use case illustrates the configuration of multiple subscription request with prefix option using a YAML file input. It streamlines the subscription setup process by specifying the desired paths and subscription parameters directly in the YAML file.

YAML File Content (prefix_path.yaml)

```
#cat prefix_path.yaml
subscriptions:                                     #Container for
subscriptions

RAM_stats_hw:                                     #A named subscription for
RAM statistics

prefix: "ipi:"                                     #Common prefix for paths in
this subscription

paths: "/components/component[name=\"RAM\"]/ram/state" #List of
subscription paths for the RAM_stats_hw subscription

stream-mode: sample                               #Stream mode for RAM
statistics

sample-interval: 11s                               #Sampling interval for RAM
statistics (e.g., 11 seconds)

encoding: json_ietf                               #Encoding format for RAM
statistics (e.g., JSON_IETF)
```

```

intf-tray_stats_hw:                                     #A named subscription for
interface tray statistics

prefix: "ipi:"                                          #Common prefix for paths in
this subscription

paths:                                                  #List of subscription paths
for the intf-tray_stats_hw subscription
  "ipi:/interfaces/interface[name=\"xe1\"] /state"
  "ipi:/interfaces/interface[name=\"vlan1.8\"] /state"

stream-mode: sample                                    #Stream mode for
interface tray statistics

sample-interval: 14s                                  #Sampling interval for
interface tray statistics (e.g., 14 seconds)

encoding: json_ietf                                    #Encoding format for
interface tray statistics (e.g., JSON_IETF)

```

gnmic Command

```

# gnmic -a 10.12.91.111:9339 -u ocnos -p ocnos --insecure --config prefix_path.yaml subscribe
{
  "source": "10.12.91.111:9339",
  "subscription-name": "ram_stats_hw",
  "timestamp": 1550833401188910121,
  "time": "2019-02-22T11:03:21.388910121Z",

  "updates": [
    {
      "Path": "components/component[name=\"RAM\"] /ram/state",
      "values": {
        "components/component/ram/state": {
          "available-high-memory": "0",
          "available-memory": "14793",
          "buffers": "16",
          "current-process-count": 231,
          "free-swap": "0",
          "shared-memory": "8",
          "total-high-memory": "0",
          "total-memory": "16012",
          "total-swap": "0",
          "used-memory": "1219"
        }
      }
    }
  ]
}

{
  "source": "10.12.91.111:9339",
  "subscription-name": "intf-tray_stats_hw",
  "timestamp": 1550830401388910120,
  "time": "2019-02-22T11:03:21.388900120Z",
  "updates": [
    {
      "Path": "interfaces/interface[name=\"xe1\"] /state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": "0",

```

```

        "in-discards": "0",
        "in-errors": "0",
        "in-fcs-errors": "0",
        "in-multicast-pkts": "0",
        "in-octets": "0",
        "in-pkts": "0",
        "in-unicast-pkts": "0",
        "last-clear": "Never",
        "out-broadcast-pkts": "0",
        "out-discards": "0",
        "out-errors": "0",
        "out-multicast-pkts": "9",
        "out-octets": "738",
        "out-pkts": "9",
        "out-unicast-pkts": "0"
    },
    "ifindex": 10001,
    "last-change": 0,
    "logical": false,
    "oper-status": "down"
}
}
]
}
{
    "source": "10.12.91.111:9339",
    "subscription-name": "intf-tray_stats_hw",
    "timestamp": 1550833401288910122,
    "time": "2019-02-22T11:03:21.388912122Z",
    "updates": [
        {
            "Path": "interfaces/interface[name=\"vlan1.8\"]/state",
            "values": {
                "interfaces/interface/state": {
                    "admin-status": "up",
                    "counters": {
                        "in-broadcast-pkts": "0",
                        "in-discards": "0",
                        "in-errors": "0",
                        "in-fcs-errors": "0",
                        "in-multicast-pkts": "0",
                        "in-octets": "0",
                        "in-pkts": "0",
                        "in-unicast-pkts": "0",
                        "last-clear": "Never",
                        "out-broadcast-pkts": "0",
                        "out-discards": "0",
                        "out-errors": "0",
                        "out-multicast-pkts": "0",
                        "out-octets": "0",
                        "out-pkts": "0",
                        "out-unicast-pkts": "0"
                    },
                    "ifindex": 25008,
                    "last-change": 22500,
                    "logical": false,
                    "oper-status": "up"
                }
            }
        }
    ]
}

```

Validation

The below show command provides details about the subscriptions that have been established, including the client ID, sampling interval, encoding type, and the sensor paths that are being monitored.

```
OcNOS#show streaming-telemetry dynamic-subscriptions

Number of telemetry instances : 1 (default)
Platform type                 : High range
Maximum sensor-paths         : 100
Minimum sample-interval      : 10
CPU monitoring                : ENABLED (NORMAL)
CPU monitoring threshold     : 40
Number of active sensor-paths : 5 (Dial-In : 5, Dial-out : 0)

SI          : Sampling Interval in seconds
Enc-Type    : Encoding type
Origin:Path  : Sensor Path

1. Subscription Details (VRF-Name: management):
~~~~~
Port        : 9339
TLS         : Disabled
insecure-tls : False

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
10.12.43.154:50167 32137 11     JSON_IETF     ipi:components/component
[name="RAM"]/ram/state

10.12.43.154:50614 36412 14     JSON_IETF     ipi:interfaces/interface
[name="vlan1.8"]/state/counters
[ipi:interfaces/interface
[name="vlan1.8"]/state
[ipi:interfaces/interface
[name="xe1"]/state/counters
[ipi:interfaces/interface[name="xe1"]/state
```

Implementation Examples

Multi-Tenant Data Center Monitoring:

Scenario

A cloud service provider (CSP) hosts thousands of virtual machines and containerized workloads for enterprises. Maintaining high-performance networking is critical to prevent latency-sensitive applications from failing.

The network operations team requires real-time telemetry data to troubleshoot performance bottlenecks, but polling data for every tenant consumes too many resources. Instead, the team uses OcNOS Streaming Telemetry Dial-In Mode to facilitate proactive monitoring of tenant networks.

Implementation

- Enable streaming telemetry on OcNOS-based spine-leaf switches connecting virtualized workloads.

- Use gNMI Dial-In Mode to request interface statistics only for specific tenant networks experiencing issues.
- Integrate with a cloud observability platform (e.g., Splunk or Prometheus) to correlate telemetry data with application performance metrics.
- Take proactive measures to redistribute the workloads to mitigate any downtime of the applications due to network issues.

For step-by-step configurations, refer to the [Dial-In configuration](#) section.

Dial-In Mode Command

Refer to the streaming telemetry dial-in mode commands in the [Streaming Telemetry Commands \(page 43\)](#) section.

Glossary

The following provides definitions for key terms or abbreviations and their meanings used throughout this document:

Key Terms/Acronym	Description
JSON	JavaScript Object Notation
RPC	Remote Procedure Call
gNMI	gRPC Network Management Interface
JSON-Internet Engineering Task Force (JSON-IETF)	JSON-IETF is a data interchange format that follows the specifications defined by the IETF. It is a lightweight, text-based format used for representing structured data. JSON-IETF is commonly used for configuration and data exchange in various network and Internet-related protocols.
Streaming Telemetry	A monitoring approach that efficiently transmits operational data from OcNOS routers to remote management systems in real-time for analysis, troubleshooting, and network monitoring.
Telemetry Data	Structured operational data generated by routers that is transmitted in real-time to external systems for analysis.
Remote Management System	An external system responsible for monitoring, managing, and analyzing data received from network devices.
Network Health	The overall condition and performance of a network, including factors like stability, resource utilization, and data flow.
Resilient Network	A network designed to withstand failures or disruptions, maintaining functionality even in challenging conditions.

STREAMING TELEMETRY DIAL-OUT MODE

Overview

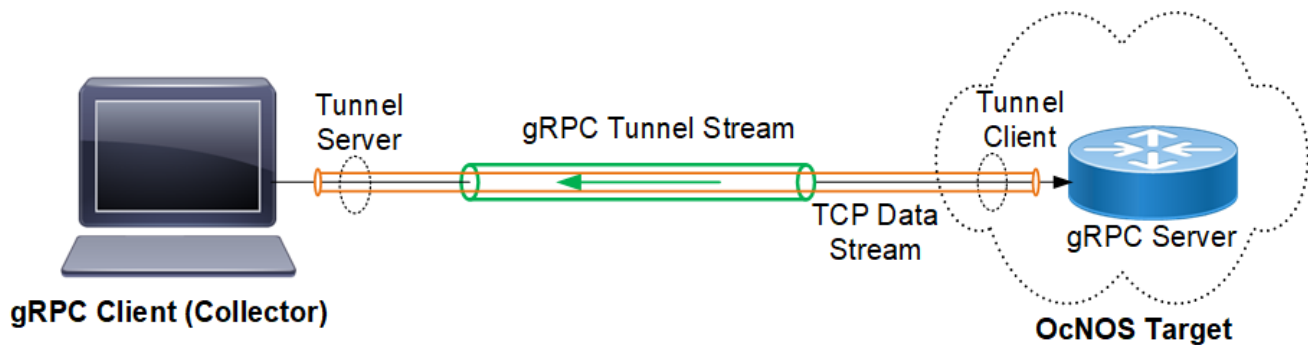
In OcNOS, dial-out telemetry subscriptions, also known as persistent subscriptions, ensure continuous data streaming, even if the Remote Procedure Call (gRPC) session terminates unexpectedly. With persistent subscriptions, the OcNOS device continuously retries to establish a gRPC connection to the collector server, thus maintaining persistent data streaming.

Feature Characteristics

The dial-out telemetry feature in OcNOS comprises several key aspects ensuring seamless data streaming and connectivity with collector servers:

The described topology outlines a system architecture that utilizes gRPC-based tunneling for persistent streaming telemetry.

Figure 9. Dial-Out Subscription Mode



Here is a detailed explanation of the components and data flow:

- **gNMI Client (gRPC Client):** The gNMI client, which acts as the gRPC client in this scenario, is responsible for handling telemetry data and connecting to the OcNOS target device.
- **Tunnel Server:** The tunnel server, part of the gNMI collector process, listens for incoming gRPC tunnel streams from the gRPC server.
- **gRPC Tunnel Stream:** Represents the persistent communication channel established between the tunnel client (OcNOS) and the tunnel server (collector).
- **Tunnel Client:** The gRPC tunnel client operates on the OcNOS device and connects to the tunnel server. It manages the tunneling of telemetry data.
- **gRPC Server:** Interacts with the tunnel client to establish and manage the tunnel.



Note: Ensure that the tunnel server is reachable over the network from the tunnel client, and configure both the tunnel client and tunnel server with compatible authentication mechanisms.

Data Flow

The [Figure 10](#) flow chart illustrates streaming telemetry in Dial-out Mode.

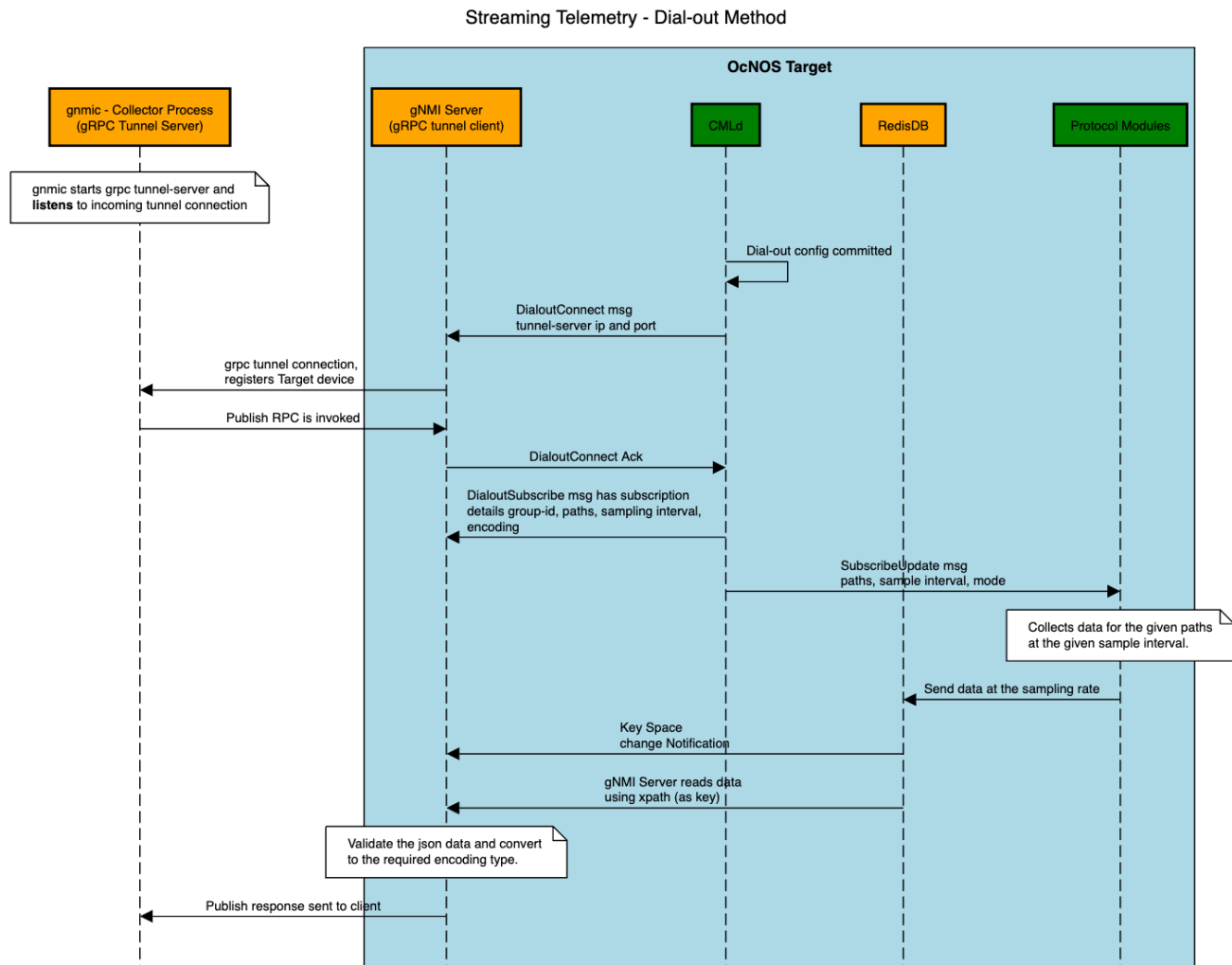
- **Initialization:** When the dial-out command [subscription-name \(page 77\)](#) is applied successfully, the tunnel client on the OcNOS device initiates a connection to the tunnel server hosted on the collector.
- **Tunnel Establishment:** Upon successful connection, the gRPC client and server establish a persistent tunnel stream. This tunnel facilitates the continuous transmission of telemetry data.



Note: OcNOS supports insecure tunnel connections.

- **Telemetry Data Transmission:** When telemetry data needs to be transmitted from the OcNOS device, the gNMI client sends a Publish RPC request over the established tunnel.
- **Subscription Configuration:** Telemetry commands follow the OpenConfig telemetry model, standardizing the configuration of telemetry subscriptions and related entities.

Figure 10. Data Flow: Dial-Out Mode



Benefits

- Ensures continuous data streaming even in the event of gRPC session termination, enhancing network monitoring and troubleshooting capabilities.
- Simplifies configuration and management of telemetry subscriptions using standard OpenConfig models.
- Facilitates secure and reliable communication between the OcNOS device and the collector server.
- Enhances interoperability by enabling integration with third-party gRPC client applications like gNMI client, expanding telemetry options for network operators.

Prerequisites

Before configuring Dial-Out mode, ensure that:

- A supported OcNOS router running a compatible release is required.
- Access to the management interface of the router is necessary.
- Refer to the [gnmic Installation \(page 32\)](#) to download the gNMI collector package.

Configuration

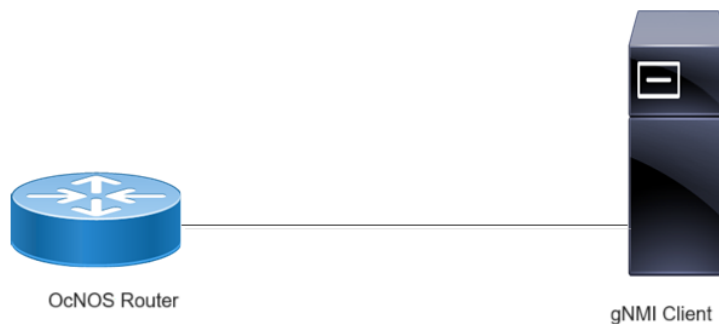
Set up the OcNOS router to transmit streaming telemetry data to a gNMI client using the dial-out method.

The sample configuration on the OcNOS router sets up streaming telemetry subscriptions using gNMI to monitor specific paths related to the state of Hard Disk, RAM, and Chassis. The router sends telemetry data to the specified collector over a configured tunnel connection. The gNMI client subscribed to these paths will receive updates regarding the state of RAM and Hard Disk at the specified intervals. This setup enables proactive monitoring and management of key hardware components on the network device.

Topology

In this setup, an OcNOS router functions as the data source for streaming telemetry, while a gNMI client acts as the receiver of telemetry data. The OcNOS router sends telemetry data to the gNMI client over a dial-out connection.

Figure 11. Dial-out Streaming Telemetry Topology



Use Case 1: Configuring and Validating Telemetry on Management VRF



Note: Before configuring Dial-out, meet all [Prerequisites \(page 135\)](#).

1. Enable streaming telemetry on a management VRF.

```
OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#exit
```

2. Create Sensor Group

Create a sensor group (Platform) where sensor paths will be specified for dial-out subscriptions. Specify sensor paths within the sensor group (Platform) to monitor the chassis state.

```
OcNOS(config)#sensor-group Platform vrf management
OcNOS(telemetry-sensor-group)#sensor-path ipi:/components/component[name="CHASSIS"]/state
OcNOS(telemetry-sensor-group)#exit
```

3. Create Destination Group

Create a destination group (Collector2) where tunnel server settings will be configured for dial-out subscriptions. Specify the tunnel server (gNMI Client) IP address (10.21.3.4) and port (11123) within the destination group (Collector2).

```
OcNOS(config)#destination-group Collector2 vrf management
OcNOS(telemetry-grpc-tunnel-group)#tunnel-server ip 10.21.3.4 port 11123
OcNOS(telemetry-grpc-tunnel-group)#exit
```

4. Create Persistent Subscription

Establish a persistent subscription (storage2) with an encoding type (JSON-IETF). Associate it with the destination group (Collector2), and sensor group (Platform) to monitor the chassis state with a sample interval (95 seconds).

```
OcNOS(config)#subscription-name storage2 vrf management
OcNOS(telemetry-subscription)#encoding json-ietf
OcNOS(telemetry-subscription)#destination-group Collector2
OcNOS(telemetry-subscription)#sensor-group Platform sample-interval 95
OcNOS(telemetry-subscription)#commit
OcNOS(telemetry-subscription)#exit
```

5. Verify the Running Configurations on Management VRF

To confirm the configuration, use the `show running-config streaming-telemetry` command, which displays all configured settings, including sensor groups, destination groups, and subscriptions:

```
OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
!
sensor-group Platform vrf management
  sensor-path ipi:/components/component[name="CHASSIS"]/state
!
destination-group Collector2 vrf management
  tunnel-server ip 10.21.3.4 port 11123
!
subscription-name storage2 vrf management
  destination-group Collector2
  sensor-group Platform sample-interval 95
!
```

6. Validate the Telemetry Configuration on Management VRF

Use the `show streaming-telemetry persistent-subscriptions details` command to verify the active telemetry sessions. The output should confirm:

- Telemetry instances running on `management` VRF
- Active sensor paths (4) and sample intervals (10)
- Destination group status and configured IP:Port details `10.21.3.4:11123`.
- Dial-out subscriptions marked as `ACTIVE`

The validation output confirms that the telemetry subscription (`storage2`) is active, sending data to `Collector2`, and monitoring the chassis state at a 95-second interval.

```
OcNOS#show streaming-telemetry persistent-subscriptions details
```

```
Number of telemetry instances : 1 (management)
Platform type                 : High range
Maximum sensor-paths         : 100
Minimum sample-interval      : 10
CPU monitoring                : ENABLED (NORMAL)
CPU monitoring threshold      : 40
Number of active sensor-paths : 4 (Dial-In : 0, Dial-out : 4)
```

```
SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path   : Sensor Path
```

```
1. Subscription Details (VRF-Name: management):
```

```
~~~~~
Port          : 9339
TLS           : Disabled
insecure-tls  : False
```

```
Dial-Out Subscription Details:
```

```
~~~~~
```

```
1. Subscription-name : storage2
```

```
Status : ACTIVE
```

```
Enc-Type : JSON
```

```
Tunnel-server details:
```

```
~~~~~
```

```
Tunnel-server Retry-interval : Default-60 (seconds)
```

```
Destination-group      Status      Tunnel-IP:Port
-----
Collector2             ACTIVE      10.21.3.4:11123
```

```
Sensor-group details:
```

```
~~~~~
```

```
Sensor-group      SI      Origin:Path
```

```
-----
```

```
Platform          95      ipi:/components/component[name="CHASSIS"]/state
```

```
[*]ipi:/components/component[name="CHASSIS"]/state/memory
```

```
[*]ipi:/components/component[name="CHASSIS"]/state/board-
```

```
fru
```

```
[*]ipi:/components/component
```

```
[name="CHASSIS"]/state/temperature
```

```
[*]-> Indicates child path learnt from parent config, not configured by user
```

Use Case 2: Configuring and Validating Telemetry on a User-defined VRF



Note: Before configuring Dial-out, meet all [Prerequisites \(page 135\)](#).

1. Create the VRF `VRF1` and enable streaming telemetry in a user-defined VRF on an OcNOS router.

```
OcNOS(config)#ip vrf VRF1
OcNOS(config-vrf)#exit
OcNOS(config)#feature streaming-telemetry vrf VRF1
OcNOS(feature-telemetry-config)#exit
```

2. Create Sensor Group

Create a sensor group (Platform) where sensor paths will be specified for dial-out subscriptions. Specify sensor paths within the sensor group (Platform) to monitor the state of RAM and Hard Disk.

```
OcNOS(config)#sensor-group Platform vrf VRF1
OcNOS(telemetry-sensor-group)#sensor-path ipi:/components/component[name="RAM"]/ram/state
OcNOS(telemetry-sensor-group)#sensor-path ipi:/components/component[name="HARD-DISK"]/storage/state
OcNOS(telemetry-sensor-group)#exit
```

3. Create Destination Group

Create a destination group (Collector3) where tunnel server settings will be configured for dial-out subscriptions. Specify the tunnel server (gNMI Client) IP address (10.21.3.4) and port (11123) within the destination group (Collector3).

```
OcNOS(config)#destination-group Collector3 vrf VRF1
OcNOS(telemetry-grpc-tunnel-group)#tunnel-server ip 10.21.3.4 port 11123
OcNOS(telemetry-grpc-tunnel-group)#exit
```

4. Create Persistent Subscription

Establish a persistent subscription (storage) with an encoding type (JSON-IETF). Associate it with the destination group (Collector3), and sensor group (Platform) to monitor the state of RAM and Hard Disk with a sample interval (95 seconds).

```
OcNOS(config)#subscription-name storage vrf VRF1
OcNOS(telemetry-subscription)#encoding json-ietf
OcNOS(telemetry-subscription)#destination-group Collector3
OcNOS(telemetry-subscription)#sensor-group Platform sample-interval 95
OcNOS(telemetry-subscription)#commit
OcNOS(telemetry-subscription)#exit
```

5. Verify the Running Configurations on User-defined VRF

To confirm the telemetry configuration, use the `show running-config streaming-telemetry` command, which displays all active settings, including enabled telemetry features, sensor groups, destination groups, and subscriptions:

```
OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry vrf VRF1
!
debug telemetry gnmi enable severity debug
!
sensor-group Platform vrf VRF1
  sensor-path ipi:/components/component[name="RAM"]/ram/state
  sensor-path ipi:/components/component[name="HARD-DISK"]/storage/state
!
destination-group Collector3 vrf VRF1
  tunnel-server ip 10.21.3.4 port 11123
!
subscription-name storage vrf VRF1
  destination-group Collector3
  sensor-group Platform sample-interval 95
!
```

6. Validate the Telemetry Configuration on User-defined VRF

To verify telemetry is actively streaming data, use the `show streaming-telemetry persistent-subscriptions details` command. The output confirms:

- Telemetry instances running on VRF1
- Number of active sensor paths (2) and sample intervals (10)
- Destination group status and configured IP:Port details 10.21.3.4:11123.
- Dial-out subscriptions marked as ACTIVE

```
OcNOS#show streaming-telemetry persistent-subscriptions details
```

```
Number of telemetry instances : 1 (VRF1)
Platform type                 : High range
Maximum sensor-paths         : 100
Minimum sample-interval      : 10
CPU monitoring                : ENABLED (NORMAL)
CPU monitoring threshold      : 40
Number of active sensor-paths : 2 (Dial-In : 0, Dial-out : 2)
```

```
SI          : Sampling Interval in seconds
Enc-Type    : Encoding type
Origin:Path  : Sensor Path
```

```
1. Subscription Details (VRF-Name: VRF1):
```

```
~~~~~
Port          : 9339
TLS           : Disabled
insecure-tls  : False
```

```
Dial-Out Subscription Details:
```

```
~~~~~
```

```
1. Subscription-name : storage
   Status             : ACTIVE
   Enc-Type           : JSON
```

```
Tunnel-server details:
```

```
~~~~~
```

```
Tunnel-server Retry-interval : Default-60 (seconds)
```

Destination-group	Status	Tunnel-IP:Port
-----	-----	-----
Collector3	ACTIVE	10.21.3.4:11123

```
Sensor-group details:
```

```
~~~~~
```

Sensor-group	SI	Origin:Path
-----	-----	-----
Platform	95	ipi:/components/component[name="RAM"]/ram/state
		ipi:/components/component[name="HARD-DISK"]/storage/state

Use Case 3: Configuring and Validating Telemetry on Default VRF



Note: Before configuring Dial-out, meet all [Prerequisites \(page 135\)](#).

1. Enable Streaming Telemetry in a default VRF on an OcNOS router.

```
OcNOS(config)#feature streaming-telemetry
OcNOS(feature-telemetry-config)#exit
```

2. Create Sensor Group

Create a sensor group (Platform) where sensor paths will be specified for dial-out subscriptions. Specify sensor paths within the sensor group (Platform) to monitor the state of RAM and Hard Disk.

```
OcNOS (config) #sensor-group Platform
OcNOS (telemetry-sensor-group) #sensor-path ipi:/components/component[name="RAM"]/ram/state
OcNOS (telemetry-sensor-group) #sensor-path ipi:/components/component[name="HARD-DISK"]/storage/state
OcNOS (telemetry-sensor-group) #exit
```

3. Create Destination Group

Create a destination group (Collector1) where tunnel server settings will be configured for dial-out subscriptions. Specify the tunnel server (gNMI Client) IP address (10.12.101.72) and port (11161) within the destination group (Collector1).

```
OcNOS (config) #destination-group Collector1
OcNOS (telemetry-grpc-tunnel-group) #tunnel-server ip 10.12.101.72 port 11161
OcNOS (telemetry-grpc-tunnel-group) #exit
```

4. Create Persistent Subscription

Establish a persistent subscription (storage) with an encoding type (JSON-IETF). Associate it with the destination group (Collector1), and sensor group (Platform) to monitor the state of RAM and Hard Disk with a sample interval (10 seconds).

```
OcNOS (config) #subscription-name storage
OcNOS (telemetry-subscription) #encoding json-ietf
OcNOS (telemetry-subscription) #destination-group Collector1
OcNOS (telemetry-subscription) #sensor-group Platform sample-interval 10
OcNOS (telemetry-subscription) #commit
OcNOS (telemetry-subscription) #exit
```

5. Verify the Telemetry Running Configurations on default VRF

To confirm the configuration, use the `show running-config streaming-telemetry` command, which displays all configured settings, including sensor groups, destination groups, and subscriptions:

```
OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry
!
debug telemetry gnmi enable severity debug
!
sensor-group Platform
  sensor-path ipi:/components/component[name="RAM"]/ram/state
  sensor-path ipi:/components/component[name="HARD-DISK"]/storage/state
!
destination-group Collector1
  tunnel-server ip 10.12.101.72 port 11161
!
subscription-name storage
  destination-group Collector1
  sensor-group Platform sample-interval 10
!
!
```

6. Validate the Telemetry Configuration on Default VRF

Use the `show streaming-telemetry persistent-subscriptions details` command to verify that telemetry is actively streaming data. The output confirms:

- Telemetry instance running on the default VRF
- Number of active sensor paths (2) and sample intervals (10)
- Destination group status and configured IP:Port details (10.12.101.72:11161)

- Dial-out subscriptions marked as ACTIVE

```
#show streaming-telemetry persistent-subscriptions details

Number of telemetry instances : 1 (default)
Platform type                : High range
Maximum sensor-paths         : 100
Minimum sample-interval      : 10
CPU monitoring                : ENABLED (NORMAL)
CPU monitoring threshold      : 40
Number of active sensor-paths : 2 (Dial-In : 0, Dial-out : 2)

SI          : Sampling Interval in seconds
Enc-Type    : Encoding type
Origin:Path  : Sensor Path

1. Subscription Details (VRF-Name: default):
~~~~~
Port        : 9339
TLS         : Disabled
insecure-tls : False

Dial-Out Subscription Details:
~~~~~
1. Subscription-name : storage
   Status            : ACTIVE
   Enc-Type          : JSON
   Tunnel-server details:
   ~~~~~
   Tunnel-server Retry-interval : Default-60 (seconds)

   Destination-group      Status      Tunnel-IP:Port
   -----
   Collector1             ACTIVE      10.12.101.72:11161

Sensor-group details:
~~~~~
Sensor-group      SI      Origin:Path
-----
Platform          10      ipi:/components/component[name="RAM"]/ram/state
                   ipi:/components/component[name="HARD-DISK"]/storage/state
```

Use Case 4: Configuring and Validating Telemetry with Multiple Key Sensor Paths in Management VRF



Note: Before configuring Dial-out, meet all [Prerequisites \(page 135\)](#).

1. Enable Streaming Telemetry in a Management VRF on an OcNOS router.

```
OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#commit
OcNOS(feature-telemetry-config)#exit
```

2. Create Sensor Group

Define a sensor group (bfd) to monitor the state of BFD session counters for IPv4 packets. Configure the sensor path using multiple key values.

**Notes:**

- Key-value pairs must be configured in the same order defined by the [IPI data model sensor path](#) list. For more details, refer to the [XPath Formatting Rules for Streaming Telemetry \(page 39\)](#) section.
- OcNOS does not support the following sensor-path key-pattern combinations in dial-out mode. Avoid these configurations:
 - **Partial + Implicit sensor-path:** `ipi:/bgp/bgp-instances/bgp-instance[bgp-as=1*]/peers/peer/state`
 - **Explicit + Implicit sensor-path:** `ipi:/bgp/bgp-instances/bgp-instance[bgp-as=*]/peers/peer/state`
 - **Implicit + Explicit sensor-path:** `ipi:/bgp/bgp-instances/bgp-instance/peers/peer[peer-address=*]/state`
- Ensure that sensor-path configurations use only supported wildcard types, explicit key values, or full implicit paths when setting up dial-out subscriptions.

```
OcNOS(config)#sensor-group bfd vrf management
OcNOS(telemetry-sensor-group)#sensor-path ipi:/bfd/sessions/session[local-discriminator="2050"][vrf-name="default"]/state/counters/packets/ipv4
OcNOS(telemetry-sensor-group)#commit
OcNOS(telemetry-sensor-group)#exit
```

3. Create Destination Group

Configure the destination group (tunnel-1) with the gNMI client's IP address (10.16.12.40) and port (11123).

```
OcNOS(config)#destination-group tunnel-1 vrf management
OcNOS(telemetry-grpc-tunnel-group)#tunnel-server ip 10.16.12.40 port 11123
OcNOS(telemetry-grpc-tunnel-group)#commit
OcNOS(telemetry-grpc-tunnel-group)#exit
```

4. Create Persistent Subscription

Create a persistent subscription (sub-1) and associate it with the tunnel-1 destination group and bfd sensor group. Set a sample interval of 100 seconds.

```
OcNOS(config)#subscription-name sub-1 vrf management
OcNOS(telemetry-subscription)#destination-group tunnel-1
OcNOS(telemetry-subscription)#sensor-group bfd sample-interval 100
OcNOS(telemetry-subscription)#commit
OcNOS(telemetry-subscription)#exit
```

5. Verify the Telemetry Running Configurations for Multiple Key Sensor Paths

To confirm the configuration, use the `show running-config streaming-telemetry` command. The output displays all configured settings, including sensor groups, destination groups, and subscriptions.

```
OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
!
sensor-group bfd vrf management
  sensor-path ipi:/bfd/sessions/session[local-discriminator="2050"][vrf-name="default"]/state/counters/packets/ipv4
!
destination-group tunnel-1 vrf management
  tunnel-server ip 10.16.12.40 port 11123
!
```

```
subscription-name sub-1 vrf management
destination-group tunnel-1
sensor-group bfd sample-interval 100
!
!
```

6. Validate the Telemetry Configuration for Multiple Key Sensor Paths

Use the `show streaming-telemetry` command to confirm the telemetry instance is running and verify sensor group details. The expected output should confirm:

- Telemetry is running on the `management` VRF
- One active sensor path for dial-out telemetry
- Configured subscription (`sub-1`)
- Destination group (`tunnel-1`) should be `ACTIVE`
- BFD sensor path is properly monitored at a `100-second` sample interval

```
OcNOS#show streaming-telemetry
```

```
Number of telemetry instances : 1 (management)
Platform type                 : Standard range
Maximum sensor-paths         : 50
Minimum sample-interval      : 90
CPU monitoring                : ENABLED (NORMAL)
CPU monitoring threshold      : 40
Number of active sensor-paths : 1 (Dial-In : 0, Dial-out : 1)
```

```
SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path  : Sensor Path
```

```
1. Subscription Details (VRF-Name: management):
```

```
~~~~~
Port          : 9339
TLS           : Disabled
insecure-tls  : False
```

```
Dial-Out Subscription Details:
```

```
~~~~~
```

```
1. Subscription-name : sub-1
Status              : ACTIVE
Enc-Type            : JSON
```

```
Tunnel-server details:
```

```
~~~~~
```

```
Tunnel-server Retry-interval : Default-60 (seconds)
```

Destination-group	Status	Tunnel-IP:Port
-----	-----	-----
tunnel-1	IN-ACTIVE	10.16.12.40:11123

```
Sensor-group details:
```

```
~~~~~
```

Sensor-group	SI	Origin:Path
-----	-----	-----
bfd	100	ipi:/bfd/sessions/session[local-discriminator="2050"]

```
[vrf-name="default"]/state/counters/packets/ipv4
```

Telemetry Subscription Invoked via gnmic Command and YAML Input

Start the gNMI collector with the `--use-tunnel-server` and `publish` options to receive the streamed gRPC responses. Execute the following command to start the gRPC tunnel server in listening mode, enabling it to accept incoming connections from gRPC tunnel clients (OcNOS target).

```
./gnmic --insecure --config <path to Tunnel-server yaml file> --use-tunnel-server publish
```

Invoke Publish RPC on OcNOS Target

The following output represents telemetry data published by the `gnmic` command, monitoring the state of Hard Disk and RAM on the specified OcNOS router.

```
# ./gnmic --insecure --config abc.yaml --use-tunnel-server publish
2024/04/12 11:22:50.516313 [gnmic] version=dev, commit=none, date=unknown, gitURL=,
docs=https://gnmic.openconfig.net
2024/04/12 11:22:50.516377 [gnmic] using config file "abc.yaml"
2024/04/12 11:22:50.517770 [gnmic] starting output type file
2024/04/12 11:22:50.517971 [file_output:default-stdout] initialized file output: {"Cfg":
{"FileName":"","FileType":"stdout","Format":"json","Multiline":true,"Indent":"","Separator":"\n","O
verrideTimestamps":false,"AddTarget":"","TargetTemplate":"","EventProcessors":null,"MsgTemplate":"","
ConcurrencyLimit":1000,"EnableMetrics":false,"Debug":false}}
2024/04/12 11:22:50.518018 [gnmic] StartPublishCollector is invoked
2024/04/12 11:22:50.518446 [gnmic] Initializing error chan
2024/04/12 11:22:54.508410 [gnmic] tunnel server discovered target {ID:e8:c5:7a:fe:fd:32 Type:GNMI_
GNOI}
2024/04/12 11:22:54.508720 [gnmic] adding target
{"name":"e8:c5:7a:fe:fd:32","address":"e8:c5:7a:fe:fd:32","username":"root","password":"****","timeou
t":10000000000,"insecure":true,"skip-verify":false,"buffer-size":100,"retry-timer":10000000000,"log-
tls-secret":false,"gzip":false,"token":"","tunnel-target-type":"GNMI_GNOI"}
2024/04/12 11:22:54.508756 [gnmic] calling publishStream
2024/04/12 11:22:54.508772 [gnmic] publishStream is invoked
2024/04/12 11:22:54.508779 [gnmic] targetPublishStream is invoked
2024/04/12 11:22:54.508830 [gnmic] a.targetsChan: 0xc0004eb1a0
2024/04/12 11:22:54.508840 [gnmic] t.Config.Outputs: []
2024/04/12 11:22:54.508850 [gnmic] starting target "e8:c5:7a:fe:fd:32" listener
2024/04/12 11:22:54.508879 [gnmic] queuing target "e8:c5:7a:fe:fd:32"
2024/04/12 11:22:54.508902 [gnmic] subscribing to target: "e8:c5:7a:fe:fd:32"
2024/04/12 11:22:54.508918 [gnmic] calling clientPublish
2024/04/12 11:22:54.508930 [gnmic] targetDialOpts: []grpc.DialOption
2024/04/12 11:22:54.508968 [gnmic] a.targetsChan: 0xc0004eb1a0
2024/04/12 11:22:54.508976 [gnmic] t.Config.Outputs: []
2024/04/12 11:22:54.509402 [gnmic] dialing tunnel connection for tunnel target "e8:c5:7a:fe:fd:32"
Publish Request sent to e8:c5:7a:fe:fd:32{
  "source": "e8:c5:7a:fe:fd:32",
  "subscription-name": "storage",
  "timestamp": 1712920892603436151,
  "time": "2024-04-12T16:51:32.603436151+05:30",
  "updates": [
    {
      "Path": "ipi:components/component[name=\"HARD-DISK\"]/storage/state",
      "values": {
        "components/component/storage/state": {
          "free-memory": 0,
          "total-memory": 61057,
          "used-memory": 0
        }
      }
    }
  ]
}
{
  "source": "e8:c5:7a:fe:fd:32",
```

```

"subscription-name": "storage",
"timestamp": 1712920892603253590,
"time": "2024-04-12T16:51:32.60325359+05:30",
"updates": [
  {
    "Path": "ipi:components/component[name=\"RAM\"]/ram/state",
    "values": {
      "components/component/ram/state": {
        "available-high-memory": 0,
        "available-memory": 15084,
        "buffers": 101,
        "current-process-count": 227,
        "free-swap": 0,
        "shared-memory": 28,
        "total-high-memory": 0,
        "total-memory": 16010,
        "total-swap": 0,
        "used-memory": 926
      }
    }
  }
]
}

```

The output of the Publish RPC includes the following information:

Table 16. Publish RPC Output details

Option	Description
source	Displays the MAC address associated with the management port of the target. Each gNMI device have a unique target ID, allowing the collector to distinguish responses between various targets.
subscription-name	The name of the subscription.
timestamp	The timestamp of the response.
time	The timestamp in a human-readable format.
updates	An array of updates, each containing Path and Values.
Path	The path to the published data.
values	The values of the published data.

The telemetry data output includes detailed fields for monitoring the state of the Hard Disk and RAM, offering insights into the memory and storage utilization of the OcNOS router.

1. Hard Disk State

- **Free Memory:** The amount of free memory available on the hard disk.
- **Total Memory:** The total capacity of memory on the hard disk.
- **Used Memory:** The amount of memory currently in use on the hard disk.

2. RAM State

- **Available High Memory:** The available high memory in the RAM.
- **Available Memory:** The total available memory in the RAM.
- **Buffers:** The number of buffer processes running in the RAM.

- **Current Process Count:** The count of active processes in the RAM.
- **Free Swap:** The amount of free swap space in the RAM.
- **Shared Memory:** The shared memory usage in the RAM.
- **Total High Memory:** The total high memory capacity in the RAM.
- **Total Memory:** The total memory capacity in the RAM.
- **Total Swap:** The total swap space available in the RAM.
- **Used Memory:** The amount of memory currently in use in the RAM.

Implementation Examples

ISP Backbone Network Monitoring

Scenario

An Internet Service Provider (ISP) operates a large-scale network across multiple cities. The Network Operations Center (NOC) needs real-time monitoring of core routers, including CPU utilization, link bandwidth usage, and BGP peer status. Instead of polling data periodically using SNMP, they implement OcNOS Streaming Telemetry Dial-Out Mode to push telemetry data directly to a central collector.

Implementation

- Enable streaming telemetry on core routers handling internet traffic.
- Configure sensor groups to monitor BGP neighbors, interface utilization, and hardware health.
- Set up a telemetry collector (Prometheus, InfluxDB, or a custom-built system) to receive dial-out telemetry streams.
- Establish persistent subscriptions for real-time alerts on link congestion, dropped packets, and CPU spikes.

For step-by-step configurations, refer to the [Dial-Out configuration](#) section.

Dial-Out Commands

Refer to the streaming telemetry dial-out mode commands in the [Streaming Telemetry Commands \(page 43\)](#) section.

Revised CLI Commands

The following is the revised command for telemetry.

show techsupport

- The existing syntax now includes the newly added parameter for telemetry, namely `gnmi`.
- The command `show techsupport gnmi` collects gNMI-related information for technical support. For more details, refer to the `show techsupport` command in the **Software Monitoring and Reporting** section in the *OcNOS Sysytem Management Guide*.

Glossary

The following provides definitions for key terms or abbreviations and their meanings used throughout this document:

Key Terms/Acronym	Description
gRPC	Remote Procedure Call
Persistent Subscription	Telemetry subscription that maintains continuous data streaming even after interruptions in connectivity.
gRPC Network Management Interface (gNMI)	A standardized protocol for network management using gRPC and protocol buffers.
Destination Group	Specifies the collector server's details and connection parameters for telemetry subscriptions.
Sensor Group	Contains sensor paths that define the specific data to be monitored and transmitted.
OpenConfig	Standardized model for network configuration and telemetry using a vendor-neutral approach.

STREAMING TELEMETRY OVER TRANSPORT LAYER SECURITY

Overview

Transport Layer Security (TLS) is a cryptographic protocol that secures communication over networks by encrypting data exchanged between systems. TLS ensures confidentiality and integrity, which prevents unauthorized access and data tampering.

Streaming telemetry with TLS secures the real-time transmission of network monitoring data between gNMI Server (OcNOS Target) and gNMI Client (Collector). By encrypting telemetry streams, TLS prevents data interception, manipulation, and unauthorized access, ensuring that only trusted endpoints can exchange sensitive network performance metrics.

Feature Characteristics

To secure networks, configure and copy the TLS server, client, and CA certificates to the OcNOS device, following the [telemetry certificate generation process](#). The session between the gNMI server and the gNMI client remains encrypted using TLS. The system validates connections with the certificates used by the server and client.

Insecure TLS: Allows users to enable an [insecure](#) option where client certificates are validated only if provided.



Note: In OcNOS, streaming telemetry over TLS secures incoming packets for dial-in connections. Transport Layer Security (TLS) is not supported for dial-out mode subscriptions.

Benefits

Enhanced Security: Encrypts telemetry data in transit, preventing unauthorized access and data interception. TLS ensures confidentiality, integrity, and authentication, making sure only trusted endpoints exchange telemetry data.

Real-Time Secure Monitoring: Ensures telemetry insights are securely delivered to collectors without risk of interception.

Scalability: Supports high-frequency telemetry streams with minimal performance overhead.

Flexibility: Supports both secure (TLS-enabled) and insecure (optional) modes based on deployment needs.

User Authentication and Certificate Loading for gNMI TLS Connections

OcNOS enhances gNMI TLS connection support by additional authentication and certificate management capabilities.

The gNMI client-server communication continues to use TLS for secure transport. In addition to validating the client X.509 certificate's Common Name (CN) for authentication, OcNOS supports gRPC-contained user and password—

based authentication. This enhancement addresses customer requirements for flexible authentication methods during secure telemetry sessions.

TLS-based Connection Security: TLS provides encryption and integrity for all gNMI communication between the client and the OcNOS server.

Client Authentication Options

- **X.509 Certificate Validation:** The device validates the client certificate's Common Name (CN) to authenticate the client identity.
- **User and Password Authentication:** gRPC-contained credentials (username and password) are supported in addition to certificate-based validation.

Loading X.509 Certificates on OcNOS

To simplify certificate handling and enable seamless Zero Touch Provisioning (ZTP) workflows, [crypto pki load source-interface \(page 45\)](#) command is used to load X.509 server and CA certificates directly from an external source.

Updated the [port \(page 58\)](#) and [tls tls-port \(page 86\)](#) commands port range from <32768-60999> to <1024-65535> to support flexible TLS deployment with the default port configuration.

gNMI TLS Authentication Command

Use the gnmic client to initiate a TLS-secured gNMI connection using both X.509 certificate authentication and gRPC-contained user credentials.

```
gnmic -a <device_address:port> -u <username> -p <password> get \
--path "ipi:/components/component[name=\"HARD-DISK\"]/storage/state" \
--tls-cert ClientCert.pem --tls-key client.pem --tls-ca ca.pem \
--tls-server-name "OcNOS" --encoding "JSON_IETF" --debug
```

This command:

- Connects securely to the OcNOS gNMI server using TLS.
- Authenticates the client with both user credentials and certificates.
- Retrieves the specified sensor path data in JSON_IETF encoding format.

Configuration

The following steps illustrate an example use case for configuring and validating a secure gNMI TLS connection with user authentication and X.509 certificates.

Step 1: Load Server and CA Certificates

Use the [crypto pki load source-interface \(page 45\)](#) command to copy the required server and CA certificates from an external source to OcNOS. This enables TLS authentication for gNMI sessions.

```
OcNOS#crypto pki load http://root:sysmgmt123@10.16.99.115/cert.pem
OcNOS#crypto pki load http://root:sysmgmt123@10.16.99.115/ca.pem
```

The above commands load the server certificate (`cert.pem`) and CA certificate (`ca.pem`) from an HTTP server into the device certificate store.

Step 2: Enable Streaming Telemetry and Configure TLS Port

Enter configuration mode and enable the Streaming Telemetry feature under the management VRF. Specify a TLS port in the supported range (1024–65535).

```
OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#tls tls-port 55545
OcNOS(feature-telemetry-config)#commit
2025 Aug 23 04:09:51.461 : OcNOS : CML : CRITI : Commit Progress: 100%
[|||||] ETA: --:--:--

OcNOS(feature-telemetry-config)#exit
```

Step 3: Verify Telemetry Configuration

Use the [show running-config streaming-telemetry \(page 76\)](#) command to verify the telemetry configuration.

```
OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
tls tls-port 55545
!
```

Check the operational status using the [show streaming-telemetry \(page 66\)](#) command.

```
OcNOS#show streaming-telemetry

Number of telemetry instances : 1 (management)
Platform type                 : High range
Maximum sensor-paths         : 100
Minimum sample-interval      : 10
CPU monitoring                : ENABLED (NORMAL)
CPU monitoring threshold      : 40
Number of active sensor-paths : 1 (Dial-In : 1, Dial-out : 0)

SI          : Sampling Interval in seconds
Enc-Type    : Encoding type
Origin:Path  : Sensor Path

1. Subscription Details (VRF-Name: management):
~~~~~
Port        : 55545
TLS         : Enabled
insecure-tls : False

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
10.14.105.105:45210 53937 90      JSON_IETF     ipi:/interfaces/interface[n
ame="eth0"]/state/counters
```

Step 4: Establish Secure gNMI Connection from Client

From the gNMI client system, initiate a secure TLS-based connection using both user credentials and certificates.

Use the following sample `gnmic` command:

```
./gnmic -a 10.16.179.118:55545 -u ocnos -p ocnos -e json_ietf --mode STREAM --stream-mode sample --
sample-interval 90s sub --path "ipi:/interfaces/interface[name=\"eth0\"]/state/counters" --tls-ca
ca.pem --tls-cert ClientCert.pem --tls-key client.pem --tls-server-name "OcNOS" --log
```

This command authenticates using the provided username and password, validates the TLS certificates, and streams telemetry data for the specified sensor path.

Step 5: Observe Streaming Output

When the connection is successfully established, the gNMI client receives periodic telemetry updates.

```
{
  "source": "10.16.179.118:55545",
  "subscription-name": "default-1755922991",
  "timestamp": 1755922360262334487,
  "time": "2025-08-23T04:12:40.262334487Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state/counters",
      "values": {
        "interfaces/interface/state/counters": {
          "in-broadcast-pkts": "0",
          "in-discards": "0",
          "in-errors": "0",
          "in-multicast-pkts": "19886",
          "in-octets": "48551882",
          "in-pkts": "57036",
          "in-unicast-pkts": "0",
          "last-clear": "Never",
          "out-broadcast-pkts": "0",
          "out-discards": "0",
          "out-errors": "0",
          "out-multicast-pkts": "0",
          "out-octets": "1369239",
          "out-pkts": "8408",
          "out-unicast-pkts": "0"
        }
      }
    }
  ]
}
```

```
{
  "source": "10.16.179.118:55545",
  "subscription-name": "default-1755922991",
  "timestamp": 1755922449267968226,
  "time": "2025-08-23T04:14:09.267968226Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state/counters",
      "values": {
        "interfaces/interface/state/counters": {
          "in-broadcast-pkts": "0",
          "in-discards": "0",
          "in-errors": "0",
          "in-multicast-pkts": "19961",
          "in-octets": "48557417",
          "in-pkts": "57108",
          "in-unicast-pkts": "0",
          "last-clear": "Never",
          "out-broadcast-pkts": "0",
          "out-discards": "0",
          "out-errors": "0",
          "out-multicast-pkts": "0",
          "out-octets": "1369239",
          "out-pkts": "8408",
          "out-unicast-pkts": "0"
        }
      }
    }
  ]
}
```

```

        "out-errors": "0",
        "out-multicast-pkts": "0",
        "out-octets": "1370733",
        "out-pkts": "8423",
        "out-unicast-pkts": "0"
    }
}
]
}

```

Certificate Management for OcNOS and gNMI



Note: Before proceeding with certificate generation, ensure that the date and time on the OcNOS device matches those on the virtual machine (VM) where all certificates are generated. A discrepancy can result in errors such as **certificate is expired**, which may hinder connection establishment.

Generate CA certificates

To create a Certificate Authority (CA) certificate and its corresponding private key, use the following OpenSSL command:

```
openssl req -newkey rsa:2048 -new -nodes -x509 -days 3650 -keyout rootCAKey.pem -out rootCACert.pem
```

Generate Server Certificates

1. To generate the server key, server certificate request (CSR), and certificate authority (CA) certificate, follow the below steps at the OcNOS cmlsh prompt:

- Use the following command, replacing `<server-ip>` with the server's actual IPv4 address:

```
crypto pki generate rsa common-name ipv4 <server-ip>
```

2. After generating, view the CSR with:

```
show crypto csr
```

- Copy the output from the `show crypto csr` command and paste it into a file named `ServerCert.csr`.

3. **Subject Alternative Name Requirement:** For the gNMI server, it is important to include the Subject Alternative Name (SAN) in the server certificate. To incorporate SAN into the server certificate, use the `san.ext` extension file.

```

cat san.ext

subjectAltName = @alt_names

[alt_names]
DNS.1 = OcNOS

```

Utilize the `san.ext` file and the CSR to generate the server certificate using the following OpenSSL command:

```
openssl x509 -req -sha256 -in ServerCert.csr -extfile san.ext -CA rootCACert.pem -CAkey rootCAKey.pem -CAcreateserial -out ServerCert.pem -days 365
```

Generate Client Certificates

1. Create a configuration file named `ClientCertReq.config` with the following content:

```
[req]
distinguished_name = dn
prompt = no

[dn]
CN = <common-name>
C = IN
L = BNG
O = IPI
```



Note: The client's IP address can be used as a common name. Separate client certificates can be generated for more than one client, but it's important to use the same CA certificate to generate all client certificates.

2. Generate the client certificate and key with the following commands:

```
openssl req -newkey rsa:2048 -keyout ClientKey.pem -out ClientCert.csr -config
./ClientCertReq.config -nodes -days 365
```

```
openssl x509 -req -sha256 -in ClientCert.csr -CA rootCACert.pem -CAkey rootCAKey.pem -
CAcreateserial -out ClientCert.pem -days 365
```

Rename and Copy Certificates

1. Rename and prepare the certificates for deployment as follows:

```
cp ClientKey.pem client.pem
cp ServerCert.pem cert_gnmid.pem
cp rootCACert.pem ca.pem
cat ClientCert.pem >> client.pem
```

2. Copy the server certificate and CA certificate to the OcNOS device using:

```
scp cert_gnmid.pem root@<mgmtIP>:/cfg/usr/local/etc/tls/certs/
scp ca.pem root@<mgmtIP>:/cfg/usr/local/etc/tls/certs/
```

3. Copy Client Certificates where `gnmic` can access `copy ClientCert.pem client.pem` and `ca.pem`
4. Enable TLS for dial-in and dial-out configurations by placing client certificates in the `/cfg/usr/local/etc/tls/client/` directory on the OcNOS device.



Note: Create a directory named `client` within the `/cfg/usr/local/etc/tls/` directory on the OcNOS device. Then, copy the client certificates (`ClientCert.pem`, `client.pem`, and `ca.pem`) into the `client` folder at `/cfg/usr/local/etc/tls/client/`.

Insecure TLS Configuration

TLS encryption secures the session between the gNMI server and client, with both parties validating the provided certificates. Users can enable TLS with the insecure option but note that the system will only verify client certificates if they are provided. Here is an example for the [insecure TLS setup](#).

gNMI Client



Note: In OcNOS, streaming telemetry over TLS secures incoming packets for dial-in connections. Transport Layer Security (TLS) is not supported for dial-out mode subscriptions.

To authenticate a certificate, `gnmic` utilizes the client certificate, key, and CA certificate. Below are the command syntax and examples for dial-in subscription mode to establish secure and insecure TLS connections using the gNMI client, providing flexibility depending on the user's security requirements.

Syntax: Secure TLS

```
gnmic -a <ipaddress:port> -u <UserName> -p <Password> --mode STREAM --stream-mode sample --sample-interval <sample-interval-value> sub --path <path> --tls-cert ClientCert.pem --tls-key client.pem --tls-ca ca.pem --tls-server-name "<subject-alt-name>"
```

Example to establish a secure TLS dial-in connection:

```
./gnmic -a 10.12.160.33:55545 -u admin -p admin --mode STREAM --stream-mode sample --sample-interval 90s sub --path "ipi:/interfaces/interface[name=\"eth0\"]/state" --tls-cert ClientCert.pem --tls-key client.pem --tls-ca ca.pem --tls-server-name "OcNOS" --debug
```

Syntax: Insecure TLS

```
./gnmic -a <ipaddress:port> -u <Username> -p <Password> --mode STREAM --stream-mode sample --sample-interval <sample-interval-value> sub --path <path> --tls-cert ClientCert.pem --tls-key client.pem --tls-ca ca.pem --tls-ca ca.pem --tls-server-name "<subject-alt-name>" --debug
```

```
./gnmic -a <ipaddress:port> -u <Username> -p <Password> --mode STREAM --stream-mode sample --sample-interval <sample-interval-value> sub --path <path> --tls-ca ca.pem --tls-server-name "<subject-alt-name>" --debug
```

Example to subscribe using an insecure TLS connection:

```
./gnmic -a 10.12.160.33:55545 -u admin -p admin --mode STREAM --stream-mode sample --sample-interval 90s sub --path "ipi:/interfaces/interface[name=eth0]/state" --tls-cert ClientCert.pem --tls-key client.pem --tls-ca ca.pem --tls-server-name "<subject-alt-name>" --debug
```

```
./gnmic -a 10.12.160.33:55545 -u admin -p admin --mode STREAM --stream-mode sample --sample-interval 90s sub --path "ipi:/interfaces/interface[name=eth0]/state" --tls-ca ca.pem --tls-server-name "<subject-alt-name>" --debug
```

TLS Configuration

This section outlines the sample configuration for streaming telemetry over TLS in dial-in subscription mode.

Prerequisites

Before configuring streaming telemetry with TLS, ensure the following:

- A supported OcNOS router running a compatible release.
- Access to the management interface of the router.
- Any gNMI client that complies with gNMI specifications can be used as a client.
- Download and install the gNMI collector package by referring to the [gnmic Installation \(page 32\)](#) section.
- Generate the server and client certificates following the [Certificate Management for OcNOS and gNMI \(page 152\)](#) process to enable secure communication.

Topology

In the following topology ([Figure 12](#)), the gNMI Server (OcNOS Router) establishes a telemetry session with the gNMI Client (Collector). TLS encrypts the telemetry stream, ensuring secure, real-time monitoring of network performance data.

Figure 12. TLS Connection



Note: Before configuring, meet all [Prerequisites \(page 155\)](#).

Enable TLS Connection

Enable streaming telemetry in management VRF and TLS to encrypt and protect the data transmitted during dial-in sessions with the TLS port number 55545.

```
OcNOS(config)#feature streaming-telemetry vrf management
OcNOS(feature-telemetry-config)#tls tls-port 55545
OcNOS(feature-telemetry-config)#commit
OcNOS(feature-telemetry-config)#exit
OcNOS(config)#debug telemetry gnmi enable severity debug
OcNOS(config)#commit
```

Validation

To verify the TLS connection status, check the `TLS` and `insecure-tls` fields in the show output. If the `TLS` field shows `enabled`, the TLS connection is active. If the `insecure-tls` field is marked as `false`, it confirms that it is a secure TLS connection.

```
OcNOS#show streaming-telemetry
```

```
Number of telemetry instances : 1 (management)
Platform type                 : High range
Maximum sensor-paths         : 100
Minimum sample-interval      : 10
Number of active sensor-paths : 6 (Dial-In : 6, Dial-out : 0)
```

```
SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path  : Sensor Path
```

```
1. Subscription Details (VRF-Name: management):
```

```
~~~~~
Port           : 55545
TLS            : Enabled
insecure-tls   : False
```

```
Dial-In STREAM Mode Subscription Details:
```

```
~~~~~
```

ClientIP:Port	ID	SI	Enc-Type	Origin:Path
10.14.105.105:41982	22122	30	JSON	ipi:/interfaces/interface[name="eth0"]/state ipi:/interfaces/interface [name="eth0"]/state/counters ipi:/interfaces/interface[name="xe8"]/state ipi:/interfaces/interface [name="xe8"]/state/counters ipi:/components/component[name="CPU"]/cpu/state ipi:/components/component[name="HARD- DISK"]/storage/state

Streaming Telemetry Running Configuration

To verify the telemetry configuration and view the overall commands used for TLS configuration, use the `show running-config streaming-telemetry` command on the OcNOS router.

```
OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry vrf management
  tls tls-port 55545
!
debug telemetry gnmi enable severity debug
!
!
```

gnmic Response

Below is a sample response illustrating how gnmic retrieves telemetry metrics.

```
./gnmic -a 10.16.179.113:55545 -u admin -p admin --mode STREAM --stream-mode sample --sample-interval
30s sub --path "ipi:/interfaces/interface[name=\"eth0\"]/state" --path "ipi:/interfaces/interface
[name=\"xe8\"]/state" --path "ipi:/components/component[name=\"CPU\"]/cpu/state" --path
"ipi:/components/component[name=\"HARD-DISK\"]/storage/state" --tls-cert ClientCert.pem --tls-key
client.pem --tls-ca ca.pem --tls-server-name "OcNOS"
```

```

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333698145383105,
  "time": "2025-03-18T21:34:58.145383105Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "ifindex": 3,
          "last-change": 9200,
          "logical": false,
          "oper-status": "up",
          "vrf-name": "management"
        }
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333698159202200,
  "time": "2025-03-18T21:34:58.1592022Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state/counters",
      "values": {
        "interfaces/interface/state/counters": {
          "in-broadcast-pkts": 0,
          "in-discards": 0,
          "in-errors": 0,
          "in-multicast-pkts": 36404,
          "in-octets": 3370900,
          "in-pkts": 38518,
          "in-unicast-pkts": 0,
          "last-clear": "Never",
          "out-broadcast-pkts": 0,
          "out-discards": 0,
          "out-errors": 0,
          "out-multicast-pkts": 0,
          "out-octets": 342580,
          "out-pkts": 2555,
          "out-unicast-pkts": 0
        }
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333698166395384,
  "time": "2025-03-18T21:34:58.166395384Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"xe8\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "ifindex": 10009,
          "last-change": 12700,
          "logical": false,

```

```

        "oper-status": "up"
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333698178179386,
  "time": "2025-03-18T21:34:58.178179386Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"xe8\"]/state/counters",
      "values": {
        "interfaces/interface/state/counters": {
          "in-broadcast-pkts": 0,
          "in-discards": 0,
          "in-errors": 0,
          "in-fcs-errors": 0,
          "in-multicast-pkts": 141,
          "in-octets": 15582,
          "in-pkts": 183,
          "in-unicast-pkts": 42,
          "last-clear": "Never",
          "out-broadcast-pkts": 0,
          "out-discards": 0,
          "out-errors": 0,
          "out-multicast-pkts": 1649,
          "out-octets": 229334,
          "out-pkts": 1700,
          "out-unicast-pkts": 51
        }
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333698250104789,
  "time": "2025-03-18T21:34:58.250104789Z",
  "updates": [
    {
      "Path": "ipi:components/component[name=\"CPU\"]/cpu/state",
      "values": {
        "components/component/cpu/state": {
          "cpu-15min-load-percentage": 3.55,
          "cpu-1min-load-percentage": 5.71,
          "cpu-5min-load-percentage": 3.89,
          "cpu-utilization": 6.35,
          "cpu-utilization-alert": 90,
          "cpu-utilization-critical": 80,
          "processor-count": 8
        }
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333698250711580,
  "time": "2025-03-18T21:34:58.25071158Z",
  "updates": [

```

```

{
  "Path": "ipi:components/component[name=\"HARD-DISK\"]/storage/state",
  "values": {
    "components/component/storage/state": {
      "head-count": 16,
      "sector-count": 250000000,
      "total-memory": 122070,
      "unformatted-bytes-or-sector": 0,
      "unformatted-bytes-or-track": 0
    }
  }
}
]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333727146348463,
  "time": "2025-03-18T21:35:27.146348463Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": 0,
            "in-discards": 0,
            "in-errors": 0,
            "in-multicast-pkts": 36424,
            "in-octets": 3372999,
            "in-pkts": 38547,
            "in-unicast-pkts": 0,
            "last-clear": "Never",
            "out-broadcast-pkts": 0,
            "out-discards": 0,
            "out-errors": 0,
            "out-multicast-pkts": 0,
            "out-octets": 345007,
            "out-pkts": 2564,
            "out-unicast-pkts": 0
          },
          "ifindex": 3,
          "last-change": 9200,
          "logical": false,
          "oper-status": "up",
          "vrf-name": "management"
        }
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333727167695852,
  "time": "2025-03-18T21:35:27.167695852Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"xe8\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": 0,
            "in-discards": 0,

```

```

        "in-errors": 0,
        "in-fcs-errors": 0,
        "in-multicast-pkts": 141,
        "in-octets": 15582,
        "in-pkts": 183,
        "in-unicast-pkts": 42,
        "last-clear": "Never",
        "out-broadcast-pkts": 0,
        "out-discards": 0,
        "out-errors": 0,
        "out-multicast-pkts": 1650,
        "out-octets": 229475,
        "out-pkts": 1701,
        "out-unicast-pkts": 51
    },
    "ifindex": 10009,
    "last-change": 12700,
    "logical": false,
    "oper-status": "up"
}
}
]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333727251455652,
  "time": "2025-03-18T21:35:27.251455652Z",
  "updates": [
    {
      "Path": "ipi:components/component[name=\"CPU\"] /cpu/state",
      "values": {
        "components/component/cpu/state": {
          "cpu-15min-load-percentage": 3.55,
          "cpu-1min-load-percentage": 4.9,
          "cpu-5min-load-percentage": 3.91,
          "cpu-utilization": 2.57,
          "cpu-utilization-alert": 90,
          "cpu-utilization-critical": 80,
          "processor-count": 8
        }
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333727251935488,
  "time": "2025-03-18T21:35:27.251935488Z",
  "updates": [
    {
      "Path": "ipi:components/component[name=\"HARD-DISK\"] /storage/state",
      "values": {
        "components/component/storage/state": {
          "head-count": 16,
          "sector-count": 250000000,
          "total-memory": 122070,
          "unformatted-bytes-or-sector": 0,
          "unformatted-bytes-or-track": 0
        }
      }
    }
  ]
}

```

```

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333757147739862,
  "time": "2025-03-18T21:35:57.147739862Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": 0,
            "in-discards": 0,
            "in-errors": 0,
            "in-multicast-pkts": 36444,
            "in-octets": 3375108,
            "in-pkts": 38576,
            "in-unicast-pkts": 0,
            "last-clear": "Never",
            "out-broadcast-pkts": 0,
            "out-discards": 0,
            "out-errors": 0,
            "out-multicast-pkts": 0,
            "out-octets": 347514,
            "out-pkts": 2574,
            "out-unicast-pkts": 0
          },
          "ifindex": 3,
          "last-change": 9200,
          "logical": false,
          "oper-status": "up",
          "vrf-name": "management"
        }
      }
    }
  ]
}
{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333757169646737,
  "time": "2025-03-18T21:35:57.169646737Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"xe8\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": 0,
            "in-discards": 0,
            "in-errors": 0,
            "in-fcs-errors": 0,
            "in-multicast-pkts": 141,
            "in-octets": 15582,
            "in-pkts": 183,
            "in-unicast-pkts": 42,
            "last-clear": "Never",
            "out-broadcast-pkts": 0,
            "out-discards": 0,
            "out-errors": 0,
            "out-multicast-pkts": 1651,
            "out-octets": 229616,
            "out-pkts": 1702,
            "out-unicast-pkts": 51
          }
        }
      }
    }
  ]
}

```

```

        },
        "ifindex": 10009,
        "last-change": 12700,
        "logical": false,
        "oper-status": "up"
    }
}
]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333757252957426,
  "time": "2025-03-18T21:35:57.252957426Z",
  "updates": [
    {
      "Path": "ipi:components/component[name=\"CPU\"]/cpu/state",
      "values": {
        "components/component/cpu/state": {
          "cpu-15min-load-percentage": 3.47,
          "cpu-1min-load-percentage": 3.8,
          "cpu-5min-load-percentage": 3.72,
          "cpu-utilization": 2.03,
          "cpu-utilization-alert": 90,
          "cpu-utilization-critical": 80,
          "processor-count": 8
        }
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333757253488377,
  "time": "2025-03-18T21:35:57.253488377Z",
  "updates": [
    {
      "Path": "ipi:components/component[name=\"HARD-DISK\"]/storage/state",
      "values": {
        "components/component/storage/state": {
          "head-count": 16,
          "sector-count": 250000000,
          "total-memory": 122070,
          "unformatted-bytes-or-sector": 0,
          "unformatted-bytes-or-track": 0
        }
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333787148439365,
  "time": "2025-03-18T21:36:27.148439365Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": 0,

```

```

        "in-discards": 0,
        "in-errors": 0,
        "in-multicast-pkts": 36468,
        "in-octets": 3377517,
        "in-pkts": 38608,
        "in-unicast-pkts": 0,
        "last-clear": "Never",
        "out-broadcast-pkts": 0,
        "out-discards": 0,
        "out-errors": 0,
        "out-multicast-pkts": 0,
        "out-octets": 350031,
        "out-pkts": 2584,
        "out-unicast-pkts": 0
    },
    "ifindex": 3,
    "last-change": 9200,
    "logical": false,
    "oper-status": "up",
    "vrf-name": "management"
}
}
]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333787175261207,
  "time": "2025-03-18T21:36:27.175261207Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"xe8\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": 0,
            "in-discards": 0,
            "in-errors": 0,
            "in-fcs-errors": 0,
            "in-multicast-pkts": 141,
            "in-octets": 15582,
            "in-pkts": 183,
            "in-unicast-pkts": 42,
            "last-clear": "Never",
            "out-broadcast-pkts": 0,
            "out-discards": 0,
            "out-errors": 0,
            "out-multicast-pkts": 1652,
            "out-octets": 229757,
            "out-pkts": 1703,
            "out-unicast-pkts": 51
          },
          "ifindex": 10009,
          "last-change": 12700,
          "logical": false,
          "oper-status": "up"
        }
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",

```

```

"timestamp": 1742333787254084630,
"time": "2025-03-18T21:36:27.25408463Z",
"updates": [
  {
    "Path": "ipi:components/component[name=\"CPU\"]/cpu/state",
    "values": {
      "components/component/cpu/state": {
        "cpu-15min-load-percentage": 3.47,
        "cpu-1min-load-percentage": 3.96,
        "cpu-5min-load-percentage": 3.75,
        "cpu-utilization": 2.58,
        "cpu-utilization-alert": 90,
        "cpu-utilization-critical": 80,
        "processor-count": 8
      }
    }
  }
]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333787254608376,
  "time": "2025-03-18T21:36:27.254608376Z",
  "updates": [
    {
      "Path": "ipi:components/component[name=\"HARD-DISK\"]/storage/state",
      "values": {
        "components/component/storage/state": {
          "head-count": 16,
          "sector-count": 250000000,
          "total-memory": 122070,
          "unformatted-bytes-or-sector": 0,
          "unformatted-bytes-or-track": 0
        }
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333817149889539,
  "time": "2025-03-18T21:36:57.149889539Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": 0,
            "in-discards": 0,
            "in-errors": 0,
            "in-multicast-pkts": 36491,
            "in-octets": 3379761,
            "in-pkts": 38638,
            "in-unicast-pkts": 0,
            "last-clear": "Never",
            "out-broadcast-pkts": 0,
            "out-discards": 0,
            "out-errors": 0,
            "out-multicast-pkts": 0,
            "out-octets": 352373,
            "out-pkts": 2592,

```

```

        "out-unicast-pkts": 0
      },
      "ifindex": 3,
      "last-change": 9200,
      "logical": false,
      "oper-status": "up",
      "vrf-name": "management"
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333817179553310,
  "time": "2025-03-18T21:36:57.17955331Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\\xe8\\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": 0,
            "in-discards": 0,
            "in-errors": 0,
            "in-fcs-errors": 0,
            "in-multicast-pkts": 141,
            "in-octets": 15582,
            "in-pkts": 183,
            "in-unicast-pkts": 42,
            "last-clear": "Never",
            "out-broadcast-pkts": 0,
            "out-discards": 0,
            "out-errors": 0,
            "out-multicast-pkts": 1653,
            "out-octets": 229898,
            "out-pkts": 1704,
            "out-unicast-pkts": 51
          },
          "ifindex": 10009,
          "last-change": 12700,
          "logical": false,
          "oper-status": "up"
        }
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333817255106323,
  "time": "2025-03-18T21:36:57.255106323Z",
  "updates": [
    {
      "Path": "ipi:components/component[name=\\\"CPU\\\"]/cpu/state",
      "values": {
        "components/component/cpu/state": {
          "cpu-15min-load-percentage": 3.47,
          "cpu-1min-load-percentage": 3.97,
          "cpu-5min-load-percentage": 3.78,
          "cpu-utilization": 2.8,
          "cpu-utilization-alert": 90,
          "cpu-utilization-critical": 80,

```

```

        "processor-count": 8
      }
    }
  ]
}

{
  "source": "10.16.179.113:55545",
  "subscription-name": "default-1742333759",
  "timestamp": 1742333817255632799,
  "time": "2025-03-18T21:36:57.255632799Z",
  "updates": [
    {
      "Path": "ipi:components/component[name=\"HARD-DISK\"]/storage/state",
      "values": {
        "components/component/storage/state": {
          "head-count": 16,
          "sector-count": 250000000,
          "total-memory": 122070,
          "unformatted-bytes-or-sector": 0,
          "unformatted-bytes-or-track": 0
        }
      }
    }
  ]
}

```

Implementation Examples

Secure Network Monitoring in a Data Center

Scenario: A data center is tasked with monitoring the health and performance of various network devices, including switches, routers, and servers, across a large-scale infrastructure. The network administrators need to securely stream telemetry data in real time to ensure smooth operations, prevent failures, and guarantee secure access to sensitive performance data.

Solution: Using gNMI with Transport Layer Security (TLS), the administrators configure the gNMI server (the network router) and the gNMI client (a telemetry collector system) for streaming telemetry. The telemetry streams include performance metrics from multiple sensors, such as interface states and component statuses, collected in real-time for analysis.

Troubleshooting TLS Issues in OcNOS

When TLS is enabled for streaming telemetry in OcNOS, various certificate-related errors may occur. The following are common issues and their resolutions:

1. %% TLS is enabled but certificates are not present. Please generate key and certificates to enable tls for streaming-telemetry

Resolution: Follow all the steps from [Certificate Management for OcNOS and gNMI \(page 152\)](#) to generate and copy certificates to OcNOS.

2. %% TLS is enabled but client certificates are not present. Please upload client key and certificates to "/cfg/usr/local/etc/tls/client"

Resolution: When TLS is enabled before configuring the dial-out configurations, copy the client certificates `ca.pem`, `ClientCert.pem`, and `client.pem` to `/cfg/usr/local/etc/tls/client` on OcNOS.

3. Failed to load TLS credentials: `tls: private key does not match public key`

Resolution: This means the `/cfg/usr/local/etc/tls/certs/cert_gnmid.pem` file is not matching with `/cfg/usr/local/etc/tls/keys/key.pem`. Generate the server certificate again by copying the output of the `show crypto csr` command into the `ServerCert.csr` file. Restart the `gnmid` to load the new certificates.

4. authentication handshake failed: `tls: failed to verify certificate: x509: certificate signed by unknown authority`

Resolution: The CA certificate on the server (OcNOS) is not matching with the CA certificate on the client side. Use the same CA certificate to generate the server and client certificates.

5. authentication handshake failed: `tls: failed to verify certificate: x509: certificate is valid for OcNOS, not Admin`

Resolution: `--tls-server-name` in the `gnmic` command should be the same as the `subjectAltName` defined in the `san.ext` file.

6. authentication handshake failed: `tls: failed to verify certificate: x509: certificate is not valid for any names, but wanted to match Admin`

Resolution: The error means `san.ext` is not used (`subjectAltName` is not defined) while generating the server certificate `ServerCert.pem`. Define a SAN and use it while generating the server certificate, and use the same SAN for the flag `--tls-server-name` in `gnmic`.

TLS Commands

To configure the system for secure and insecure TLS connections, use the commands [tls tls-port \(page 86\)](#) and [port \(page 58\)](#).

TLS Glossary

The following provides definitions for key terms or abbreviations and their meanings used throughout this document:

Key Terms/Acronym	Description
Transport Layer Security (TLS)	A cryptographic protocol that secures telemetry data transmission by encrypting the communication channel.
gNMI Server (Target)	The network device (e.g., router) that generates and streams telemetry data to the gNMI Client.
gNMI Client (Collector)	The software that collects telemetry data from the gNMI Server.
Encryption	The process of converting telemetry data into a secure format to prevent unauthorized access during transmission.
gRPC Network Management Interface (gNMI)	A protocol used for streaming telemetry data between a network device (Target) and a monitoring system (Collector).
Authentication	The process of verifying the identity of a client or server before establishing a secure telemetry connection.
Certificate Authority Certificate (CA Certificate)	A digital certificate issued by a trusted entity to authenticate the identity of servers and clients in TLS-secured telemetry.

Insecure TLS Mode	A configuration that allows telemetry streaming with optional client certificate validation for flexibility.
TLS Port	The network structure illustrating the connection between a gNMI Server and a gNMI Client using TLS.

STREAMING TELEMETRY CPU MONITORING

Overview

Streaming telemetry CPU monitoring in OcNOS is designed to maintain critical system performance even under high CPU load. This feature ensures that telemetry operations, including both dial-in and dial-out, do not degrade control plane applications or other essential system functions by regulating telemetry activities based on CPU usage.

Feature Characteristics

OcNOS implements CPU monitoring through these mechanisms:

- **CPU Usage Monitoring:** The system monitors the **5-minute average CPU usage**, enabled by default through the CML daemon (CMLd).
- **Configurable Threshold:** Users can define a CPU usage threshold between 20% and 80%; the default is 40%.
- **State Transition Logic:** The telemetry functionality transitions between a "Normal" and "Paused" state based on the monitored CPU usage relative to the configured threshold.
 - **Transition to Pause:** When the 5-minute average CPU usage goes above the default or configured threshold and stays above the threshold for at least a minute, the telemetry state transitions from "Normal" to "Pause".
 - **Transition to Normal:** When the 5-minute average CPU usage drops below 3/4th of the default or configured threshold and remains low for 300 seconds, the telemetry state transitions from "Pause" to "Normal."
- **Actions in "Paused" State:**
 - Pause existing dial-in subscriptions by sending unsubscribe messages to protocol modules, which frees up CPU usage in PMs, redis-server, and gnmid. No gNMI responses are sent for these paused subscriptions.
 - Pause existing dial-out telemetry subscriptions. No gNMI responses are sent for these paused subscriptions.
 - Rejects new incoming dial-in connections.
 - When in the pause state, on any new dial-out subscription activation, the corresponding sensor-paths enter a paused state immediately.
- **Actions in "Normal" State:**
 - Resume paused dial-in and dial-out subscriptions by resending subscribe messages to the relevant sensor-paths.
 - Accept new subscription connections (dial-in). In Dial-out mode, on subscription activation, corresponding sensor-paths are activated immediately. gNMI responses are sent as usual at the sample interval.
- **Status Display:** Use the command `show streaming-telemetry` to check the current status of the telemetry functionality (Normal or Paused).



Note: The OpenConfig data model does not support CPU monitoring.

Benefits

CPU monitoring protects system health by dynamically reducing telemetry overhead during CPU stress conditions:

- During scale scenarios or critical control plane applications that require a higher number of CPU cycles, non-critical applications like telemetry can take less CPU cycles by entering into a pause state.
- Ensures more CPU cycles are available for high-priority processes.

CPU Monitoring Configuration

This procedure outlines the steps to configure Streaming Telemetry with CPU monitoring in OcNOS. CPU monitoring helps prevent overload during high utilization by pausing telemetry sessions when the CPU crosses a configured threshold.

Prerequisites

Ensure that the streaming telemetry is correctly configured with the appropriate sensor groups, destination groups, and subscriptions.

1. Enable streaming telemetry on required VRFs, and set the ports and tunnel retry interval.

```
!
ip vrf management
!
ip vrf vrf1
!
feature streaming-telemetry vrf vrf1
  grpc-tunnel-server retry-interval 30
!
feature streaming-telemetry vrf management
  port 35000
  grpc-tunnel-server retry-interval 30
!
feature streaming-telemetry
  port 36000
  grpc-tunnel-server retry-interval 30
!
```

2. Define sensor groups and paths to device metrics that are published as telemetry data.

```
sensor-group int vrf vrf1
  sensor-path ipi:/components/component[name="RAM"]/ram/state
  sensor-path ipi:/components/component[name="CPU"]/cpu/state
  sensor-path ipi:/components/component[name="HARD-DISK"]/storage/state
  sensor-path ipi:/components/component[name="PSU-1"]/power-supply/state
  sensor-path ipi:/components/component[name="FAN-3"]/fan/state
  sensor-path ipi:/interfaces/interface[name="eth0"]/state
  sensor-path ipi:/components/component[name="CHASSIS"]/state
  sensor-path /interfaces/interface[name="eth0"]/state
  sensor-path /interfaces/interface[name="xe4"]/state/counters
  sensor-path /components/component[name="RAM"]/state/memory
  sensor-path /components/component[name="CPU"]/cpu/utilization/state
  sensor-path /components/component[name="HARD-DISK"]/state
  sensor-path /components/component[name="HARD-DISK"]/state/memory
```

```

sensor-path /components/component[name="HARD-DISK"]/state/temperature
sensor-path /components/component[name="CHASSIS"]/state
sensor-path /components/component[name="CHASSIS"]/state/memory
sensor-path /components/component[name="CHASSIS"]/state/temperature
!
sensor-group ipi vrf management
sensor-path ipi:/components/component[name="RAM"]/ram/state
sensor-path ipi:/components/component[name="CPU"]/cpu/state
sensor-path ipi:/components/component[name="HARD-DISK"]/storage/state
sensor-path ipi:/components/component[name="PSU-1"]/power-supply/state
sensor-path ipi:/components/component[name="FAN-3"]/fan/state
sensor-path ipi:/interfaces/interface[name="eth0"]/state
sensor-path ipi:/components/component[name="CHASSIS"]/state
sensor-path /interfaces/interface[name="eth0"]/state
sensor-path /interfaces/interface[name="xe4"]/state/counters
sensor-path /components/component[name="RAM"]/state/memory
sensor-path /components/component[name="CPU"]/cpu/utilization/state
sensor-path /components/component[name="HARD-DISK"]/state
sensor-path /components/component[name="HARD-DISK"]/state/memory
sensor-path /components/component[name="HARD-DISK"]/state/temperature
sensor-path /components/component[name="CHASSIS"]/state
sensor-path /components/component[name="CHASSIS"]/state/memory
sensor-path /components/component[name="CHASSIS"]/state/temperature
!
sensor-group ipi1
sensor-path ipi:/components/component[name="RAM"]/ram/state
sensor-path ipi:/components/component[name="CPU"]/cpu/state
sensor-path ipi:/components/component[name="HARD-DISK"]/storage/state
sensor-path ipi:/components/component[name="PSU-1"]/power-supply/state
sensor-path ipi:/components/component[name="FAN-3"]/fan/state
sensor-path ipi:/interfaces/interface[name="eth0"]/state
sensor-path ipi:/components/component[name="CHASSIS"]/state
sensor-path /interfaces/interface[name="eth0"]/state
sensor-path /interfaces/interface[name="xe4"]/state/counters
sensor-path /components/component[name="RAM"]/state/memory
sensor-path /components/component[name="CPU"]/cpu/utilization/state
sensor-path /components/component[name="HARD-DISK"]/state
sensor-path /components/component[name="HARD-DISK"]/state/memory
sensor-path /components/component[name="HARD-DISK"]/state/temperature
sensor-path /components/component[name="CHASSIS"]/state
sensor-path /components/component[name="CHASSIS"]/state/memory
sensor-path /components/component[name="CHASSIS"]/state/temperature
!

```

3. Configure destination groups that defines where telemetry data should be sent. Establishes IP and port of remote collector (e.g., a telemetry server or analytics engine).

```

destination-group des2 vrf vrf1
  tunnel-server ip 20.1.1.2 port 10300
!
destination-group des1 vrf management
  tunnel-server ip 10.16.99.109 port 10600
!
destination-group des3
  tunnel-server ip 40.1.1.2 port 10200
!
destination-group des1
!

```

4. Create persistent subscriptions and bind a sensor group to a destination group, specifying how often data should be sent.

```

subscription-name sub1 vrf vrf1
  destination-group des2
  sensor-group int sample-interval 10
!
subscription-name sub2 vrf management

```

```

destination-group des1
sensor-group ipi sample-interval 10
!
subscription-name sub3
destination-group des3
sensor-group ipi1 sample-interval 10
!
!

```

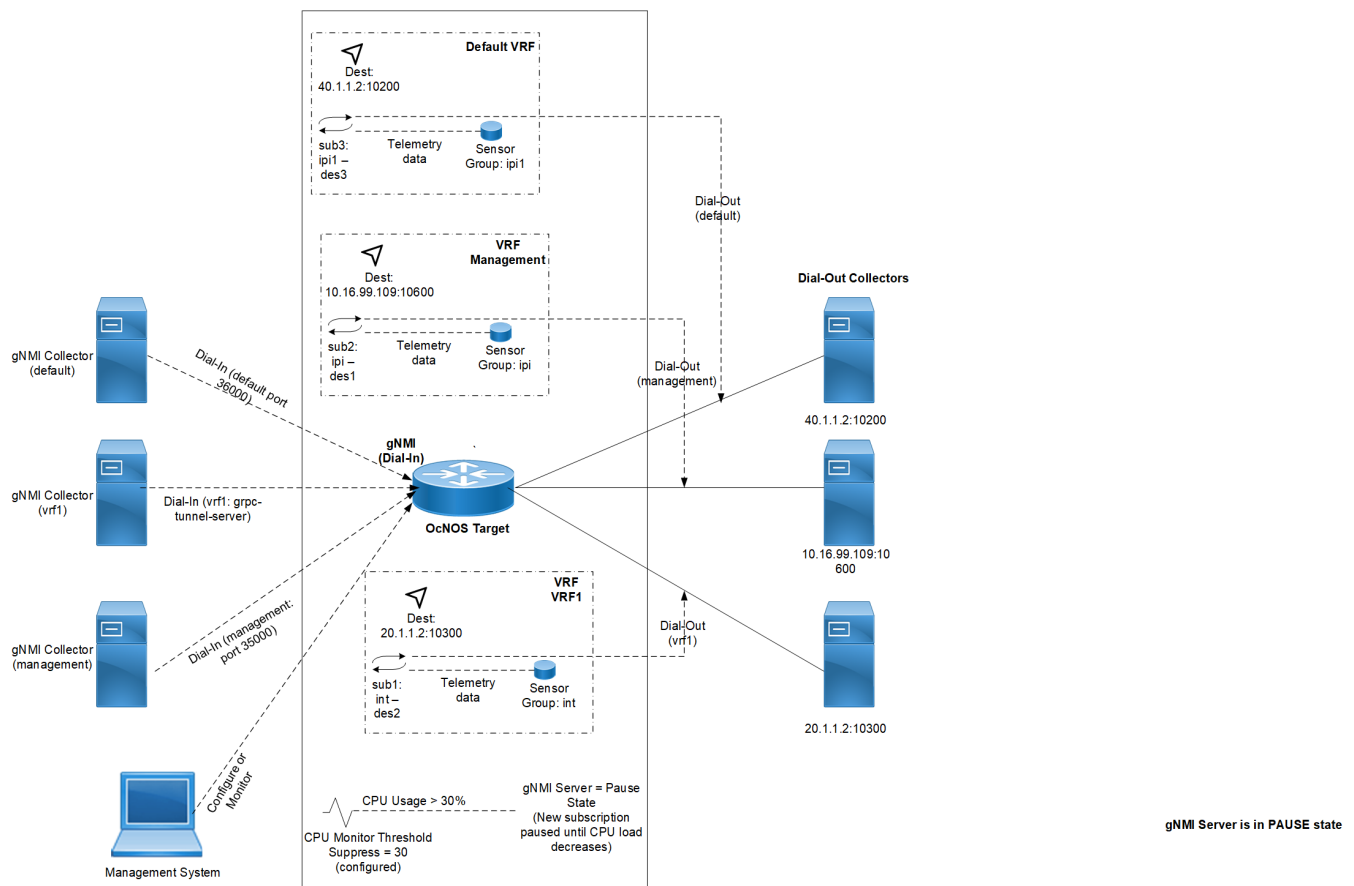
Topology

The figure below illustrates the OcNOS gNMI telemetry environment with both dial-in and dial-out connections across three VRFs: default, management, and vrf1. The OcNOS target streams telemetry data to gNMI collectors using predefined sensor groups. When a 5-minute CPU average usage exceeds the configured 30% threshold, the gNMI server enters a PAUSE state, suppressing telemetry and rejecting new subscriptions until CPU load decreases.

Key elements:

- **Dial-In Clients:** gNMI collectors initiate subscriptions via default, management (port 35000), and vrf1 tunnel-server.
- **Dial-Out Subscriptions:** OcNOS pushes telemetry to remote collectors at specified destinations per VRF.
- **Telemetry Flow:** Each VRF associates a subscription name, destination collector, and sensor group.
- **CPU Monitor Logic:** If CPU > configured 30% threshold, telemetry streaming is paused, as shown by the PAUSE state indicator.

Figure 13. Telemetry CPU Monitoring



Enable CPU Monitoring and Set Suppression Threshold

To prevent high CPU utilization from impacting telemetry responsiveness, enable CPU monitoring to manage system load dynamically. And define a suppression threshold (CPU usage percentage 30%) above which telemetry is paused.

```
OcNOS(config)# telemetry cpu-monitor enable
OcNOS(telemetry-cpu-monitor)# suppress-threshold 30
OcNOS(telemetry-cpu-monitor)# commit
OcNOS(telemetry-cpu-monitor)# end
```

gNMI Client Behavior When CPU Monitoring is Active

If CPU usage exceeds the configured threshold, the gNMI server enters the PAUSE state. New telemetry subscription requests are paused until the system CPU usage drops below the configured threshold. Below is one such scenario, in which the message confirms that the telemetry server has paused accepting new subscriptions to reduce CPU load.

```
# ./gnmic -a 10.16.154.118:35000 -u ocnos -p ocnos --encoding json_ietf --insecure --mode STREAM
--stream-mode sample --sample-interval 90s subscribe --path 'ipi:/interfaces/interface
[name="eth0"]/state' --log
2025/06/11 11:57:50.415698 [gnmic] version=dev, commit=none, date=unknown, gitURL=,
docs=https://gnmic.openconfig.net
2025/06/11 11:57:50.415717 [gnmic] using config file ""
2025/06/11 11:57:50.415822 [gnmic] starting output type file
2025/06/11 11:57:50.415861 [gnmic] queuing target "10.16.154.118:35000"
2025/06/11 11:57:50.416005 [file_output:default-stdout] initialized file output: {"Cfg":
{"FileName":"","FileType":"stdout","Format":"json","Multiline":true,"Indent":"","Separator":"\n",
"OverrideTimestamps":false,"AddTarget":"","TargetTemplate":"","EventProcessors":null,"MsgTempla
te":"","ConcurrencyLimit":1000,"EnableMetrics":false,"Debug":false}}
2025/06/11 11:57:50.416085 [gnmic] starting target "10.16.154.118:35000" listener
2025/06/11 11:57:50.416156 [gnmic] subscribing to target: "10.16.154.118:35000"
2025/06/11 11:57:50.417046 [gnmic] target "10.16.154.118:35000" gNMI client created
2025/06/11 11:57:50.417086 [gnmic] sending gNMI SubscribeRequest: subscribe='subscribe:
{subscription:{path:{origin:"ipi" elem:{name:"interfaces"} elem:{name:"interface" key:{key:"name"
value:"\eth0\"}}} elem:{name:"state"}} mode:SAMPLE sample_interval:90000000000} encoding:JSON_
IETF}', mode='STREAM', encoding='JSON_IETF', to 10.16.154.118:35000
2025/06/11 11:57:50.418932 [gnmic] target "10.16.154.118:35000": subscription default-1749643070
rcv error: rpc error: code = Unimplemented desc = GNMI Server is in PAUSE state. Please retry
later when system CPU load is lesser
2025/06/11 11:57:50.418961 [gnmic] target "10.16.154.118:35000": subscription default-1749643070
rcv error: retrying in 10s
2025/06/11 11:58:00.419755 [gnmic] target "10.16.154.118:35000": subscription default-1749643070
rcv error: rpc error: code = Unimplemented desc = GNMI Server is in PAUSE state. Please retry
later when system CPU load is lesser
2025/06/11 11:58:00.419881 [gnmic] target "10.16.154.118:35000": subscription default-1749643070
rcv error: retrying in 10s
```

Validation

Verify the CPU monitoring state and threshold value using the `show streaming-telemetry` command along with the subscription details.

Enabled (Normal) State

The CPU monitoring field displays `ENABLED (NORMAL)` when the gNMI target's CPU usage is below the configured threshold (30%), allowing both dial-in and dial-out telemetry streams to operate without restriction.

```
OcNOS#show streaming-telemetry
```

```

Number of telemetry instances : 3 (vrf1,management,default)
Platform type                 : High range
Maximum sensor-paths         : 100
Minimum sample-interval      : 10
CPU monitoring                : ENABLED (NORMAL)
CPU monitoring threshold      : 30
Number of active sensor-paths : 70 (Dial-In : 4, Dial-out : 66)

```

```

SI           : Sampling Interval in seconds
Enc-Type     : Encoding type
Origin:Path  : Sensor Path

```

1. Subscription Details (VRF-Name: vrf1):

```

~~~~~
Port           : 9339
TLS            : Disabled
insecure-tls   : False

```

Dial-Out Subscription Details:

```

~~~~~
1. Subscription-name : sub1
   Status            : ACTIVE
   Enc-Type          : JSON
   Tunnel-server details:
   ~~~~~
   Tunnel-server Retry-interval : 30 (seconds)

```

Destination-group	Status	Tunnel-IP:Port
-----	-----	-----
des2	IN-ACTIVE	20.1.1.2:10300

Sensor-group details:

```

~~~~~
Sensor-group      SI      Origin:Path
-----
int              10      ipi:/components/component[name="RAM"]/ram/state
                               ipi:/components/component[name="CPU"]/cpu/state
                               ipi:/components/component[name="HARD-DISK"]/storage/state
                               ipi:/components/component[name="PSU-1"]/power-supply/state
                               ipi:/components/component[name="FAN-3"]/fan/state
                               ipi:/interfaces/interface[name="eth0"]/state
                               [*]ipi:/interfaces/interface[name="eth0"]/state/counters
                               ipi:/components/component[name="CHASSIS"]/state
                               [*]ipi:/components/component[name="CHASSIS"]/state/memory
                               [*]ipi:/components/component[name="CHASSIS"]/state/board-fru
                               [*]ipi:/components/component
                               [name="CHASSIS"]/state/temperature
                               /interfaces/interface[name="eth0"]/state
                               [*]/interfaces/interface[name="eth0"]/state/counters
                               /interfaces/interface[name="xe4"]/state/counters
                               /components/component[name="RAM"]/state/memory
                               /components/component[name="CPU"]/cpu/utilization/state
                               /components/component[name="HARD-DISK"]/state
                               /components/component[name="HARD-DISK"]/state/memory
                               /components/component[name="HARD-DISK"]/state/temperature
                               /components/component[name="CHASSIS"]/state
                               /components/component[name="CHASSIS"]/state/memory
                               /components/component[name="CHASSIS"]/state/temperature

```

[*]-> Indicates child path learnt from parent config, not configured by user

2. Subscription Details (VRF-Name: management):

```

~~~~~
Port           : 35000
TLS            : Disabled
insecure-tls   : False

```

Dial-In STREAM Mode Subscription Details:

```

~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
10.16.99.109:46708  4574   90     JSON_IETF     ipi:/interfaces/interface[name="eth0"]/state
                               ipi:/interfaces/interface
[name="eth0"]/state/counters

Dial-Out Subscription Details:
~~~~~
1. Subscription-name : sub2
   Status            : ACTIVE
   Enc-Type          : JSON
   Tunnel-server details:
   ~~~~~
   Tunnel-server Retry-interval : 30 (seconds)

   Destination-group      Status      Tunnel-IP:Port
   -----
   des1                   ACTIVE      10.16.99.109:10600

Sensor-group details:
~~~~~
Sensor-group      SI      Origin:Path
-----
   ipi            10     ipi:/components/component[name="RAM"]/ram/state
                               ipi:/components/component[name="CPU"]/cpu/state
                               ipi:/components/component[name="HARD-DISK"]/storage/state
                               ipi:/components/component[name="PSU-1"]/power-supply/state
                               ipi:/components/component[name="FAN-3"]/fan/state
                               ipi:/interfaces/interface[name="eth0"]/state
                               [*]ipi:/interfaces/interface[name="eth0"]/state/counters
                               ipi:/components/component[name="CHASSIS"]/state
                               [*]ipi:/components/component[name="CHASSIS"]/state/memory
                               [*]ipi:/components/component[name="CHASSIS"]/state/board-fru
                               [*]ipi:/components/component
                               /interfaces/interface[name="eth0"]/state
                               [*]/interfaces/interface[name="eth0"]/state/counters
                               /interfaces/interface[name="xe4"]/state/counters
                               /components/component[name="RAM"]/state/memory
                               /components/component[name="CPU"]/cpu/utilization/state
                               /components/component[name="HARD-DISK"]/state
                               /components/component[name="HARD-DISK"]/state/memory
                               /components/component[name="HARD-DISK"]/state/temperature
                               /components/component[name="CHASSIS"]/state
                               /components/component[name="CHASSIS"]/state/memory
                               /components/component[name="CHASSIS"]/state/temperature

[name="CHASSIS"]/state/temperature

[*]-> Indicates child path learnt from parent config, not configured by user

3. Subscription Details (VRF-Name: default):
~~~~~
Port      : 36000
TLS       : Disabled
insecure-tls : False

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
40.1.1.2:49602     2342   10     JSON_IETF     ipi:/interfaces/interface[name="eth0"]/state
                               ipi:/interfaces/interface
[name="eth0"]/state/counters

Dial-Out Subscription Details:
~~~~~
1. Subscription-name : sub3

```

```

Status                : ACTIVE
Enc-Type              : JSON
Tunnel-server details:
~~~~~
Tunnel-server Retry-interval : 30 (seconds)

Destination-group      Status      Tunnel-IP:Port
-----
      des3              ACTIVE      40.1.1.2:10200
Sensor-group details:
~~~~~
Sensor-group           SI           Origin:Path
-----
      ipi1              10           ipi:/components/component[name="RAM"]/ram/state
                                           ipi:/components/component[name="CPU"]/cpu/state
                                           ipi:/components/component[name="HARD-DISK"]/storage/state
                                           ipi:/components/component[name="PSU-1"]/power-supply/state
                                           ipi:/components/component[name="FAN-3"]/fan/state
                                           ipi:/interfaces/interface[name="eth0"]/state
                                           [*]ipi:/interfaces/interface[name="eth0"]/state/counters
                                           ipi:/components/component[name="CHASSIS"]/state
                                           [*]ipi:/components/component[name="CHASSIS"]/state/memory
                                           [*]ipi:/components/component[name="CHASSIS"]/state/board-fru
                                           [*]ipi:/components/component
                                           [name="CHASSIS"]/state/temperature
                                           /interfaces/interface[name="eth0"]/state
                                           [*]/interfaces/interface[name="eth0"]/state/counters
                                           /interfaces/interface[name="xe4"]/state/counters
                                           /components/component[name="RAM"]/state/memory
                                           /components/component[name="CPU"]/cpu/utilization/state
                                           /components/component[name="HARD-DISK"]/state
                                           /components/component[name="HARD-DISK"]/state/memory
                                           /components/component[name="HARD-DISK"]/state/temperature
                                           /components/component[name="CHASSIS"]/state
                                           /components/component[name="CHASSIS"]/state/memory
                                           /components/component[name="CHASSIS"]/state/temperature

[*]-> Indicates child path learnt from parent config, not configured by user

```

Enabled (Paused) State

The CPU monitoring field displays **ENABLED (PAUSED)** when the gNMI target's CPU usage exceeds the configured threshold (30%), causing the system to suppress telemetry activity and reject new incoming dial-in connections. When in the pause state, on any new dial-out subscription activation, the corresponding sensor-paths enter a paused state immediately.

```

OcNOS#sh streaming-telemetry

Number of telemetry instances : 3 (vrf1,management,default)
Platform type                 : High range
Maximum sensor-paths          : 100
Minimum sample-interval       : 10
CPU monitoring                 : ENABLED (PAUSED)
CPU monitoring threshold       : 30
Number of active sensor-paths : 68 (Dial-In : 2, Dial-out : 66)

SI          : Sampling Interval in seconds
Enc-Type    : Encoding type
Origin:Path  : Sensor Path

1. Subscription Details (VRF-Name: vrf1):
~~~~~
Port        : 9339

```

```

    TLS          : Disabled
    insecure-tls : False

Dial-Out Subscription Details:
~~~~~
1. Subscription-name : sub1
   Status            : ACTIVE
   Enc-Type          : JSON
   Tunnel-server details:
   ~~~~~
   Tunnel-server Retry-interval : 30 (seconds)

   Destination-group      Status      Tunnel-IP:Port
   -----
       des2                IN-ACTIVE    20.1.1.2:10300

Sensor-group details:
~~~~~
Sensor-group      SI      Origin:Path
-----
       int          10      ipi:/components/component[name="RAM"]/ram/state
                                ipi:/components/component[name="CPU"]/cpu/state
                                ipi:/components/component[name="HARD-DISK"]/storage/state
                                ipi:/components/component[name="PSU-1"]/power-supply/state
                                ipi:/components/component[name="FAN-3"]/fan/state
                                ipi:/interfaces/interface[name="eth0"]/state
                                [*]ipi:/interfaces/interface[name="eth0"]/state/counters
                                ipi:/components/component[name="CHASSIS"]/state
                                [*]ipi:/components/component[name="CHASSIS"]/state/memory
                                [*]ipi:/components/component[name="CHASSIS"]/state/board-fru
                                [*]ipi:/components/component
                                [name="CHASSIS"]/state/temperature
                                /interfaces/interface[name="eth0"]/state
                                [*]/interfaces/interface[name="eth0"]/state/counters
                                /interfaces/interface[name="xe4"]/state/counters
                                /components/component[name="RAM"]/state/memory
                                /components/component[name="CPU"]/cpu/utilization/state
                                /components/component[name="HARD-DISK"]/state
                                /components/component[name="HARD-DISK"]/state/memory
                                /components/component[name="HARD-DISK"]/state/temperature
                                /components/component[name="CHASSIS"]/state
                                /components/component[name="CHASSIS"]/state/memory
                                /components/component[name="CHASSIS"]/state/temperature

[*]-> Indicates child path learnt from parent config, not configured by user

2. Subscription Details (VRF-Name: management):
~~~~~
    Port          : 35000
    TLS           : Disabled
    insecure-tls  : False
    CPU Monitored Sensor Groups : ipi

Dial-In STREAM Mode Subscription Details:
~~~~~
ClientIP:Port      ID      SI      Enc-Type      Origin:Path
-----
10.16.99.109:46708  4574  90      JSON_IETF      ipi:/interfaces/interface[name="eth0"]/state
                                ipi:/interfaces/interface
                                [name="eth0"]/state/counters

Dial-Out Subscription Details:
~~~~~
1. Subscription-name : sub2
   Status            : ACTIVE
   Enc-Type          : JSON
   Tunnel-server details:
   ~~~~~

```

Tunnel-server Retry-interval : 30 (seconds)

Destination-group	Status	Tunnel-IP:Port
des1	ACTIVE	10.16.99.109:10600

Sensor-group details:

~~~~~

| Sensor-group | SI | Origin:Path                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ipi          | 10 | ipi:/components/component[name="RAM"]/ram/state<br>ipi:/components/component[name="CPU"]/cpu/state<br>ipi:/components/component[name="HARD-DISK"]/storage/state<br>ipi:/components/component[name="PSU-1"]/power-supply/state<br>ipi:/components/component[name="FAN-3"]/fan/state<br>ipi:/interfaces/interface[name="eth0"]/state<br>[*]ipi:/interfaces/interface[name="eth0"]/state/counters<br>ipi:/components/component[name="CHASSIS"]/state<br>[*]ipi:/components/component[name="CHASSIS"]/state/memory<br>[*]ipi:/components/component[name="CHASSIS"]/state/board-fru<br>[*]ipi:/components/component |

[name="CHASSIS"]/state/temperature

/interfaces/interface[name="eth0"]/state  
 [\*]/interfaces/interface[name="eth0"]/state/counters  
 /interfaces/interface[name="xe4"]/state/counters  
 /components/component[name="RAM"]/state/memory  
 /components/component[name="CPU"]/cpu/utilization/state  
 /components/component[name="HARD-DISK"]/state  
 /components/component[name="HARD-DISK"]/state/memory  
 /components/component[name="HARD-DISK"]/state/temperature  
 /components/component[name="CHASSIS"]/state  
 /components/component[name="CHASSIS"]/state/memory  
 /components/component[name="CHASSIS"]/state/temperature

[\*]-> Indicates child path learnt from parent config, not configured by user

### 3. Subscription Details (VRF-Name: default):

~~~~~

Port : 36000
 TLS : Disabled
 insecure-tls : False

Dial-Out Subscription Details:

~~~~~

1. Subscription-name : sub3  
 Status : ACTIVE  
 Enc-Type : JSON

Tunnel-server details:

~~~~~

Tunnel-server Retry-interval : 30 (seconds)

Destination-group	Status	Tunnel-IP:Port
des3	ACTIVE	40.1.1.2:10200

Sensor-group details:

~~~~~

| Sensor-group | SI | Origin:Path                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ipil         | 10 | ipi:/components/component[name="RAM"]/ram/state<br>ipi:/components/component[name="CPU"]/cpu/state<br>ipi:/components/component[name="HARD-DISK"]/storage/state<br>ipi:/components/component[name="PSU-1"]/power-supply/state<br>ipi:/components/component[name="FAN-3"]/fan/state<br>ipi:/interfaces/interface[name="eth0"]/state<br>[*]ipi:/interfaces/interface[name="eth0"]/state/counters<br>ipi:/components/component[name="CHASSIS"]/state<br>[*]ipi:/components/component[name="CHASSIS"]/state/memory<br>[*]ipi:/components/component[name="CHASSIS"]/state/board-fru<br>[*]ipi:/components/component |

[name="CHASSIS"]/state/temperature

```

/interfaces/interface[name="eth0"]/state
[*]/interfaces/interface[name="eth0"]/state/counters
/interfaces/interface[name="xe4"]/state/counters
/components/component[name="RAM"]/state/memory
/components/component[name="CPU"]/cpu/utilization/state
/components/component[name="HARD-DISK"]/state
/components/component[name="HARD-DISK"]/state/memory
/components/component[name="HARD-DISK"]/state/temperature
/components/component[name="CHASSIS"]/state
/components/component[name="CHASSIS"]/state/memory
/components/component[name="CHASSIS"]/state/temperature

```

[\*]-> Indicates child path learnt from parent config, not configured by user

## Client Response for Dial-Out

The following section outlines the client response behavior for dial-out telemetry subscription requests.

```

"source": "e8:c5:7a:db:d5:30",
"subscription-name": "sub3",
"timestamp": 1748547313731512436,
"time": "2025-05-29T19:35:13.731512436Z",
"updates": [
  {
    "Path": "interfaces/interface[name=\"xe4\"]/state/counters",
    "values": {
      "interfaces/interface/state/counters": {
        "in-broadcast-pkts": 1011,
        "in-discards": 0,
        "in-errors": 1455,
        "in-fcs-errors": 0,
        "in-multicast-pkts": 2493,
        "in-octets": 2922028,
        "in-pkts": 33686,
        "in-unicast-pkts": 28439,
        "last-clear": 0,
        "out-broadcast-pkts": 1,
        "out-discards": 0,
        "out-errors": 0,
        "out-multicast-pkts": 60,
        "out-octets": 5293702,
        "out-pkts": 33389,
        "out-unicast-pkts": 33328
      }
    }
  }
]
}
2025/06/11 12:19:16.133574 /workdir/build/src/OpenYuma/src/gnmic/app/publish.go:111: [gnmic] target
"e8:c5:7a:db:d5:30": gNMI Subscribe Response: &{SubscriptionName:default-1749639836
SubscriptionConfig:null Response:update:{timestamp:1748547315121875897 update:{path:{elem:
{name:"components"} elem:{name:"component" key:{key:"name" value:"\"RAM\""}} elem:{name:"state"}
elem:{name:"memory"}} val:{json_val:"{\"available\":33037484032,\"utilized\":2102394880}}}}
GroupId:"sub3"}}
{
  "source": "e8:c5:7a:db:d5:30",
  "subscription-name": "sub3",
  "timestamp": 1748547315121875897,
  "time": "2025-05-29T19:35:15.121875897Z",
  "updates": [
    {
      "Path": "components/component[name=\"RAM\"]/state/memory",
      "values": {
        "components/component/state/memory": {
          "available": 33037484032,
          "utilized": 2102394880
        }
      }
    }
  ]
}

```

```

    }
  }
]
}
2025/06/11 12:19:16.136542 /workdir/build/src/OpenYuma/src/gnmic/app/publish.go:111: [gnmic] target
"e8:c5:7a:db:d5:30": gNMI Subscribe Response: &{SubscriptionName:default-1749639836
SubscriptionConfig:null Response:update:{timestamp:1748547315128078085 update:{path:{elem:
{name:"components"} elem:{name:"component" key:{key:"name" value:"\\CPU\\"}} elem:{name:"cpu" elem:
{name:"utilization"} elem:{name:"state"}} val:{json_val:"
{"avg":5.78,"instant":1.4,"interval":300000000000}}} GroupId:"sub3"}}
{
  "source": "e8:c5:7a:db:d5:30",
  "subscription-name": "sub3",
  "timestamp": 1748547315128078085,
  "time": "2025-05-29T19:35:15.128078085Z",
  "updates": [
    {
      "Path": "components/component[name=\\CPU\\]/cpu/utilization/state",
      "values": {
        "components/component/cpu/utilization/state": {
          "avg": 5.78,
          "instant": 1.4,
          "interval": 300000000000
        }
      }
    }
  ]
}
2025/06/11 12:19:16.139617 /workdir/build/src/OpenYuma/src/gnmic/app/publish.go:111: [gnmic] target
"e8:c5:7a:db:d5:30": gNMI Subscribe Response: &{SubscriptionName:default-1749639836
SubscriptionConfig:null Response:update:{timestamp:1748547305039676028 update:{path:{elem:
{name:"components"} elem:{name:"component" key:{key:"name" value:"\\HARD-DISK\\"}} elem:
{name:"state"}} val:{json_val:"{"id":"\\HARD-DISK\\","memory":
{"available":119226236928,"utilized":7207911424},"name":"\\HARD-DISK\\"}}} GroupId:"sub3"}}
{
  "source": "e8:c5:7a:db:d5:30",
  "subscription-name": "sub3",
  "timestamp": 1748547305039676028,
  "time": "2025-05-29T19:35:05.039676028Z",
  "updates": [
    {
      "Path": "components/component[name=\\HARD-DISK\\]/state",
      "values": {
        "components/component/state": {
          "id": "HARD-DISK",
          "memory": {
            "available": 119226236928,
            "utilized": 7207911424
          },
          "name": "HARD-DISK"
        }
      }
    }
  ]
}
2025/06/11 12:19:16.140979 /workdir/build/src/OpenYuma/src/gnmic/app/publish.go:111: [gnmic] target
"e8:c5:7a:db:d5:30": gNMI Subscribe Response: &{SubscriptionName:default-1749639836
SubscriptionConfig:null Response:update:{timestamp:1748547315121269930 update:{path:{elem:
{name:"components"} elem:{name:"component" key:{key:"name" value:"\\HARD-DISK\\"}} elem:
{name:"state"}} val:{json_val:"{"id":"\\HARD-DISK\\","memory":
{"available":119226236928,"utilized":7207911424},"name":"\\HARD-DISK\\"}}} GroupId:"sub3"}}
{
  "source": "e8:c5:7a:db:d5:30",
  "subscription-name": "sub3",
  "timestamp": 1748547315121269930,
  "time": "2025-05-29T19:35:15.12126993Z",
  "updates": [
    {
      "Path": "components/component[name=\\HARD-DISK\\]/state",

```

```

      "values": {
        "components/component/state": {
          "id": "HARD-DISK",
          "memory": {
            "available": 119226236928,
            "utilized": 7207911424
          },
          "name": "HARD-DISK"
        }
      }
    }
  ]
}

2025/06/11 12:19:16.144182 /workdir/build/src/OpenYuma/src/gnmic/app/publish.go:111: [gnmic] target
"e8:c5:7a:db:d5:30": gNMI Subscribe Response: &{SubscriptionName:default-1749639836
SubscriptionConfig:null Response:update:{timestamp:1748547315121269930 update:{path:{elem:
{name:"components"} elem:{name:"component" key:{key:"name" value:"\\\"HARD-DISK\\\""}} elem:
{name:"state"} elem:{name:"memory"}} val:{json_val:"
{\\\"available\\\":119226236928,\\\"utilized\\\":7207911424}}}} GroupId:"sub3"}}
{
  "source": "e8:c5:7a:db:d5:30",
  "subscription-name": "sub3",
  "timestamp": 1748547315121269930,
  "time": "2025-05-29T19:35:15.12126993Z",
  "updates": [
    {
      "Path": "components/component[name=\\\"HARD-DISK\\\"]/state/memory",
      "values": {
        "components/component/state/memory": {
          "available": 119226236928,
          "utilized": 7207911424
        }
      }
    }
  ]
}

2025/06/11 12:19:16.149807 /workdir/build/src/OpenYuma/src/gnmic/app/publish.go:111: [gnmic] target
"e8:c5:7a:db:d5:30": gNMI Subscribe Response: &{SubscriptionName:default-1749639836
SubscriptionConfig:null Response:update:{timestamp:1748547315122589861 update:{path:{elem:
{name:"components"} elem:{name:"component" key:{key:"name" value:"\\\"CHASSIS\\\""}} elem:{name:"state"}}
val:{json_val:"{\\\"description\\\":\\\"UFI_S9600-72XC\\\",\\\"empty\\\":false,\\\"firmware-version\\\":\\\"Extend
Board ID-9/BMC-3.03/BMC AUX-0x00.0x00.0x00.0x00\\\",\\\"id\\\":\\\"CHASSIS\\\",\\\"mfg-date\\\":\\\"2023-11-
09\\\",\\\"mfg-name\\\":\\\"Ufi Space\\\",\\\"model-name\\\":\\\"S9600-72XC-R\\\",\\\"name\\\":\\\"CHASSIS\\\",\\\"oper-
status\\\":\\\"ACTIVE\\\",\\\"part-no\\\":\\\"S9600-72XC-RB5B\\\",\\\"removable\\\":false,\\\"serial-
no\\\":\\\"WLF1DAVH00004P5\\\",\\\"software-version\\\":\\\"UFI_S9600-72XC-OcNOS-6.6.1.123-SP_MPLS_Q2-Alpha\\\"}}}}
GroupId:"sub3"}}
{
  "source": "e8:c5:7a:db:d5:30",
  "subscription-name": "sub3",
  "timestamp": 1748547315122589861,
  "time": "2025-05-29T19:35:15.122589861Z",
  "updates": [
    {
      "Path": "components/component[name=\\\"CHASSIS\\\"]/state",
      "values": {
        "components/component/state": {
          "description": "UFI_S9600-72XC",
          "empty": false,
          "firmware-version": "Extend Board ID-9/BMC-3.03/BMC AUX-0x00.0x00.0x00.0x00",
          "id": "CHASSIS",
          "mfg-date": "2023-11-09",
          "mfg-name": "Ufi Space",
          "model-name": "S9600-72XC-R",
          "name": "CHASSIS",
          "oper-status": "ACTIVE",
          "part-no": "S9600-72XC-RB5B",
          "removable": false,
          "serial-no": "WLF1DAVH00004P5",
          "software-version": "UFI_S9600-72XC-OcNOS-6.6.1.123-SP_MPLS_Q2-Alpha"
        }
      }
    }
  ]
}

```

```

    }
  }
}

source": "40.1.1.1:36000",
"subscription-name": "default-1749643105",
"timestamp": 1748546733499057800,
"time": "2025-05-29T19:25:33.4990578Z",
"updates": [
{
  "Path": "ipi:interfaces/interface[name=\"eth0\"]/state/counters",
  "values": {
    "interfaces/interface/state/counters": {
      "in-broadcast-pkts": "0",
      "in-discards": "0",
      "in-errors": "0",
      "in-multicast-pkts": "7684",
      "in-octets": "1326420",
      "in-pkts": "16794",
      "in-unicast-pkts": "0",
      "last-clear": "Never",
      "out-broadcast-pkts": "0",
      "out-discards": "0",
      "out-errors": "0",
      "out-multicast-pkts": "0",
      "out-octets": "1717703",
      "out-pkts": "11419",
      "out-unicast-pkts": "0"
    }
  }
}

```

## Client Response for Dial-In

The following section outlines the client response behavior for dial-in telemetry subscription requests.

```

{
  "source": "40.1.1.1:36000",
  "subscription-name": "default-1749643105",
  "timestamp": 1748546733486092566,
  "time": "2025-05-29T19:25:33.486092566Z",
  "updates": [
    {
      "Path": "ipi:interfaces/interface[name=\"eth0\"]/state",
      "values": {
        "interfaces/interface/state": {
          "admin-status": "up",
          "counters": {
            "in-broadcast-pkts": "0",
            "in-discards": "0",
            "in-errors": "0",
            "in-multicast-pkts": "7677",
            "in-octets": "1318458",
            "in-pkts": "16671",
            "in-unicast-pkts": "0",
            "last-clear": "Never",
            "out-broadcast-pkts": "0",
            "out-discards": "0",
            "out-errors": "0",
            "out-multicast-pkts": "0",
            "out-octets": "1637007",
            "out-pkts": "11159",
            "out-unicast-pkts": "0"
          },
          "ifindex": 3,
          "last-change": 0,
          "logical": false,

```

```

        "oper-status": "up",
        "vrf-name": "management"
    }
}
}

```

## Running Configuration

```

OcNOS#show running-config streaming-telemetry
!
feature streaming-telemetry vrf vrf1
  grpc-tunnel-server retry-interval 30
!
feature streaming-telemetry vrf management
  port 35000
  grpc-tunnel-server retry-interval 30
!
feature streaming-telemetry
  port 36000
  grpc-tunnel-server retry-interval 30
!
sensor-group int vrf vrf1
  sensor-path ipi:/components/component[name="RAM"]/ram/state
  sensor-path ipi:/components/component[name="CPU"]/cpu/state
  sensor-path ipi:/components/component[name="HARD-DISK"]/storage/state
  sensor-path ipi:/components/component[name="PSU-1"]/power-supply/state
  sensor-path ipi:/components/component[name="FAN-3"]/fan/state
  sensor-path ipi:/interfaces/interface[name="eth0"]/state
  sensor-path ipi:/components/component[name="CHASSIS"]/state
  sensor-path /interfaces/interface[name="eth0"]/state
  sensor-path /interfaces/interface[name="xe4"]/state/counters
  sensor-path /components/component[name="RAM"]/state/memory
  sensor-path /components/component[name="CPU"]/cpu/utilization/state
  sensor-path /components/component[name="HARD-DISK"]/state
  sensor-path /components/component[name="HARD-DISK"]/state/memory
  sensor-path /components/component[name="HARD-DISK"]/state/temperature
  sensor-path /components/component[name="CHASSIS"]/state
  sensor-path /components/component[name="CHASSIS"]/state/memory
  sensor-path /components/component[name="CHASSIS"]/state/temperature
!
sensor-group ipi vrf management
  sensor-path ipi:/components/component[name="RAM"]/ram/state
  sensor-path ipi:/components/component[name="CPU"]/cpu/state
  sensor-path ipi:/components/component[name="HARD-DISK"]/storage/state
  sensor-path ipi:/components/component[name="PSU-1"]/power-supply/state
  sensor-path ipi:/components/component[name="FAN-3"]/fan/state
  sensor-path ipi:/interfaces/interface[name="eth0"]/state
  sensor-path ipi:/components/component[name="CHASSIS"]/state
  sensor-path /interfaces/interface[name="eth0"]/state
  sensor-path /interfaces/interface[name="xe4"]/state/counters
  sensor-path /components/component[name="RAM"]/state/memory
  sensor-path /components/component[name="CPU"]/cpu/utilization/state
  sensor-path /components/component[name="HARD-DISK"]/state
  sensor-path /components/component[name="HARD-DISK"]/state/memory
  sensor-path /components/component[name="HARD-DISK"]/state/temperature
  sensor-path /components/component[name="CHASSIS"]/state
  sensor-path /components/component[name="CHASSIS"]/state/memory
  sensor-path /components/component[name="CHASSIS"]/state/temperature
!
sensor-group ipil
  sensor-path ipi:/components/component[name="RAM"]/ram/state
  sensor-path ipi:/components/component[name="CPU"]/cpu/state
  sensor-path ipi:/components/component[name="HARD-DISK"]/storage/state
  sensor-path ipi:/components/component[name="PSU-1"]/power-supply/state
  sensor-path ipi:/components/component[name="FAN-3"]/fan/state
  sensor-path ipi:/interfaces/interface[name="eth0"]/state

```

```

sensor-path ipi:/components/component[name="CHASSIS"]/state
sensor-path /interfaces/interface[name="eth0"]/state
sensor-path /interfaces/interface[name="xe4"]/state/counters
sensor-path /components/component[name="RAM"]/state/memory
sensor-path /components/component[name="CPU"]/cpu/utilization/state
sensor-path /components/component[name="HARD-DISK"]/state
sensor-path /components/component[name="HARD-DISK"]/state/memory
sensor-path /components/component[name="HARD-DISK"]/state/temperature
sensor-path /components/component[name="CHASSIS"]/state
sensor-path /components/component[name="CHASSIS"]/state/memory
sensor-path /components/component[name="CHASSIS"]/state/temperature
!
destination-group des2 vrf vrf1
  tunnel-server ip 20.1.1.2 port 10300
!
destination-group des1 vrf management
  tunnel-server ip 10.16.99.109 port 10600
!
destination-group des3
  tunnel-server ip 40.1.1.2 port 10200
!
destination-group des1
!
subscription-name sub1 vrf vrf1
  destination-group des2
  sensor-group int sample-interval 10
!
subscription-name sub2 vrf management
  destination-group des1
  sensor-group ipi sample-interval 10
!
subscription-name sub3
  destination-group des3
  sensor-group ipil sample-interval 10
!
telemetry cpu-monitor enable
  suppress-threshold 30
!
!

```

## Implementation Example

### Dynamic Resource Management in Service Provider Data Center

#### Scenario

A Tier-1 Service Provider operates a set of distributed regional data centers interconnected through a backbone MPLS network. The infrastructure utilizes OcNOS-powered access and edge routers to manage tenant connectivity, L2 or L3 VPNs, BGP route reflectors, and multi-tenancy overlays. During periods of: Route churn (e.g., BGP session flaps), topology changes (e.g., ECMP rehashes), and high control-plane activity (e.g., LDP or IS-IS convergence), the routers experience CPU spikes that risk delaying or dropping telemetry responses. This leads telemetry collectors to mark the node as "unreachable," triggering false alarms and noise in Network Operations Center (NOC) dashboards. To ensure telemetry does not destabilize the control plane during these peaks, the service provider implements OcNOS Streaming Telemetry CPU Monitoring.

## Implementation

- Enable CPU monitoring on all access and core routers to track 5-minute CPU average and respond dynamically.
- Configure CPU thresholds (e.g., 50%) to automatically pause non-essential telemetry when CPU is over-utilized.
- Integrate telemetry pause or normal status into the NOC dashboard by polling the `show streaming-telemetry` status on each router.
- Correlate telemetry gaps in observability tools (e.g., Prometheus, InfluxDB) with CPU state transitions to suppress alert noise.

For step-by-step configurations, refer to the [CPU Monitoring Configuration \(page 170\)](#) section.

## Benefits

- Maintains telemetry continuity for high-priority data during load surges.
- Prevents telemetry from overloading the control plane, ensuring routing and convergence stability.
- Auto-resumes full telemetry without manual intervention once CPU load normalizes.
- Delivers graceful degradation and self-healing behavior aligned with SLAs.

---

## CPU Monitoring Commands

Below is the list of CPU monitoring commands; for more details, refer to the [Streaming Telemetry Commands \(page 43\)](#) section.

- [suppress-threshold \(page 78\)](#)
- [telemetry cpu-monitor \(page 80\)](#)

---

## Revised Commands

### show streaming-telemetry

To verify the status of telemetry CPU usage and the configured threshold, introduced two fields in all the `show streaming-telemetry` command output:

- **CPU monitoring:**

Displays the current operational state of CPU-based telemetry control. It shows:

- **ENABLED (NORMAL)** – when telemetry is enabled and the current CPU usage is below the configured threshold.
- **ENABLED (PAUSED)** – when telemetry is enabled and the CPU usage exceeds the configured threshold, causing telemetry streams to pause.
- **DISABLED** - when telemetry CPU monitoring is explicitly disabled via configuration.
- **CPU monitoring threshold:** Displays the active CPU threshold value (in percentage) configured to trigger the pause or resume logic for telemetry streaming.

These fields help operators identify whether streaming telemetry is operating normally, in a throttled state due to high CPU, or completely unmonitored due to the feature being turned off.

For more details, refer to the [show streaming-telemetry](#), [show streaming-telemetry persistent-subscriptions \(page 73\)](#), and [show streaming-telemetry dynamic-subscriptions \(page 70\)](#) commands.

## CPU Monitoring Glossary

The following provides definitions for key terms or abbreviations and their meanings used throughout this document:

| Key Terms or Acronyms                              | Description                                                                                   |
|----------------------------------------------------|-----------------------------------------------------------------------------------------------|
| CPU Monitoring                                     | A mechanism that tracks the device's CPU usage to manage telemetry activity.                  |
| 5-minute average                                   | Average CPU usage over a 5-minute sliding window.                                             |
| Paused State                                       | State where telemetry activities are temporarily suppressed due to high CPU load.             |
| Normal State                                       | State where telemetry functions as usual, CPU usage is under the defined threshold.           |
| Protocol Modules (PMs)                             | Internal components processing gNMI, telemetry, or routing.                                   |
| Redis-server                                       | Backend process used for internal data caching or distribution.                               |
| Prometheus or InfluxDB                             | Monitoring and observability tools are commonly used to collect and visualize telemetry data. |
| Network Operations Center (NOC)                    | The central team and dashboard monitor network health.                                        |
| Service-Level Agreement (SLA)                      | Guaranteed level of service performance.                                                      |
| Equal-Cost Multi-Path (ECMP)                       | Routing strategy using multiple best paths for traffic.                                       |
| Label Distribution Protocol (LDP)                  | Used in MPLS to distribute labels.                                                            |
| Intermediate System to Intermediate System (IS-IS) | Interior gateway routing protocol.                                                            |
| Route churn                                        | Frequent route changes or flaps in dynamic routing environments.                              |
| Telemetry Pause Indicator                          | Visual or log marker showing telemetry suppression due to high CPU.                           |

# STREAMING TELEMETRY IPI DATA MODELS

## Overview

Streaming telemetry incrementally supports all IPI data models, listed in this section. Telemetry supports only operational containers and a subset of leaf attributes.

## Telemetry IPI Pyang Tree

The Pyang tree output illustrates the supported containers or leaf, along with a list of supported container-level paths.

## Container Level Sensor Paths and Leaf Attributes

Lists the container level sensor paths and leaf attributes supported for IPI data models.



**Note:** For details on wildcard support, refer to the [Wildcard Support in Sensor Paths \(page 33\)](#) and [XPath Formatting Rules for Streaming Telemetry \(page 39\)](#) sections.

# IPI-Platform

## Pyang Tree: ipi-platform

```

+--rw components {feature-list:HAVE_CMMD}?
  +--ro component* [name]
    +--ro name                                -> ../state/name
    +--ro state
      | +--ro name?                            string
      | +--ro type?                            ipi-platform-types:cmmm_component_type_t
    {feature-list:NOT_HAVE_TIBIT}?
      | +--ro location?                        string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro mfg-name?                        string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro mfg-date?                        yang:date-and-time {feature-list:NOT_HAVE_
TIBIT}?
      | +--ro description?                     string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro hardware-version?                string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro firmware-version?                string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro software-version?                string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro serial-no?                       string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro part-no?                         string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro removable?                       boolean {feature-list:NOT_HAVE_TIBIT}?
      | +--ro oper-status?                     ipi-platform-types:cmmm_component_oper_status_t
    {feature-list:NOT_HAVE_TIBIT}?
      | +--ro product-name?                    string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro asset-tag?                       string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro component-additional-details*    string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro parent?                          -> /components/component/state/name {feature-
list:NOT_HAVE_TIBIT}?
      | +--ro empty?                           boolean {feature-list:NOT_HAVE_TIBIT}?
      | +--ro memory {feature-list:NOT_HAVE_TIBIT}?
      | | +--ro available?      uint64
      | | +--ro utilized?       uint64
      | +--ro board-fru {feature-list:NOT_HAVE_TIBIT}?
      | | +--ro board-name?      string
      | | +--ro board-serial-no?  string
      | | +--ro board-mfg-name?   string
      | | +--ro board-mfg-date?   yang:date-and-time
      | +--ro temperature {feature-list:HAVE_CMMD}?
      | | +--ro instant?          decimal64
      | | +--ro min?               decimal64
      | | +--ro max?               decimal64
      | | +--ro avg?               decimal64
      | | +--ro interval?          uint32
      | | +--ro sensor-name?       string
      | | +--ro sensor-index?      uint8
      | | +--ro alarm-status?       boolean
      | | +--ro alarm-threshold?    decimal64
      | | +--ro alarm-severity?     cml_alarm_severity_t
      | | +--ro minimum-emergency-temperature? decimal64
      | | +--ro maximum-emergency-temperature? decimal64
      | | +--ro minimum-alert-temperature?   decimal64
      | | +--ro maximum-alert-temperature?   decimal64
      | | +--ro minimum-critical-temperature? decimal64
      | | +--ro maximum-critical-temperature? decimal64
    +--ro bmc-sensor-data-record {feature-list:NOT_HAVE_TIBIT}?
      | +--ro state
      | | +--ro sensor-name?      string
      | | +--ro value?             ipi-platform-types:cmmm_bmc_value_t
      | | +--ro units?             string
      | | +--ro lower-non-recoverable? decimal64
      | | +--ro lower-non-critical? decimal64
      | | +--ro lower-critical?     decimal64
      | | +--ro upper-non-critical? decimal64

```

```

|      +--ro upper-critical?          decimal64
|      +--ro upper-non-recoverable?   decimal64
|      +--ro operational-status?      string
|      +--ro threshold?               decimal64
|      +--ro event-type?              ipi-platform-types:cmm_bmc_event_type_t
+--ro cpu {feature-list:HAVE_CMMD}?
|  +--ro state
|  |  +--ro processor-count?          uint32
|  |  +--ro cpu-1min-load-percentage? decimal64
|  |  +--ro cpu-5min-load-percentage? decimal64
|  |  +--ro cpu-15min-load-percentage? decimal64
|  |  +--ro cpu-utilization?          decimal64
|  |  +--ro cpu-utilization-alert?    uint8
|  |  +--ro cpu-utilization-critical? uint8
+--ro storage {feature-list:HAVE_CMMD}?
|  +--ro state
|  |  +--ro head-count?               uint16
|  |  +--ro sector-count?             uint32
|  |  +--ro unformatted-bytes-or-track? uint16
|  |  +--ro unformatted-bytes-or-sector? uint16
|  |  +--ro total-memory?             uint64
+--ro ram {feature-list:HAVE_CMMD}?
|  +--ro state
|  |  +--ro total-memory?             uint64
|  |  +--ro used-memory?              uint64
|  |  +--ro available-memory?         uint64
|  |  +--ro shared-memory?            uint64
|  |  +--ro buffers?                  uint64
|  |  +--ro total-swap?                uint64
|  |  +--ro free-swap?                 uint64
|  |  +--ro current-process-count?    uint16
|  |  +--ro total-high-memory?        uint64
|  |  +--ro available-high-memory?    uint64
|  |  +--ro unit-size?                 uint32
+--ro transceiver {feature-list:HAVE_CMMD,feature-list:NOT_HAVE_TIBIT}?
|  +--ro state
|  |  +--ro grid-spacing?              decimal64
|  |  +--ro first-frequency?           decimal64
|  |  +--ro last-frequency?            decimal64
|  |  +--ro transceiver-temperature?   decimal64
|  |  +--ro presence?                  ipi-platform-transceiver-types:ddm_cmm_trans_
presence_t
|  |  +--ro transceiver-voltage?       decimal64
|  |  +--ro type?                      ipi-platform-transceiver-types:ddm_cmm_trans_
type_t
|  |  +--ro transceiver-identifier?     ipi-platform-transceiver-types:ddm_cmm_trans_
identifier_t
|  |  +--ro connector-type?             ipi-platform-transceiver-types:ddm_cmm_trans_
connector_type_t
|  |  +--ro vendor-name?                string
|  |  +--ro vendor-part-number?         string
|  |  +--ro vendor-revision-number?     string
|  |  +--ro vendor-serial-number?       string
|  |  +--ro vendor-manufacturing-date?  string
|  +--ro sfp
|  |  +--ro state
|  |  |  +--ro transmit-status?        ipi-platform-transceiver-types:ddm_tx_
rx_state_t
|  |  |  +--ro recieve-loss-status?     ipi-platform-transceiver-types:ddm_tx_
rx_state_t
|  |  |  +--ro sfp-identifier?          ipi-platform-transceiver-types:ddm_cmm_
trans_sfp_extended_identifier_t
|  |  |  +--ro sfp-options-implemented? ipi-platform-transceiver-types:ddm_cmm_
trans_sfp_options_implemented_t
|  |  |  +--ro fiber-channel-sfp-speed? ipi-platform-transceiver-types:ddm_cmm_
trans_fiber_channel_speed_t
|  |  |  +--ro sfp-infiniband-compliance-code? ipi-platform-transceiver-types:ddm_cmm_
trans_sfp_infiniband_compliance_t

```

```

| | +--ro sfp-escon-compliance-code? ipi-platform-transceiver-types:ddm_cmm_
trans_sfp_escon_compliance_t
| | +--ro sfp-plus-cable-technology? ipi-platform-transceiver-types:ddm_cmm_
trans_sfp_plus_cable_tech_t
| | +--ro xfp
| | +--ro state
| | +--ro transmit-status? ipi-platform-transceiver-
types:ddm_tx_rx_state_t
| | +--ro recieve-loss-status? ipi-platform-transceiver-
types:ddm_tx_rx_state_t
| | +--ro xsfp-identifier? ipi-platform-transceiver-
types:ddm_cmm_trans_xfp_extended_identifier_t
| | +--ro xfp-10g-ethernet-compliance-code? ipi-platform-transceiver-
types:ddm_cmm_trans_xfp_10g_eth_compliance_t
| | +--ro xfp-10g-fiber-channel-compliance-code? ipi-platform-transceiver-
types:ddm_cmm_trans_xfp_10g_fiber_chn_compliance_t
| | +--ro xfp-10g-copper-link-compliance-code? ipi-platform-transceiver-
types:ddm_cmm_trans_xfp_10g_copper_links_rsvd_t
| | +--ro xfp-lower-speed-link-compliance-code? ipi-platform-transceiver-
types:ddm_cmm_trans_xfp_lower_speed_links_t
| | +--ro xfp-sonet-interconnect-compliance-code? ipi-platform-transceiver-
types:ddm_cmm_trans_xfp_sonet_interconnect_t
| | +--ro xfp-sonet-short-haul-compliance-code? ipi-platform-transceiver-
types:ddm_cmm_trans_xfp_sonet_short_haul_t
| | +--ro xfp-sonet-long-haul-compliance-code? ipi-platform-transceiver-
types:ddm_cmm_trans_xfp_sonet_long_haul_t
| | +--ro xfp-sonet-very-long-haul-compliance-code? ipi-platform-transceiver-
types:ddm_cmm_trans_xfp_sonet_very_long_haul_t
| | +--ro xfp-serial-encoding-algorithm? ipi-platform-transceiver-
types:ddm_cmm_trans_xfp_encoding_t
| | +--ro xsfp-options-implemented? ipi-platform-transceiver-
types:ddm_cmm_trans_xfp_options_implemented_t
| | +--ro xfp-auxillary-voltage? ipi-platform-transceiver-
types:ddm_cmm_trans_xfp_voltage_aux_monitor_t
| | +--ro qsfp
| | +--ro state
| | +--ro reset-status? ipi-platform-transceiver-types:ddm_cmm_trans_
reset_t
| | +--ro power? ipi-platform-transceiver-types:ddm_cmm_trans_
power_t
| | +--ro lane1-transmission? ipi-platform-transceiver-types:ddm_tx_rx_
state_t
| | +--ro lane1-transmission-loss? ipi-platform-transceiver-types:ddm_tx_rx_
state_t
| | +--ro lane1-recieve-loss? ipi-platform-transceiver-types:ddm_tx_rx_
state_t
| | +--ro lane2-transmission? ipi-platform-transceiver-types:ddm_tx_rx_
state_t
| | +--ro lane2-transmission-loss? ipi-platform-transceiver-types:ddm_tx_rx_
state_t
| | +--ro lane2-recieve-loss? ipi-platform-transceiver-types:ddm_tx_rx_
state_t
| | +--ro lane3-transmission? ipi-platform-transceiver-types:ddm_tx_rx_
state_t
| | +--ro lane3-transmission-loss? ipi-platform-transceiver-types:ddm_tx_rx_
state_t
| | +--ro lane3-recieve-loss? ipi-platform-transceiver-types:ddm_tx_rx_
state_t
| | +--ro lane4-transmission? ipi-platform-transceiver-types:ddm_tx_rx_
state_t
| | +--ro lane4-transmission-loss? ipi-platform-transceiver-types:ddm_tx_rx_
state_t
| | +--ro lane4-recieve-loss? ipi-platform-transceiver-types:ddm_tx_rx_
state_t
| | +--ro qsfp-identifier? ipi-platform-transceiver-types:ddm_cmm_qsfp_
extended_identifier_t
| | +--ro fiber-channel-qsfp-speed? ipi-platform-transceiver-types:ddm_cmm_trans_
fiber_channel_speed_t
| | +--ro qsfp-options-implemented? ipi-platform-transceiver-types:ddm_cmm_trans_
qsfp_options_implemented_t

```

```

|   +--ro channels
|   |   +--ro channel* [index]
|   |   |   +--ro index    -> ../state/index
|   |   |   +--ro state
|   |   |   |   +--ro index?                uint8
|   |   |   |   +--ro input-power?          decimal64
|   |   |   |   +--ro input-power-alert-max-threshold? decimal64
|   |   |   |   +--ro input-power-critical-max-threshold? decimal64
|   |   |   |   +--ro input-power-critical-min-threshold? decimal64
|   |   |   |   +--ro input-power-alert-min-threshold? decimal64
|   |   |   |   +--ro output-power?         decimal64
|   |   |   |   +--ro output-power-alert-max-threshold? decimal64
|   |   |   |   +--ro output-power-critical-max-threshold? decimal64
|   |   |   |   +--ro output-power-critical-min-threshold? decimal64
|   |   |   |   +--ro output-power-alert-min-threshold? decimal64
|   |   |   |   +--ro laser-bias-current?    decimal64
|   |   |   |   +--ro laser-bias-current-alert-max-threshold? decimal64
|   |   |   |   +--ro laser-bias-current-critical-max-threshold? decimal64
|   |   |   |   +--ro laser-bias-current-critical-min-threshold? decimal64
|   |   |   |   +--ro laser-bias-current-alert-min-threshold? decimal64
|   |   +--ro cmis-module {feature-list:HAVE_CMMD,feature-list:NOT_HAVE_TIBIT}?
|   |   |   +--ro eeprom
|   |   |   |   +--ro state
|   |   |   |   |   +--ro identifier?        ipi-platform-sff8024-types:cmm_sff8024_
|   |   |   |   |   +--ro vendor-name?       string
|   |   |   |   |   +--ro vendor-oui?        string
|   |   |   |   |   +--ro part-number?       string
|   |   |   |   |   +--ro revision-level?    string
|   |   |   |   |   +--ro serial-number?     string
|   |   |   |   |   +--ro manufacturing-date? string
|   |   |   |   |   +--ro clei-code?         string
|   |   |   |   |   +--ro module-power-class? ipi-platform-cmis-types:cmm_cmis_module_
|   |   |   |   +--ro power_class_t
|   |   |   |   |   +--ro module-max-power?   decimal64
|   |   |   |   |   +--ro cooling-implemented? ipi-platform-cmis-types:cmm_cmis_yes_no_
|   |   |   |   |   +--ro temperature-max?    int16
|   |   |   |   |   +--ro temperature-min?    int16
|   |   |   |   |   +--ro operatin-voltage-min? decimal64
|   |   |   |   |   +--ro optical-detector?   ipi-platform-cmis-types:cmm_cmis_
|   |   |   |   |   +--ro rx-power-measurement? ipi-platform-cmis-types:cmm_cmis_rx_
|   |   |   |   |   +--ro tx-disable-module-wide? ipi-platform-cmis-types:cmm_cmis_yes_no_
|   |   |   |   |   +--ro cable-assembly-link-length? int16
|   |   |   |   |   +--ro connector-type?     ipi-platform-sff8024-types:cmm_sff8024_
|   |   |   |   +--ro connector_type_t
|   |   |   |   |   +--ro cca-5ghz?          uint8
|   |   |   |   |   +--ro cca-7ghz?          uint8
|   |   |   |   |   +--ro cca-12p9ghz?       uint8
|   |   |   |   |   +--ro cca-25p8ghz?       uint8
|   |   |   |   |   +--ro media-interface-technology? ipi-platform-cmis-types:cmm_cmis_media_
|   |   |   |   |   +--ro cmis-revision?      string
|   |   |   |   |   +--ro memory-model?       ipi-platform-cmis-types:cmm_cmis_memory_
|   |   |   |   |   +--ro mci-max-speed?     ipi-platform-cmis-types:cmm_cmis_mci_
|   |   |   |   |   +--ro active-firmware-revision? string
|   |   |   |   |   +--ro inactive-firmware-revision? string
|   |   |   |   |   +--ro hardware-revision?  string
|   |   |   |   |   +--ro media-type?         ipi-platform-cmis-types:cmm_cmis_media_
|   |   |   |   |   +--ro max-smf-link-length? decimal64
|   |   |   |   |   +--ro max-mmfm2-link-length? uint8
|   |   |   |   |   +--ro max-mmfm3-link-length? uint16

```

|                         |  |                                             |                                   |
|-------------------------|--|---------------------------------------------|-----------------------------------|
|                         |  | +--ro max-mmfm-om4-link-length?             | uint16                            |
|                         |  | +--ro max-mmfm-om5-link-length?             | uint16                            |
|                         |  | +--ro wavelength-nominal?                   | decimal64                         |
|                         |  | +--ro wavelength-tolerance?                 | decimal64                         |
|                         |  | +--ro advertisement                         |                                   |
|                         |  | +--ro applications                          |                                   |
|                         |  | +--ro application* [id]                     |                                   |
|                         |  | +--ro id -> ../state/id                     |                                   |
|                         |  | +--ro state                                 |                                   |
|                         |  | +--ro id? uint8                             |                                   |
|                         |  | +--ro host                                  |                                   |
|                         |  | +--ro state                                 |                                   |
|                         |  | +--ro interface-type?                       | ipi-platform-cmis-types:cmm_cmis_ |
| interface_type_t        |  |                                             |                                   |
|                         |  | +--ro application-bitrate?                  | ipi-platform-cmis-types:cmm_cmis_ |
| bit_rate_t              |  |                                             |                                   |
|                         |  | +--ro lane-count?                           | uint8                             |
|                         |  | +--ro signal-bitrate?                       | ipi-platform-cmis-types:cmm_cmis_ |
| bit_rate_t              |  |                                             |                                   |
|                         |  | +--ro modulation-format?                    | ipi-platform-cmis-types:cmm_cmis_ |
| modulation_format_t     |  |                                             |                                   |
|                         |  | +--ro bits-per-unit-interval?               | decimal64                         |
|                         |  | +--ro lane-assignment?                      | ipi-platform-cmis-types:cmm_cmis_ |
| lane_assignment_t       |  |                                             |                                   |
|                         |  | +--ro host-config?                          | string                            |
|                         |  | +--ro media                                 |                                   |
|                         |  | +--ro state                                 |                                   |
|                         |  | +--ro interface-type?                       | ipi-platform-cmis-types:cmm_cmis_ |
| interface_type_t        |  |                                             |                                   |
|                         |  | +--ro application-bitrate?                  | ipi-platform-cmis-types:cmm_cmis_ |
| bit_rate_t              |  |                                             |                                   |
|                         |  | +--ro lane-count?                           | uint8                             |
|                         |  | +--ro signal-bitrate?                       | ipi-platform-cmis-types:cmm_cmis_ |
| bit_rate_t              |  |                                             |                                   |
|                         |  | +--ro modulation-format?                    | ipi-platform-cmis-types:cmm_cmis_ |
| modulation_format_t     |  |                                             |                                   |
|                         |  | +--ro bits-per-unit-interval?               | decimal64                         |
|                         |  | +--ro lane-assignment?                      | ipi-platform-cmis-types:cmm_cmis_ |
| lane_assignment_t       |  |                                             |                                   |
|                         |  | +--ro controls                              |                                   |
|                         |  | +--ro state                                 |                                   |
|                         |  | +--ro wavelength-control?                   | ipi-platform-cmis-types:cmm_cmis_ |
| yes_no_t                |  |                                             |                                   |
|                         |  | +--ro tunable-transmitter?                  | ipi-platform-cmis-types:cmm_cmis_ |
| yes_no_t                |  |                                             |                                   |
|                         |  | +--ro tx-output-squelching-method?          | ipi-platform-cmis-types:cmm_cmis_ |
| tx_squelch_method_t     |  |                                             |                                   |
|                         |  | +--ro forced-tx-output-squelching?          | ipi-platform-cmis-types:cmm_cmis_ |
| yes_no_t                |  |                                             |                                   |
|                         |  | +--ro tx-output-squelching-disable?         | ipi-platform-cmis-types:cmm_cmis_ |
| yes_no_t                |  |                                             |                                   |
|                         |  | +--ro tx-output-disable?                    | ipi-platform-cmis-types:cmm_cmis_ |
| yes_no_t                |  |                                             |                                   |
|                         |  | +--ro input-polarity-flip-tx?               | ipi-platform-cmis-types:cmm_cmis_ |
| yes_no_t                |  |                                             |                                   |
|                         |  | +--ro rx-output-squelching-disable?         | ipi-platform-cmis-types:cmm_cmis_ |
| yes_no_t                |  |                                             |                                   |
|                         |  | +--ro rx-output-disable?                    | ipi-platform-cmis-types:cmm_cmis_ |
| yes_no_t                |  |                                             |                                   |
|                         |  | +--ro output-polarity-flip-rx?              | ipi-platform-cmis-types:cmm_cmis_ |
| yes_no_t                |  |                                             |                                   |
|                         |  | +--ro diagnostics                           |                                   |
|                         |  | +--ro module                                |                                   |
|                         |  | +--ro state                                 |                                   |
|                         |  | +--ro simultaneous-host-and-media-loopback? | ipi-platform-cmis-                |
| types:cmm_cmis_yes_no_t |  |                                             |                                   |
|                         |  | +--ro report-bit-error-ratio?               | ipi-platform-cmis-                |
| types:cmm_cmis_yes_no_t |  |                                             |                                   |
|                         |  | +--ro count-bits-and-errors?                | ipi-platform-cmis-                |

```

types:cmm_cmis_yes_no_t
| | | | +--ro host
| | | | +--ro state
| | | | +--ro output-loopack? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro input-loopack? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro per-lane-loopack? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro report-input-snr? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro report-fec? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro prbs-checker-post-fec? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro prbs-checker-pre-fec? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro prbs-checker-types? ipi-platform-cmis-types:cmm_cmis_
prbs_support_type_t | | | | +--ro prbs-generator-post-fec? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro prbs-generator-pre-fec? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro prbs-generator-types? ipi-platform-cmis-types:cmm_cmis_
prbs_support_type_t | | | | +--ro media
| | | | +--ro state
| | | | +--ro output-loopack? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro input-loopack? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro per-lane-loopack? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro report-input-snr? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro report-fec? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro prbs-checker-post-fec? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro prbs-checker-pre-fec? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro prbs-checker-types? ipi-platform-cmis-types:cmm_cmis_
prbs_support_type_t | | | | +--ro prbs-generator-post-fec? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro prbs-generator-pre-fec? ipi-platform-cmis-types:cmm_cmis_yes_
no_t | | | | +--ro prbs-generator-types? ipi-platform-cmis-types:cmm_cmis_
prbs_support_type_t | | | | +--ro durations
| | | | +--ro state
| | | | +--ro modsel-wait-time? uint32
| | | | +--ro dpinit-maximun-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | | | +--ro dpdeinit-maximun-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | | | +--ro dptxturnon-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | | | +--ro dptxturnoff-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | | | +--ro modulepwrup-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | | | +--ro modulepwrdown-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | | | +--ro npinit-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | | | +--ro npdeinit-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | | | +--ro nptxturnon-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t

```

```

| | | +---ro nptxturnoff-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t
| | | +---ro laser
| | | +---ro state
| | | +---ro supported-grids? ipi-platform-cmis-types:cmm_
cmis_laser_grid_support_t
| | | +---ro fine-tune-supported? ipi-platform-cmis-types:cmm_
cmis_yes_no_t
| | | +---ro fine-tune-resolution? decimal64
| | | +---ro fine-tune-low-offset? decimal64
| | | +---ro fine-tune-high-offset? decimal64
| | | +---ro per-lane-programmable-output-power? ipi-platform-cmis-types:cmm_
cmis_yes_no_t
| | | +---ro minimum-programmable-output-power? decimal64
| | | +---ro maximum-programmable-output-power? decimal64
| | | +---ro grids
| | | +---ro grid* [id]
| | | +---ro id -> ../state/id
| | | +---ro state
| | | +---ro id? ipi-platform-cmis-types:cmm_
cmis_laser_grid_spacing_t
| | | +---ro lowest-channel-frequency? decimal64
| | | +---ro highest-channel-frequency? decimal64
| | | +---ro channel-count? uint16
| | | +---ro monitoring
| | | +---ro module
| | | +---ro monitors
| | | +---ro monitor* [id]
| | | +---ro id -> ../state/id
| | | +---ro state
| | | +---ro id? ipi-platform-cmis-types:cmm_cmis_module_
monitor_id_t
| | | +---ro supported? ipi-platform-cmis-types:cmm_cmis_yes_no_t
| | | +---ro host
| | | +---ro monitors
| | | +---ro monitor* [id]
| | | +---ro id -> ../state/id
| | | +---ro state
| | | +---ro id? ipi-platform-cmis-types:cmm_cmis_host_
monitor_id_t
| | | +---ro supported? ipi-platform-cmis-types:cmm_cmis_yes_no_
t
| | | +---ro lanes-assigned? ipi-platform-cmis-types:cmm_cmis_lane_
assignment_t
| | | +---ro flags
| | | +---ro flag* [id]
| | | +---ro id -> ../state/id
| | | +---ro state
| | | +---ro id? ipi-platform-cmis-types:cmm_cmis_host_
flag_id_t
| | | +---ro supported? ipi-platform-cmis-types:cmm_cmis_yes_no_
t
| | | +---ro lanes-assigned? ipi-platform-cmis-types:cmm_cmis_lane_
assignment_t
| | | +---ro media
| | | +---ro monitors
| | | +---ro monitor* [id]
| | | +---ro id -> ../state/id
| | | +---ro state
| | | +---ro id? ipi-platform-cmis-types:cmm_cmis_media_
monitor_id_t
| | | +---ro supported? ipi-platform-cmis-types:cmm_cmis_yes_no_
t
| | | +---ro lanes-assigned? ipi-platform-cmis-types:cmm_cmis_lane_
assignment_t
| | | +---ro flags
| | | +---ro flag* [id]
| | | +---ro id -> ../state/id

```

```

| | | +--ro state
| | | +--ro id? ipi-platform-cmis-types:cmm_cmis_media_
flag_id_t
| | | +--ro supported? ipi-platform-cmis-types:cmm_cmis_yes_no_
t
| | | +--ro lanes-assigned? ipi-platform-cmis-types:cmm_cmis_lane_
assignment_t
| | +--ro pages
| | +--ro state
| | +--ro network-path-pages-supported? ipi-platform-cmis-types:cmm_cmis_
yes_no_t
| | +--ro vdm-pages-supported? ipi-platform-cmis-types:cmm_cmis_
yes_no_t
| | +--ro vdm-groups? ipi-platform-cmis-types:cmm_cmis_
vdm_pages_support_t
| | +--ro diagnostics-pages-supported? ipi-platform-cmis-types:cmm_cmis_
yes_no_t
| | +--ro user-page-supported? ipi-platform-cmis-types:cmm_cmis_
yes_no_t
| | +--ro banks-per-page? ipi-platform-cmis-types:cmm_cmis_
bank_per_page_support_t
| +--ro module-state
| | +--ro state
| | | +--ro fault-state? ipi-platform-cmis-types:cmm_cmis_module_fault_state_t
| | | +--ro current-state? ipi-platform-cmis-types:cmm_cmis_module_state_t
| | +--ro datapaths
| | +--ro datapath* [lane]
| | +--ro lane -> ../state/lane
| | +--ro state
| | +--ro lane? uint8
| | +--ro current-state? ipi-platform-cmis-types:cmm_cmis_datapath_
states_t
| | +--ro host-rate? decimal64
| | +--ro media-rate? decimal64
| | +--ro interface-name? string
| +--ro module-monitors
| | +--ro monitors
| | | +--ro monitor* [id]
| | | +--ro id -> ../state/id
| | | +--ro state
| | | +--ro id? ipi-platform-cmis-types:cmm_cmis_module_monitor_
id_t
| | | +--ro description? string
| | | +--ro value? decimal64
| | | +--ro high-alarm? decimal64
| | | +--ro high-warning? decimal64
| | | +--ro low-warning? decimal64
| | | +--ro low-alarm? decimal64
| | +--ro monitor-alarm
| | +--ro state
| | +--ro alarm-id? ipi-platform-cmis-types:cmm_cmis_module_
monitor_id_t
| | +--ro alarm-type? ipi-platform-cmis-types:cmm_cmis_threshold_
alarm_t
| | +--ro current-value? decimal64
| | +--ro threshold-minimum? decimal64
| | +--ro threshold-maximum? decimal64
| +--ro host-monitors
| | +--ro lanes
| | +--ro lane* [number]
| | +--ro number -> ../state/number
| | +--ro state
| | | +--ro number? uint8
| | | +--ro dp-assigned? boolean
| | +--ro monitors
| | | +--ro monitor* [id]
| | | +--ro id -> ../state/id
| | | +--ro state

```

```

monitor_id_t | | | | | +--ro id? ipi-platform-cmis-types:cmm_cmis_host_
| | | | | +--ro description? string
| | | | | +--ro value? decimal64
| | | | | +--ro high-alarm? decimal64
| | | | | +--ro high-warning? decimal64
| | | | | +--ro low-warning? decimal64
| | | | | +--ro low-alarm? decimal64
| | | | | +--ro flags
| | | | | | +--ro flag* [id]
| | | | | | +--ro id -> ../state/id
| | | | | | +--ro state
| | | | | | +--ro id? ipi-platform-cmis-types:cmm_cmis_host_flag_
id_t | | | | | +--ro description? string
| | | | | +--ro value? boolean
| | | | | +--ro monitor-alarm
| | | | | | +--ro state
| | | | | | +--ro alarm-id? ipi-platform-cmis-types:cmm_cmis_host_
monitor_id_t | | | | | +--ro alarm-type? ipi-platform-cmis-types:cmm_cmis_
threshold_alarm_t | | | | | +--ro current-value? decimal64
| | | | | +--ro threshold-minimum? decimal64
| | | | | +--ro threshold-maximum? decimal64
| | | | | +--ro flag-alarm
| | | | | | +--ro state
| | | | | | +--ro alarm-id? ipi-platform-cmis-types:cmm_cmis_host_flag_id_t
+--ro media-monitors
+--ro lanes
+--ro lane* [number]
+--ro number -> ../state/number
+--ro state
| +--ro number? uint8
+--ro monitors
| +--ro monitor* [id]
| +--ro id -> ../state/id
| +--ro state
| +--ro id? ipi-platform-cmis-types:cmm_cmis_media_
monitor_id_t | | | | | +--ro description? string
| | | | | +--ro value? decimal64
| | | | | +--ro high-alarm? decimal64
| | | | | +--ro high-warning? decimal64
| | | | | +--ro low-warning? decimal64
| | | | | +--ro low-alarm? decimal64
| | | | | +--ro flags
| | | | | | +--ro flag* [id]
| | | | | | +--ro id -> ../state/id
| | | | | | +--ro state
| | | | | | +--ro id? ipi-platform-cmis-types:cmm_cmis_media_
flag_id_t | | | | | +--ro description? string
| | | | | +--ro value? boolean
| | | | | +--ro monitor-alarm
| | | | | | +--ro state
| | | | | | +--ro alarm-id? ipi-platform-cmis-types:cmm_cmis_media_
monitor_id_t | | | | | +--ro alarm-type? ipi-platform-cmis-types:cmm_cmis_
threshold_alarm_t | | | | | +--ro current-value? decimal64
| | | | | +--ro threshold-minimum? decimal64
| | | | | +--ro threshold-maximum? decimal64
| | | | | +--ro flag-alarm
| | | | | | +--ro state
| | | | | | +--ro alarm-id? ipi-platform-cmis-types:cmm_cmis_media_flag_id_t
+--ro power-supply {feature-list:HAVE_CMMD}?

```

```

|   +--ro state
|   |   +--ro operational-status?    cml_cmm_power_supply_operstatus_t
|   |   +--ro capacity?              decimal64
|   |   +--ro power-consumption?     decimal64
|   |   +--ro input-power?           decimal64
|   |   +--ro input-voltage?         decimal64
|   |   +--ro output-voltage?        decimal64
|   |   +--ro input-current?         decimal64
|   |   +--ro output-current?        decimal64
|   |   +--ro temperature-sensor1?   decimal64
|   |   +--ro temperature-sensor2?   decimal64
|   |   +--ro temperature-sensor3?   decimal64
|   |   +--ro fan1-rpm?              uint32
|   |   +--ro fan2-rpm?              uint32
|   |   +--ro fan3-rpm?              uint32
|   |   +--ro fan4-rpm?              uint32
+--ro fan {feature-list:HAVE_CMMD}?
|   +--ro state
|   |   +--ro rpm?                   uint32
|   |   +--ro minimum-rpm?           uint32
|   |   +--ro maximum-rpm?           uint32
|   |   +--ro fan-status?            cml_cmm_fan_status_t
|   |   +--ro fan-location?          cml_cmm_fan_location_t
+--ro fan-tray {feature-list:HAVE_CMMD}?
|   +--ro state
|   |   +--ro tray-number?           uint8
|   |   +--ro status?                cml_cmm_fan_tray_status_t
|   |   +--ro led-color?             cml_cmm_led_color_code_t
|   |   +--ro fan-count?             uint32

```

### hardware-profile-filter-groups

```

module: ipi-platform
+--rw profiles {feature-list:HAVE_BROADCOM}?
|   +--rw hardware-profile
|   |   +--rw filters
|   |   |   +--ro tcam-utilization {feature-list:HAVE_ACL}?
|   |   |   |   +--ro filter-groups
|   |   |   |   |   +--ro filter-group* [group-id]
|   |   |   |   |   |   +--ro group-id    -> ../state/group-id
|   |   |   |   |   |   +--ro state
|   |   |   |   |   |   |   +--ro group-id?        uint32
|   |   |   |   |   |   |   +--ro group-name?      cml-data-types:cml_line_t
|   |   |   |   |   |   |   +--ro free-entries?    int32
|   |   |   |   |   |   |   +--ro used-entries?    int32
|   |   |   |   |   |   |   +--ro used-percentage? int32
|   |   |   |   |   |   |   +--ro total-entries?   int32
|   |   |   |   |   |   |   +--ro dedicated-entries? int32
|   |   |   |   |   |   |   +--ro shared-entries?  int32

```

### hardware-l2vpn-instances-limits

```

module: ipi-platform
+--rw profiles {feature-list:HAVE_BROADCOM,feature-list:HAVE_CMMD,feature-list:HAVE_BROADCOM_
OR_HAVE_MARVELL}?
|   +--rw hardware-profile
|   |   +--ro hardware-l2vpn-instances-limits {feature-list:HAVE_BROADCOM,feature-list:HAVE_
DUNE,feature-list:HAVE_CMMD}?
|   |   |   +--ro instances
|   |   |   |   +--ro state
|   |   |   |   |   +--ro capacity?    uint32
|   |   |   |   |   +--ro used?        uint32
|   |   |   |   |   +--ro free?        uint32
|   |   |   |   |   +--ro percentage?  uint8
|   |   |   |   +--ro services
|   |   |   |   |   +--ro service* [name]

```

```

| | | +--ro name -> ../state/name
| | | +--ro state
| | | | +--ro name? platform_l2vpn_services_t
| | | | +--ro capacity? uint32
| | | | +--ro used? uint32
| | | | +--ro free? uint32
| | | | +--ro percentage? uint8
| | +--ro vsi
| | | +--ro state
| | | | +--ro capacity? uint32
| | | | +--ro used? uint32
| | | | +--ro free? uint32
| | | | +--ro percentage? uint8
| | | +--ro services
| | | | +--ro service* [name]
| | | | | +--ro name -> ../state/name
| | | | | +--ro state
| | | | | +--ro name? platform_l2vpn_services_t
| | | | | +--ro capacity? uint32
| | | | | +--ro used? uint32
| | | | | +--ro free? uint32
| | | | | +--ro percentage? uint8
| | +--ro multicast-groups
| | | +--ro state
| | | | +--ro capacity? uint32
| | | | +--ro used? uint32
| | | | +--ro free? uint32
| | | | +--ro percentage? uint8
| | | +--ro services
| | | | +--ro service* [name]
| | | | | +--ro name -> ../state/name
| | | | | +--ro state
| | | | | +--ro name? platform_l2vpn_services_t
| | | | | +--ro capacity? uint32
| | | | | +--ro used? uint32
| | | | | +--ro free? uint32
| | | | | +--ro percentage? uint8

```

### hardware-routing-limits

```

module: ipi-platform
+--rw profiles {feature-list:HAVE_BROADCOM,feature-list:HAVE_CMMD,feature-list:HAVE_BROADCOM_
OR_HAVE_MARVELL}?
| +--rw forwarding-profiles
| | +--ro hardware-routing-limits {feature-list:HAVE_BROADCOM,feature-list:HAVE_DNX,feature-
list:HAVE_CMMD}?
| | | +--ro lpm
| | | | +--ro state
| | | | | +--ro capacity? uint32
| | | | | +--ro used? uint32
| | | | | +--ro free? uint32
| | | | | +--ro percentage? uint8
| | | +--ro ipv4-lpm
| | | | +--ro state
| | | | | +--ro capacity? uint32
| | | | | +--ro used? uint32
| | | | | +--ro free? uint32
| | | | | +--ro percentage? uint8
| | | +--ro ipv6-lpm
| | | | +--ro state
| | | | | +--ro capacity? uint32
| | | | | +--ro used? uint32
| | | | | +--ro free? uint32
| | | | | +--ro percentage? uint8
| | +--ro mpls-labels-pop
| | | +--ro state

```

```

|          |      +--ro capacity?      uint32
|          |      +--ro used?        uint32
|          |      +--ro free?        uint32
|          |      +--ro percentage?  uint8
|      +--ro mpls-labels-swap
|          +--ro state
|              +--ro capacity?      uint32
|              +--ro used?          uint32
|              +--ro free?          uint32
|              +--ro percentage?    uint8

```

## Sensor Paths: ipi-platform

The paths listed below represent telemetry paths for monitoring the state of various components, including CPU, storage, RAM, power supply, fans, fan trays, CMIS, and transceivers.

### CPU

```

Sensor Path
    ipi:/components/component[name]/cpu/state

Leaf Attributes
    ipi:/components/component[name]/cpu/state/cpu-1min-load-percentage
    ipi:/components/component[name]/cpu/state/cpu-5min-load-percentage
    ipi:/components/component[name]/cpu/state/cpu-15min-load-percentage
    ipi:/components/component[name]/cpu/state/cpu-utilization
    ipi:/components/component[name]/cpu/state/cpu-utilization-critical
    ipi:/components/component[name]/cpu/state/processor-count
    ipi:/components/component[name]/cpu/state/cpu-utilization-alert

```

### Storage

```

Sensor Path
    ipi:/components/component[name]/storage/state/

Leaf Attributes
    ipi:/components/component[name]/storage/state/total-memory
    ipi:/components/component[name]/storage/state/head-count
    ipi:/components/component[name]/storage/state/sector-count
    ipi:/components/component[name]/storage/state/unformatted-bytes-or-track
    ipi:/components/component[name]/storage/state/unformatted-bytes-or-sector

```

### RAM

```

Sensor Path
    ipi:/components/component[name]/ram/state/

Leaf Attributes
    ipi:/components/component[name]/ram/state/total-memory
    ipi:/components/component[name]/ram/state/used-memory
    ipi:/components/component[name]/ram/state/available-memory
    ipi:/components/component[name]/ram/state/shared-memory
    ipi:/components/component[name]/ram/state/buffers
    ipi:/components/component[name]/ram/state/total-swap
    ipi:/components/component[name]/ram/state/free-swap
    ipi:/components/component[name]/ram/state/current-process-count
    ipi:/components/component[name]/ram/state/total-high-memory
    ipi:/components/component[name]/ram/state/available-high-memory
    ipi:/components/component[name]/ram/state/unit-size

```

## Power-Supply

```
Sensor Path
    ipi:/components/component[name]/power-supply/state/

Leaf Attributes
    ipi:/components/component[name]/power-supply/state/capacity
    ipi:/components/component[name]/power-supply/state/power-consumption
    ipi:/components/component[name]/power-supply/state/input-power
    ipi:/components/component[name]/power-supply/state/input-voltage
    ipi:/components/component[name]/power-supply/state/input-current
    ipi:/components/component[name]/power-supply/state/output-voltage
    ipi:/components/component[name]/power-supply/state/output-current
    ipi:/components/component[name]/power-supply/state/operational-status
    ipi:/components/component[name]/power-supply/state/fan1-rpm
    ipi:/components/component[name]/power-supply/state/fan2-rpm
    ipi:/components/component[name]/power-supply/state/fan3-rpm
    ipi:/components/component[name]/power-supply/state/fan4-rpm
    ipi:/components/component[name]/power-supply/state/temperature-sensor1
    ipi:/components/component[name]/power-supply/state/temperature-sensor2
    ipi:/components/component[name]/power-supply/state/temperature-sensor3
```

## Fan

```
Sensor Path
    ipi:/components/component[name]/fan/state/

Leaf Attributes
    ipi:/components/component[name]/fan/state/rpm
    ipi:/components/component[name]/fan/state/fan-status
    ipi:/components/component[name]/fan/state/fan-location
    ipi:/components/component[name]/fan/state/minimum-rpm
    ipi:/components/component[name]/fan/state/maximum-rpm
```

## Fan-Tray

```
Sensor Path
    ipi:/components/component[name]/fan-tray/state/

Leaf Attributes
    ipi:/components/component[name]/fan-tray/state/status
    ipi:/components/component[name]/fan-tray/state/tray-number
    ipi:/components/component[name]/fan-tray/state/led-color
    ipi:/components/component[name]/fan-tray/state/fan-count
```

## Transceiver State

```
Sensor Path
    ipi:/components/component[name]/transceiver/state/

Leaf Attributes
    ipi:/components/component[name]/transceiver/state/grid-spacing
    ipi:/components/component[name]/transceiver/state/first-frequency
    ipi:/components/component[name]/transceiver/state/last-frequency
    ipi:/components/component[name]/transceiver/state/transceiver-temperature
    ipi:/components/component[name]/transceiver/state/transceiver-voltage
    ipi:/components/component[name]/transceiver/state/presence
    ipi:/components/component[name]/transceiver/state/type
```

```

ipi:/components/component[name]/transceiver/state/transceiver-identifier
ipi:/components/component[name]/transceiver/state/connector-type
ipi:/components/component[name]/transceiver/state/vendor-name
ipi:/components/component[name]/transceiver/state/vendor-part-number
ipi:/components/component[name]/transceiver/state/vendor-revision-number
ipi:/components/component[name]/transceiver/state/vendor-serial-number
ipi:/components/component[name]/transceiver/state/vendor-manufacturing-date

```

## Transceiver SFP State

```

Sensor Path
    ipi:/components/component[name]/transceiver/sfp/state/

Leaf Attributes
    ipi:/components/component[name]/transceiver/sfp/state/transmit-status
    ipi:/components/component[name]/transceiver/sfp/state/recieve-loss-status
    ipi:/components/component[name]/transceiver/sfp/state/sfp-identifier
    ipi:/components/component[name]/transceiver/sfp/state/sfp-options-implemented
    ipi:/components/component[name]/transceiver/sfp/state/fiber-channel-sfp-speed
    ipi:/components/component[name]/transceiver/sfp/state/sfp-infiniband-compliance-code
    ipi:/components/component[name]/transceiver/sfp/state/sfp-escon-compliance-code
    ipi:/components/component[name]/transceiver/sfp/state/sfp-plus-cable-technology

```

## Transceiver XFP State

```

Sensor Path
    ipi:/components/component[name]/transceiver/xfp/state/

Leaf Attributes
    ipi:/components/component[name]/transceiver/xfp/state/transmit-status
    ipi:/components/component[name]/transceiver/xfp/state/recieve-loss-status
    ipi:/components/component[name]/transceiver/xfp/state/xsfp-identifier
    ipi:/components/component[name]/transceiver/xfp/state/xfp-10g-ethernet-compliance-code
    ipi:/components/component[name]/transceiver/xfp/state/xfp-10g-fiber-channel-compliance-
code
    ipi:/components/component[name]/transceiver/xfp/state/xfp-10g-copper-link-compliance-
code
    ipi:/components/component[name]/transceiver/xfp/state/xfp-lower-speed-link-compliance-
code
    ipi:/components/component[name]/transceiver/xfp/state/xfp-sonet-interconnect-compliance-
code
    ipi:/components/component[name]/transceiver/xfp/state/xfp-sonet-short-haul-compliance-
code
    ipi:/components/component[name]/transceiver/xfp/state/xfp-sonet-long-haul-compliance-
code
    ipi:/components/component[name]/transceiver/xfp/state/xfp-sonet-very-long-haul-
compliance-code
    ipi:/components/component[name]/transceiver/xfp/state/xfp-serial-encoding-algorithm
    ipi:/components/component[name]/transceiver/xfp/state/xsfp-options-implemented
    ipi:/components/component[name]/transceiver/xfp/state/xfp-auxillary-voltage

```

## Transceiver QSFP State

```

Sensor Path
    ipi:/components/component[name]/transceiver/qsfp/state/

Leaf Attributes
    ipi:/components/component[name]/transceiver/qsfp/state/reset-status
    ipi:/components/component[name]/transceiver/qsfp/state/power

```

```

ipi:/components/component[name]/transceiver/qsfp/state/lanel-transmission
ipi:/components/component[name]/transceiver/qsfp/state/lanel-transmission-loss
ipi:/components/component[name]/transceiver/qsfp/state/lanel-recieve-loss
ipi:/components/component[name]/transceiver/qsfp/state/lane2-transmission
ipi:/components/component[name]/transceiver/qsfp/state/lane2-transmission-loss
ipi:/components/component[name]/transceiver/qsfp/state/lane2-recieve-loss
ipi:/components/component[name]/transceiver/qsfp/state/lane3-transmission
ipi:/components/component[name]/transceiver/qsfp/state/lane3-transmission-loss
ipi:/components/component[name]/transceiver/qsfp/state/lane3-recieve-loss
ipi:/components/component[name]/transceiver/qsfp/state/lane4-transmission
ipi:/components/component[name]/transceiver/qsfp/state/lane4-transmission-loss
ipi:/components/component[name]/transceiver/qsfp/state/qsfp-identifier
ipi:/components/component[name]/transceiver/qsfp/state/fiber-channel-qsfp-speed
ipi:/components/component[name]/transceiver/qsfp/state/qsfp-options-implemented

```

## Transceiver Channels

### Sensor Path

```
ipi:/components/component[name]/transceiver/channels/channel[index]/state/
```

### Leaf Attributes

```

ipi:/components/component[name]/transceiver/channels/channel[index]/state/index
ipi:/components/component[name]/transceiver/channels/channel[index]/state/input-power
ipi:/components/component[name]/transceiver/channels/channel[index]/state/input-power-
alert-max-threshold
ipi:/components/component[name]/transceiver/channels/channel[index]/state/input-power-
critical-max-threshold
ipi:/components/component[name]/transceiver/channels/channel[index]/state/input-power-
critical-min-threshold
ipi:/components/component[name]/transceiver/channels/channel[index]/state/input-power-
alert-min-threshold
ipi:/components/component[name]/transceiver/channels/channel[index]/state/output-power
ipi:/components/component[name]/transceiver/channels/channel[index]/state/output-power-
alert-max-threshold
ipi:/components/component[name]/transceiver/channels/channel[index]/state/output-power-
critical-max-threshold
ipi:/components/component[name]/transceiver/channels/channel[index]/state/output-power-
critical-min-threshold
ipi:/components/component[name]/transceiver/channels/channel[index]/state/output-power-
alert-min-threshold
ipi:/components/component[name]/transceiver/channels/channel[index]/state/laser-bias-
current
ipi:/components/component[name]/transceiver/channels/channel[index]/state/laser-bias-
current-alert-max-treshold
ipi:/components/component[name]/transceiver/channels/channel[index]/state/laser-bias-
current-critical-max-threshold
ipi:/components/component[name]/transceiver/channels/channel[index]/state/laser-bias-
current-critical-min-threshold
ipi:/components/component[name]/transceiver/channels/channel[index]/state/laser-bias-
current-alert-min-threshold

```

## Platform State

### Sensor Path

```
ipi:/components/component[name]/state/
```

### Leaf Attributes

```

ipi:/components/component[name]/state/name
ipi:/components/component[name]/state/type
ipi:/components/component[name]/state/location
ipi:/components/component[name]/state/mfg-name
ipi:/components/component[name]/state/description
ipi:/components/component[name]/state/hardware-version

```

```

ipi:/components/component[name]/state/firmware-version
ipi:/components/component[name]/state/software-version
ipi:/components/component[name]/state/serial-no
ipi:/components/component[name]/state/part-no
ipi:/components/component[name]/state/removable
ipi:/components/component[name]/state/oper-status
ipi:/components/component[name]/state/product-name
ipi:/components/component[name]/state/asset-tag
ipi:/components/component[name]/state/component-additional-details
ipi:/components/component[name]/state/parent
ipi:/components/component[name]/state/empty

```

## Platform State: Memory

```

Sensor Path
    ipi:/components/component[name]/state/memory
Leaf Attributes
    ipi:/components/component[name]/state/memory/available
    ipi:/components/component[name]/state/memory/used

```

## Platform State: Board FRU

```

Sensor Path
    ipi:/components/component[name]/state/board-fru
Leaf Attributes
    ipi:/components/component[name]/state/board-fru/board-name
    ipi:/components/component[name]/state/board-fru/board-serial-no
    ipi:/components/component[name]/state/board-fru/board-mfg-name
    ipi:/components/component[name]/state/board-fru/board-mfg-date

```

## Platform State: Temperature

```

Sensor Path
    ipi:/components/component[name]/state/temperature
Leaf Attributes
    ipi:/components/component[name]/state/temperature/instant
    ipi:/components/component[name]/state/temperature/min
    ipi:/components/component[name]/state/temperature/max
    ipi:/components/component[name]/state/temperature/avg
    ipi:/components/component[name]/state/temperature/interval
    ipi:/components/component[name]/state/temperature/sensor-name
    ipi:/components/component[name]/state/temperature/sensor-index
    ipi:/components/component[name]/state/temperature/alarm-status
    ipi:/components/component[name]/state/temperature/alarm-threshold
    ipi:/components/component[name]/state/temperature/alarm-severity
    ipi:/components/component[name]/state/temperature/minimum-emergency-temperature
    ipi:/components/component[name]/state/temperature/maximum-emergency-temperature
    ipi:/components/component[name]/state/temperature/minimum-alert-temperature
    ipi:/components/component[name]/state/temperature/maximum-alert-temperature
    ipi:/components/component[name]/state/temperature/minimum-critical-temperature
    ipi:/components/component[name]/state/temperature/maximum-critical-temperature

```

## Hardware Profile: State

```

Sensor Path
    ipi:/profiles/hardware-profile/filters/tcam-utilization/filter-groups/filter-group
[group-id]/state
Leaf Attributes
    ipi:/profiles/hardware-profile/filters/tcam-utilization/filter-groups/filter-
group/state/dedicated-entries
    ipi:/profiles/hardware-profile/filters/tcam-utilization/filter-groups/filter-
group/state/free-entries
    ipi:/profiles/hardware-profile/filters/tcam-utilization/filter-groups/filter-

```

```

group/state/group-id
  ipi:/profiles/hardware-profile/filters/tcam-utilization/filter-groups/filter-
group/state/group-name
  ipi:/profiles/hardware-profile/filters/tcam-utilization/filter-groups/filter-
group/state/shared-entries
  ipi:/profiles/hardware-profile/filters/tcam-utilization/filter-groups/filter-
group/state/total-entries
  ipi:/profiles/hardware-profile/filters/tcam-utilization/filter-groups/filter-
group/state/used-entries
  ipi:/profiles/hardware-profile/filters/tcam-utilization/filter-groups/filter-
group/state/used-percentage

```

### Hardware Profile: IPv4 LPM State

```

Sensor Path
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/ipv4-lpm/state
Leaf Attributes
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/ipv4-lpm/state/capacity
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/ipv4-lpm/state/free
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/ipv4-lpm/state/percentage
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/ipv4-lpm/state/used

```

### Hardware Profile: IPv6 LPM State

```

Sensor Path
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/ipv6-lpm/state
Leaf Attributes
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/ipv6-lpm/state/capacity
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/ipv6-lpm/state/free
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/ipv6-lpm/state/percentage
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/ipv6-lpm/state/used

```

### Hardware Profile: LPM State

```

Sensor Path
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/lpm/state
Leaf Attributes
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/lpm/state/capacity
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/lpm/state/free
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/lpm/state/percentage
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/lpm/state/used

```

### Hardware Profile: MPLS Labels Pop State

```

Sensor Path
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/mpls-labels-pop/state
Leaf Attributes
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/mpls-labels-pop/state/capacity
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/mpls-labels-pop/state/free
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/mpls-labels-
pop/state/percentage
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/mpls-labels-pop/state/used

```

### Hardware Profile: MPLS Labels Swap State

```

Sensor Path
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/mpls-labels-pop/state
Leaf Attributes
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/mpls-labels-pop/state/capacity
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/mpls-labels-pop/state/free
  ipi:/profiles/forwarding-profiles/hardware-routing-limits/mpls-labels-
pop/state/percentage

```

```
ipi:/profiles/forwarding-profiles/hardware-routing-limits/mpls-labels-pop/state/used
```

### Hardware L2VPN Instances: MPLS Labels Service State

```
Sensor Path
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-
limits/instances/services/service[name]/state
Leaf Attributes
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-
limits/instances/services/service[name]/state/capacity
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-
limits/instances/services/service[name]/state/free
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-
limits/instances/services/service[name]/state/name
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-
limits/instances/services/service[name]/state/percentage
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-
limits/instances/services/service[name]/state/usage
```

### Hardware L2VPN Instances: State

```
Sensor Path
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/instances/state
Leaf Attributes
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/instances/state/capacity
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/instances/state/free
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/instances/state/percentage
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/instances/state/usage
```

### Hardware L2VPN Instances: Multicast Group Services State

```
Sensor Path
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/multicast-
groups/services/service[name]/state
Leaf Attributes
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/multicast-
groups/services/service[name]/state/capacity
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/multicast-
groups/services/service[name]/state/free
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/multicast-
groups/services/service[name]/state/name
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/multicast-
groups/services/service[name]/state/percentage
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/multicast-
groups/services/service[name]/state/usage
```

### Hardware L2VPN Instances: Multicast Group State

```
Sensor Path
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/multicast-groups/state
Leaf Attributes
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/multicast-
groups/services/state/capacity
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/multicast-
groups/services/state/free
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/multicast-
groups/services/state/percentage
  ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/multicast-
groups/services/state/usage
```

## Hardware L2VPN Instances: VSI Service State

```
Sensor Path
    ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/vsi/services/service
[name]/state
Leaf Attributes
    ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/vsi/services/service
[name]/state/capacity
    ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/vsi/services/service
[name]/state/free
    ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/vsi/services/service
[name]/state/name
    ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/vsi/services/service
[name]/state/percentage
    ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/vsi/services/service
[name]/state/usage
```

## Hardware L2VPN Instances: VSI State

```
Sensor Path
    ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/vsi/state
Leaf Attributes
    ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/vsi/state/capacity
    ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/vsi/state/free
    ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/vsi/state/percentage
    ipi:/profiles/hardware-profile/hardware-l2vpn-instances-limits/vsi/state/usage
```

# IPI-INTERFACE

## Pyang Tree: ipi-interface

```

+--rw interfaces
  +--rw interface* [name]
    +--rw name      -> ../config/name
    +--rw config
      | +--rw name?   string
      +--ro state
        +--ro ifindex?      uint32
        +--ro admin-status? ipi-if-types:if_interface_admin_status_t
        +--ro oper-status?  ipi-if-types:if_interface_oper_status_t
        +--ro last-change?  yang:timeticks
        +--ro logical?      boolean
        +--ro description?  cml-data-types:cml_line_t
        +--ro vrf-name?     -> /ipi-network-instance:network-instances/network-
instance/ipi-vrf:vrf/config/vrf-name {feature-list:HAVE_VRF}?
        +--ro mtu?          uint32
        +--ro counters
          +--ro in-octets?      yang:counter64
          +--ro in-pkts?        yang:counter64
          +--ro in-unicast-pkts? yang:counter64 {feature-list:HAVE_BROADCOM, feature-
list:HAVE_HAL, feature-list:NOT_HAVE_SWFWDR}?
          +--ro in-broadcast-pkts? yang:counter64 {feature-list:HAVE_BROADCOM, feature-
list:HAVE_HAL, feature-list:NOT_HAVE_SWFWDR}?
          +--ro in-multicast-pkts? yang:counter64
          +--ro in-discards?     yang:counter64
          +--ro in-errors?       yang:counter64
          +--ro in-fcs-errors?   yang:counter64 {feature-list:HAVE_BROADCOM, feature-
list:HAVE_HAL, feature-list:NOT_HAVE_SWFWDR}?
          +--ro out-octets?      yang:counter64
          +--ro out-pkts?        yang:counter64
          +--ro out-unicast-pkts? yang:counter64 {feature-list:HAVE_BROADCOM, feature-
list:HAVE_HAL, feature-list:NOT_HAVE_SWFWDR}?
          +--ro out-broadcast-pkts? yang:counter64 {feature-list:HAVE_BROADCOM, feature-
list:HAVE_HAL, feature-list:NOT_HAVE_SWFWDR}?
          +--ro out-multicast-pkts? yang:counter64 {feature-list:HAVE_BROADCOM, feature-
list:HAVE_HAL, feature-list:NOT_HAVE_SWFWDR}?
          +--ro out-discards?    yang:counter64
          +--ro out-errors?      yang:counter64
          +--ro last-clear?      ipi-if-types:if_last_clear_time_t

```

## Sensor Paths: ipi-interface

### Interface State

```

Sensor Path
  ipi:/interfaces/interface[name]/state

Leaf Attributes
  ipi:/interfaces/interface[name]/state/name
  ipi:/interfaces/interface[name]/state/ifindex
  ipi:/interfaces/interface[name]/state/admin-status
  ipi:/interfaces/interface[name]/state/oper-status
  ipi:/interfaces/interface[name]/state/last-change
  ipi:/interfaces/interface[name]/state/logical
  ipi:/interfaces/interface[name]/state/description
  ipi:/interfaces/interface[name]/state/mtu
  ipi:/interfaces/interface[name]/state/vrf-name

```

## Interface Counters

### Sensor Path

```
ipi:/interfaces/interface[name]/state/counters
```

### Leaf Attributes

```
ipi:/interfaces/interface[name]/state/counters/in-octets
ipi:/interfaces/interface[name]/state/counters/in-pkts
ipi:/interfaces/interface[name]/state/counters/in-unicast-pkts
ipi:/interfaces/interface[name]/state/counters/in-broadcast-pkts
ipi:/interfaces/interface[name]/state/counters/in-multicast-pkts
ipi:/interfaces/interface[name]/state/counters/in-discards
ipi:/interfaces/interface[name]/state/counters/in-errors
ipi:/interfaces/interface[name]/state/counters/in-fcs-errors
ipi:/interfaces/interface[name]/state/counters/out-octets
ipi:/interfaces/interface[name]/state/counters/out-pkts
ipi:/interfaces/interface[name]/state/counters/out-unicast-pkts
ipi:/interfaces/interface[name]/state/counters/out-broadcast-pkts
ipi:/interfaces/interface[name]/state/counters/out-multicast-pkts
ipi:/interfaces/interface[name]/state/counters/out-discards
ipi:/interfaces/interface[name]/state/counters/out-errors
ipi:/interfaces/interface[name]/state/counters/last-clear
```

## Extended Ethernet Counters

### Sensor Path

```
ipi:/interfaces/interface[name]/ethernet/state/counters/extended-ethernet-counters
```

### Leaf Attributes

```
ipi:/interfaces/interface[name]/ethernet/state/counters/extended-ethernet-
counters/receive-pkt-rate
ipi:/interfaces/interface[name]/ethernet/state/counters/extended-ethernet-
counters/send-pkt-rate
ipi:/interfaces/interface[name]/ethernet/state/counters/extended-ethernet-
counters/receive-bit-rate
ipi:/interfaces/interface[name]/ethernet/state/counters/extended-ethernet-
counters/send-bit-rate
```

## Interface Ethernet State

### Sensor Path

```
ipi:/interfaces/interface[name]/ethernet/state
```

### Leaf Attributes

```
ipi:/interfaces/interface[name]/ethernet/state/negotiated-port-speed
```

## IPI-VXLAN

### Pyang Tree: ipi-vxlan

```
+--rw vxlan {feature-list:HAVE_VXLAN}?
  +--ro tunnel* [destination-vtep-ip]
    +--ro destination-vtep-ip    -> ../state/destination-vtep-ip
    +--ro state
      +--ro destination-vtep-ip?  inet:ipv4-address
      +--ro counters
        +--ro out-bytes?         yang:counter64
        +--ro out-packets?       yang:counter64
        +--ro in-bytes?          yang:counter64
        +--ro in-packets?        yang:counter64
```

### Sensor Paths: ipi-vxlan

#### VXLAN State

```
Sensor Path
  ipi:/vxlan/tunnel[destination-vtep-ip]/state/counters

Leaf Attributes
  ipi:/vxlan/tunnel[destination-vtep-ip]/state/counters/out-bytes
  ipi:/vxlan/tunnel[destination-vtep-ip]/state/counters/out-packets
  ipi:/vxlan/tunnel[destination-vtep-ip]/state/counters/in-bytes
  ipi:/vxlan/tunnel[destination-vtep-ip]/state/counters/in-packets
```

# IPI-Platform-CMIS

## Pyang Tree: ipi-platform-cmis

```

+--rw components {feature-list:HAVE_CMMD}?
  +--ro component* [name]
    +--ro name                                -> ../state/name
    +--ro state
      | +--ro name?                            string
      | +--ro type?                            ipi-platform-types:cmm_component_type_t
    {feature-list:NOT_HAVE_TIBIT}?
      | +--ro location?                        string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro mfg-name?                        string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro mfg-date?                        yang:date-and-time {feature-list:NOT_HAVE_
TIBIT}?
      | +--ro description?                     string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro hardware-version?                string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro firmware-version?                string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro software-version?                string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro serial-no?                       string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro part-no?                         string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro removable?                       boolean {feature-list:NOT_HAVE_TIBIT}?
      | +--ro oper-status?                     ipi-platform-types:cmm_component_oper_status_t
    {feature-list:NOT_HAVE_TIBIT}?
      | +--ro product-name?                    string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro asset-tag?                       string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro component-additional-details*    string {feature-list:NOT_HAVE_TIBIT}?
      | +--ro parent?                          -> /components/component/state/name {feature-
list:NOT_HAVE_TIBIT}?
      | +--ro empty?                           boolean {feature-list:NOT_HAVE_TIBIT}?
    +--ro transceiver {feature-list:HAVE_CMMD,feature-list:NOT_HAVE_TIBIT}?
      +--ro state
        | +--ro grid-spacing?                  decimal64
        | +--ro first-frequency?                decimal64
        | +--ro last-frequency?                 decimal64
        | +--ro transceiver-temperature?       decimal64
        | +--ro transceiver-voltage?           decimal64
      +--ro cmis-module {feature-list:HAVE_CMMD,feature-list:NOT_HAVE_TIBIT}?
        +--ro eeprom
          | +--ro state
            | +--ro identifier?                 ipi-platform-sff8024-types:cmm_sff8024_
identifier_t
            | +--ro vendor-name?                string
            | +--ro vendor-oui?                 string
            | +--ro part-number?                 string
            | +--ro revision-level?              string
            | +--ro serial-number?               string
            | +--ro manufacturing-date?          string
            | +--ro clei-code?                   string
            | +--ro module-power-class?          ipi-platform-cmis-types:cmm_cmis_module_
power_class_t
            | +--ro module-max-power?            decimal64
            | +--ro cooling-implemented?          ipi-platform-cmis-types:cmm_cmis_yes_no_
t
            | +--ro temperature-max?            int16
            | +--ro temperature-min?            int16
            | +--ro operatin-voltage-min?        decimal64
            | +--ro optical-detector?           ipi-platform-cmis-types:cmm_cmis_
optical_detector_t
            | +--ro rx-power-measurement?        ipi-platform-cmis-types:cmm_cmis_rx_
power_measur_t
            | +--ro tx-disable-module-wide?      ipi-platform-cmis-types:cmm_cmis_yes_no_
t
            | +--ro cable-assembly-link-length? int16
            | +--ro connector-type?              ipi-platform-sff8024-types:cmm_sff8024_

```

```

connector_type_t
|      +---ro cca-5ghz?                uint8
|      +---ro cca-7ghz?                uint8
|      +---ro cca-12p9ghz?            uint8
|      +---ro cca-25p8ghz?            uint8
|      +---ro media-interface-technology? ipi-platform-cmis-types:cmm_cmis_media_
intf_tech_t
|      +---ro cmis-revision?           string
|      +---ro memory-model?            ipi-platform-cmis-types:cmm_cmis_memory_
model_t
|      +---ro mci-max-speed?           ipi-platform-cmis-types:cmm_cmis_mci_
max_speed_t
|      +---ro active-firmware-revision? string
|      +---ro inactive-firmware-revision? string
|      +---ro hardware-revision?       string
|      +---ro media-type?              ipi-platform-cmis-types:cmm_cmis_media_
type_t
|      +---ro max-smf-link-length?     decimal64
|      +---ro max-mmfm-om2-link-length? uint8
|      +---ro max-mmfm-om3-link-length? uint16
|      +---ro max-mmfm-om4-link-length? uint16
|      +---ro max-mmfm-om5-link-length? uint16
|      +---ro wavelength-nominal?      decimal64
|      +---ro wavelength-tolerance?    decimal64
+---ro advertisement
| +---ro applications
| | +---ro application* [id]
| |   +---ro id      -> ../state/id
| |   +---ro state
| |   | +---ro id?    uint8
| |   +---ro host
| |   | +---ro state
| |   | +---ro interface-type? ipi-platform-cmis-types:cmm_cmis_
interface_type_t
| |   | +---ro application-bitrate? ipi-platform-cmis-types:cmm_cmis_
bit_rate_t
| |   | +---ro lane-count?          uint8
| |   | +---ro signal-bitrate?      ipi-platform-cmis-types:cmm_cmis_
bit_rate_t
| |   | +---ro modulation-format?   ipi-platform-cmis-types:cmm_cmis_
modulation_format_t
| |   | +---ro bits-per-unit-interval? decimal64
| |   | +---ro lane-assignment?     ipi-platform-cmis-types:cmm_cmis_
lane_assignment_t
| |   +---ro media
| |   | +---ro state
| |   | +---ro interface-type?     ipi-platform-cmis-types:cmm_cmis_
interface_type_t
| |   +---ro application-bitrate?   ipi-platform-cmis-types:cmm_cmis_
bit_rate_t
| |   +---ro lane-count?            uint8
| |   +---ro signal-bitrate?        ipi-platform-cmis-types:cmm_cmis_
bit_rate_t
| |   +---ro modulation-format?     ipi-platform-cmis-types:cmm_cmis_
modulation_format_t
| |   +---ro bits-per-unit-interval? decimal64
| |   +---ro lane-assignment?       ipi-platform-cmis-types:cmm_cmis_
lane_assignment_t
| +---ro controls
| | +---ro state
| |   +---ro wavelength-control?    ipi-platform-cmis-types:cmm_cmis_
yes_no_t
| |   +---ro tunable-transmitter?   ipi-platform-cmis-types:cmm_cmis_
yes_no_t
| |   +---ro tx-output-squelching-method? ipi-platform-cmis-types:cmm_cmis_
tx_squelch_method_t
| |   +---ro forced-tx-output-squelching? ipi-platform-cmis-types:cmm_cmis_
yes_no_t
| |   +---ro tx-output-squelching-disable? ipi-platform-cmis-types:cmm_cmis_

```

```

yes_no_t      | |      +--ro tx-output-disable?      ipi-platform-cmis-types:cmm_cmis_
yes_no_t      | |      +--ro input-polarity-flip-tx?      ipi-platform-cmis-types:cmm_cmis_
yes_no_t      | |      +--ro rx-output-squelching-disable? ipi-platform-cmis-types:cmm_cmis_
yes_no_t      | |      +--ro rx-output-disable?      ipi-platform-cmis-types:cmm_cmis_
yes_no_t      | |      +--ro output-polarity-flip-rx?      ipi-platform-cmis-types:cmm_cmis_
yes_no_t      | |      +--ro diagnostics
                | |      +--ro module
                | |      +--ro state
                | |      +--ro simultaneous-host-and-media-loopback? ipi-platform-cmis-
types:cmm_cmis_yes_no_t
                | |      +--ro report-bit-error-ratio?      ipi-platform-cmis-
types:cmm_cmis_yes_no_t
                | |      +--ro count-bits-and-errors?      ipi-platform-cmis-
types:cmm_cmis_yes_no_t
                | |      +--ro host
                | |      +--ro state
                | |      +--ro output-loopback?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro input-loopback?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro per-lane-loopback?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro report-input-snr?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro report-fec?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro prbs-checker-post-fec?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro prbs-checker-pre-fec?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro prbs-checker-types?      ipi-platform-cmis-types:cmm_cmis_
prbs_support_type_t | |      +--ro prbs-generator-post-fec?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro prbs-generator-pre-fec?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro prbs-generator-types?      ipi-platform-cmis-types:cmm_cmis_
prbs_support_type_t | |      +--ro media
                | |      +--ro state
                | |      +--ro output-loopback?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro input-loopback?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro per-lane-loopback?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro report-input-snr?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro report-fec?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro prbs-checker-post-fec?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro prbs-checker-pre-fec?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro prbs-checker-types?      ipi-platform-cmis-types:cmm_cmis_
prbs_support_type_t | |      +--ro prbs-generator-post-fec?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro prbs-generator-pre-fec?      ipi-platform-cmis-types:cmm_cmis_yes_
no_t           | |      +--ro prbs-generator-types?      ipi-platform-cmis-types:cmm_cmis_
prbs_support_type_t | |      +--ro durations

```

```

| | +--ro state
| | +--ro modsel-wait-time? uint8
| | +--ro dpinit-maximun-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | +--ro dpdeinit-maximun-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | +--ro dptxturnon-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | +--ro dptxturnoff-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | +--ro modulepwrup-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | +--ro modulepwrdown-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | +--ro npinit-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | +--ro npdeinit-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | +--ro nptxturnon-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | +--ro nptxturnoff-maximum-duration? ipi-platform-cmis-types:cmm_cmis_
durations_t | | +--ro laser
| | +--ro state
| | | +--ro supported-grids? ipi-platform-cmis-types:cmm_
cmis_laser_grid_support_t | | | +--ro fine-tune-supported? ipi-platform-cmis-types:cmm_
cmis_yes_no_t | | | +--ro fine-tune-resolution? decimal64
| | | +--ro fine-tune-low-offset? decimal64
| | | +--ro fine-tune-high-offset? decimal64
| | | +--ro per-lane-programmable-output-power? ipi-platform-cmis-types:cmm_
cmis_yes_no_t | | | +--ro minimum-programmable-output-power? decimal64
| | | +--ro maximum-programmable-output-power? decimal64
| | +--ro grids
| | +--ro grid* [id]
| | | +--ro id -> ../state/id
| | | +--ro state
| | | +--ro id? ipi-platform-cmis-types:cmm_
cmis_laser_grid_spacing_t | | +--ro lowest-channel-frequency? decimal64
| | +--ro highest-channel-frequency? decimal64
| | +--ro channel-count? uint16
| +--ro monitoring
| | +--ro module
| | | +--ro monitors
| | | +--ro monitor* [id]
| | | | +--ro id -> ../state/id
| | | | +--ro state
| | | | +--ro id? ipi-platform-cmis-types:cmm_cmis_module_
monitor_id_t | | | +--ro supported? ipi-platform-cmis-types:cmm_cmis_yes_no_t
| | +--ro host
| | | +--ro monitors
| | | | +--ro monitor* [id]
| | | | +--ro id -> ../state/id
| | | | +--ro state
| | | | +--ro id? ipi-platform-cmis-types:cmm_cmis_host_
monitor_id_t | | | | +--ro supported? ipi-platform-cmis-types:cmm_cmis_yes_no_
t | | | | +--ro lanes-assigned? ipi-platform-cmis-types:cmm_cmis_lane_
assignment_t | | | +--ro flags
| | | +--ro flag* [id]
| | | +--ro id -> ../state/id
| | | +--ro state
| | | +--ro id? ipi-platform-cmis-types:cmm_cmis_host_

```

```

flag_id_t
t
| | | +---ro supported? ipi-platform-cmis-types:cmm_cmis_yes_no_
assignment_t
| | | +---ro lanes-assigned? ipi-platform-cmis-types:cmm_cmis_lane_
| | +---ro media
| | +---ro monitors
| | | +---ro monitor* [id]
| | | +---ro id -> ../state/id
| | | +---ro state
| | | +---ro id? ipi-platform-cmis-types:cmm_cmis_media_
monitor_id_t
t
| | | +---ro supported? ipi-platform-cmis-types:cmm_cmis_yes_no_
assignment_t
| | | +---ro lanes-assigned? ipi-platform-cmis-types:cmm_cmis_lane_
| | +---ro flags
| | +---ro flag* [id]
| | | +---ro id -> ../state/id
| | | +---ro state
| | | +---ro id? ipi-platform-cmis-types:cmm_cmis_media_
flag_id_t
t
| | +---ro supported? ipi-platform-cmis-types:cmm_cmis_yes_no_
assignment_t
| | +---ro lanes-assigned? ipi-platform-cmis-types:cmm_cmis_lane_
| +---ro pages
| +---ro state
| +---ro network-path-pages-supported? ipi-platform-cmis-types:cmm_cmis_
yes_no_t
| +---ro vdm-pages-supported? ipi-platform-cmis-types:cmm_cmis_
yes_no_t
| +---ro vdm-groups? ipi-platform-cmis-types:cmm_cmis_
vdm_pages_support_t
| +---ro diagnostics-pages-supported? ipi-platform-cmis-types:cmm_cmis_
yes_no_t
| +---ro user-page-supported? ipi-platform-cmis-types:cmm_cmis_
yes_no_t
| +---ro banks-per-page? ipi-platform-cmis-types:cmm_cmis_
bank_per_page_support_t
+---ro module-state
| +---ro state
| | +---ro fault-state? ipi-platform-cmis-types:cmm_cmis_module_fault_state_t
| | +---ro current-state? ipi-platform-cmis-types:cmm_cmis_module_state_t
| +---ro datapaths
| | +---ro datapath* [lane]
| | +---ro lane -> ../state/lane
| | +---ro state
| | +---ro lane? uint8
| | +---ro current-state? ipi-platform-cmis-types:cmm_cmis_datapath_
states_t
| +---ro host-rate? decimal64
| +---ro media-rate? decimal64
| +---ro interface-name? string
+---ro module-monitors
| +---ro monitors
| | +---ro monitor* [id]
| | +---ro id -> ../state/id
| | +---ro state
| | +---ro id? ipi-platform-cmis-types:cmm_cmis_module_monitor_
id_t
| | +---ro description? string
| | +---ro value? decimal64
| | +---ro high-alarm? decimal64
| | +---ro high-warning? decimal64
| | +---ro low-warning? decimal64
| | +---ro low-alarm? decimal64
| +---ro monitor-alarm

```

```

|      +--ro state
|      +--ro alarm-id?          ipi-platform-cmis-types:cmm_cmis_module_
monitor_id_t
|      +--ro alarm-type?        ipi-platform-cmis-types:cmm_cmis_threshold_
alarm_t
|      +--ro current-value?     decimal64
|      +--ro threshold-minimum? decimal64
|      +--ro threshold-maximum? decimal64
+--ro host-monitors
| +--ro lanes
|   +--ro lane* [number]
|   +--ro number              -> ../state/number
|   +--ro state
|   | +--ro number?          uint8
|   | +--ro dp-assigned?    boolean
|   +--ro monitors
|   | +--ro monitor* [id]
|   |   +--ro id              -> ../state/id
|   |   +--ro state
|   |   +--ro id?            ipi-platform-cmis-types:cmm_cmis_host_
monitor_id_t
|   |   +--ro description?    string
|   |   +--ro value?          decimal64
|   |   +--ro high-alarm?     decimal64
|   |   +--ro high-warning?   decimal64
|   |   +--ro low-warning?    decimal64
|   |   +--ro low-alarm?     decimal64
|   +--ro flags
|   | +--ro flag* [id]
|   |   +--ro id              -> ../state/id
|   |   +--ro state
|   |   +--ro id?            ipi-platform-cmis-types:cmm_cmis_host_flag_
id_t
|   |   +--ro description?    string
|   |   +--ro value?          boolean
|   +--ro monitor-alarm
|   | +--ro state
|   |   +--ro alarm-id?       ipi-platform-cmis-types:cmm_cmis_host_
monitor_id_t
|   |   +--ro alarm-type?     ipi-platform-cmis-types:cmm_cmis_
threshold_alarm_t
|   |   +--ro current-value?   decimal64
|   |   +--ro threshold-minimum? decimal64
|   |   +--ro threshold-maximum? decimal64
|   +--ro flag-alarm
|   | +--ro state
|   |   +--ro alarm-id?       ipi-platform-cmis-types:cmm_cmis_host_flag_id_t
+--ro media-monitors
| +--ro lanes
|   +--ro lane* [number]
|   +--ro number              -> ../state/number
|   +--ro state
|   | +--ro number?          uint8
|   +--ro monitors
|   | +--ro monitor* [id]
|   |   +--ro id              -> ../state/id
|   |   +--ro state
|   |   +--ro id?            ipi-platform-cmis-types:cmm_cmis_media_
monitor_id_t
|   |   +--ro description?    string
|   |   +--ro value?          decimal64
|   |   +--ro high-alarm?     decimal64
|   |   +--ro high-warning?   decimal64
|   |   +--ro low-warning?    decimal64
|   |   +--ro low-alarm?     decimal64
|   +--ro flags
|   | +--ro flag* [id]

```

```

|      +--ro id      -> ../state/id
|      +--ro state
|      +--ro id?      ipi-platform-cmis-types:cmm_cmis_media_
flag_id_t
|      +--ro description?  string
|      +--ro value?      boolean
+--ro monitor-alarm
|  +--ro state
|  +--ro alarm-id?      ipi-platform-cmis-types:cmm_cmis_media_
monitor_id_t
|  +--ro alarm-type?      ipi-platform-cmis-types:cmm_cmis_
threshold_alarm_t
|  +--ro current-value?    decimal64
|  +--ro threshold-minimum? decimal64
|  +--ro threshold-maximum? decimal64
+--ro flag-alarm
  +--ro state
  +--ro alarm-id?      ipi-platform-cmis-types:cmm_cmis_media_flag_id_t

```

## Sensor Paths: ipi-platform-cmis

### Transceiver EEPROM State

```

Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-module/eprom/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/identifier
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/vendor-name
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/vendor-oui
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/part-number
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/revision-level
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/serial-number
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/manufacturing-date
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/clei-code
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/module-power-class
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/module-max-power
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/cooling-
implemented
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/temperature-max
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/temperature-min
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/operatin-voltage-
min
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/optical-detector
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/rx-power-
measurement
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/tx-disable-module-
wide
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/cable-assembly-
link-length
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/connector-type
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/cca-5ghz
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/cca-7ghz
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/cca-12p9ghz
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/cca-25p8ghz
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/media-interface-
technology
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/cmis-revision
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/memory-model
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/mci-max-speed
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/active-firmware-
revision
    ipi:/components/component[name]/transceiver/cmis-module/eprom/state/inactive-firmware-
revision

```

```

            ipi:/components/component[name]/transceiver/cmis-module/eprom/state/hardware-revision
            ipi:/components/component[name]/transceiver/cmis-module/eprom/state/media-type
length      ipi:/components/component[name]/transceiver/cmis-module/eprom/state/max-smf-link-
length      ipi:/components/component[name]/transceiver/cmis-module/eprom/state/max-mmfm-om2-link-
length      ipi:/components/component[name]/transceiver/cmis-module/eprom/state/max-mmfm-om3-link-
length      ipi:/components/component[name]/transceiver/cmis-module/eprom/state/max-mmfm-om4-link-
length      ipi:/components/component[name]/transceiver/cmis-module/eprom/state/max-mmfm-om5-link-
            ipi:/components/component[name]/transceiver/cmis-module/eprom/state/wavelength-nominal
            ipi:/components/component[name]/transceiver/cmis-module/eprom/state/wavelength-
tolerance

```

## CMIS State

```

Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/state

Leaf Attributes
    ipi:/components/component[name]/state/name
    ipi:/components/component[name]/state/type
    ipi:/components/component[name]/state/location
    ipi:/components/component[name]/state/description
    ipi:/components/component[name]/state/mfg-name
    ipi:/components/component[name]/state/mfg-date
    ipi:/components/component[name]/state/hardware-version
    ipi:/components/component[name]/state/firmware-version
    ipi:/components/component[name]/state/serial-no
    ipi:/components/component[name]/state/part-no
    ipi:/components/component[name]/state/removable
    ipi:/components/component[name]/state/parent

```

## Transceiver Advertisement Control

```

Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-
module/advertisement/controls/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/controls/state/forced-tx-output-squelching
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/controls/state/input-polarity-flip-tx
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/controls/state/output-polarity-flip-rx
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/controls/state/rx-output-disable
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/controls/state/rx-output-squelching-disable
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/controls/state/tunable-transmitter
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/controls/state/tx-output-disable
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/controls/state/tx-output-squelching-disable
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/controls/state/tx-output-squelching-method
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/controls/state/wavelength-control

```

## Transceiver Advertisement Diagnostics Module

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-
module/advertisement/diagnostics/module/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/module/state/count-bits-and-errors
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/module/state/report-bit-error-ratio
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/module/state/simultaneous-host-and-media-loopback
```

## Transceiver Advertisement Diagnostics Host

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-
module/advertisement/diagnostics/host/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/host/state/input-loopback
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/host/state/output-loopback
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/host/state/per-lane-loopback
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/host/state/prbs-checker-post-fec
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/host/state/prbs-checker-pre-fec
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/host/state/prbs-checker-types
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/host/state/prbs-generator-post-fec
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/host/state/prbs-generator-pre-fec
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/host/state/prbs-generator-types
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/host/state/report-fec
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/host/state/report-input-snr
```

## Transceiver Advertisement Diagnostics Media

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-
module/advertisement/diagnostics/media/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/media/state/input-loopback
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/media/state/output-loopback
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/media/state/per-lane-loopback
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/media/state/prbs-checker-post-fec
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/media/state/prbs-checker-pre-fec
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/diagnostics/media/state/prbs-checker-types
```

```

    ipi:/components/component[name]/transceiver/cmismodule/advertisement/diagnostics/media/state/prbs-generator-post-fec
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/diagnostics/media/state/prbs-generator-pre-fec
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/diagnostics/media/state/report-fec
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/diagnostics/media/state/report-input-snr

```

## Transceiver Advertisement Duration

```

Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmismodule/advertisement/durations/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/durations/state/dpdeinit-maximum-duration
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/durations/state/dpinit-maximum-duration
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/durations/state/dptxturnoff-maximum-duration
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/durations/state/dptxturnon-maximum-duration
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/durations/state/modsel-wait-time
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/durations/state/modulepwrdown-maximum-duration
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/durations/state/modulepwrup-maximum-duration

```

## Transceiver Advertisement Laser

```

Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmismodule/advertisement/laser/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/laser/state/supported-grids
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/laser/state/fine-tune-high-offse
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/laser/state/fine-tune-low-offset
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/laser/state/fine-tune-resolution
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/laser/state/fine-tune-supported
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/laser/state/maximum-programmable-output-power
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/laser/state/minimum-programmable-output-power
    ipi:/components/component[name]/transceiver/cmismodule/advertisement/laser/state/per-lane-programmable-output-power

```

## Transceiver Advertisement Laser Grid

```

Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmismodule/advertisement/laser/grids/grid[id=SPACING TYPE]/state

```

```

Leaf Attributes
  ipi:/components/component[name]/transceiver/cmis-
module/advertisement/laser/grids/grid/state/channel-count
  ipi:/components/component[name]/transceiver/cmis-
module/advertisement/laser/grids/grid/state/highest-channel-frequency
  ipi:/components/component[name]/transceiver/cmis-
module/advertisement/laser/grids/grid/state/id
  ipi:/components/component[name]/transceiver/cmis-
module/advertisement/laser/grids/grid/state/lowest-channel-frequency

```

## Transceiver Advertisement Monitoring

```

Sensor Path
  ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-
module/advertisement/monitoring/module/monitors/monitor[id=APP Id]/state

Leaf Attributes
  ipi:/components/component[name]/transceiver/cmis-
module/advertisement/monitoring/module/monitors/monitor/state/id
  ipi:/components/component[name]/transceiver/cmis-
module/advertisement/monitoring/module/monitors/monitor/state/supported

```

## Transceiver Advertisement Host Monitoring

```

Sensor Path
  ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-
module/advertisement/monitoring/host/monitors/monitor[id= APP Id]/state

Leaf Attributes
  ipi:/components/component[name]/transceiver/cmis-
module/advertisement/monitoring/host/monitors/monitor/state/id
  ipi:/components/component[name]/transceiver/cmis-
module/advertisement/monitoring/host/monitors/monitor/state/supported

```

## Transceiver Advertisement Host Flags Monitoring

```

Sensor Path
  ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-
module/advertisement/monitoring/host/flags/flag[id=APP Id]/state

Leaf Attributes
  ipi:/components/component[name]/transceiver/cmis-
module/advertisement/monitoring/host/flags/flag/state/id
  ipi:/components/component[name]/transceiver/cmis-
module/advertisement/monitoring/host/flags/flag/state/supported

```

## Transceiver Advertisement Media Monitoring

```

Sensor Path
  ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-
module/advertisement/monitoring/media/monitors/monitor[id=APP Id]/state

Leaf Attributes
  ipi:/components/component[name]/transceiver/cmis-
module/advertisement/monitoring/media/monitors/monitor/state/id
  ipi:/components/component[name]/transceiver/cmis-
module/advertisement/monitoring/media/monitors/monitor/state/supported

```

## Transceiver Advertisement Media Flags Monitoring

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-
module/advertisement/monitoring/media/flags/flag[id = APP Id]/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/monitoring/media/flags/flag/state/id
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/monitoring/media/flags/flag/state/supported
```

## Transceiver Advertisement Pages

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-
module/advertisement/pages/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/pages/state/banks-per-page
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/pages/state/network-path-pages-supported
    ipi:/components/component[name]/transceiver/cmis-module/advertisement/pages/state/user-
page-supported
    ipi:/components/component[name]/transceiver/cmis-module/advertisement/pages/state/vdm-
groups
    ipi:/components/component[name]/transceiver/cmis-module/advertisement/pages/state/vdm-
pages-supported
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/pages/state/diagnostics-pages-supported
```

## Transceiver Advertisement Host Application

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-
module/advertisement/applications/application[id=APP_ID]/host/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/host/state/interface-type
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/host/state/application-bitrate
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/host/state/lane-count
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/host/state/signal-bitrate
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/host/state/modulation-format
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/host/state/bits-per-unit-interval
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/host/state/lane-assignment
```

## Transceiver Advertisement Media Application

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-
module/advertisement/applications/application[id=APP_ID]/media/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/media/state/interface-type
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/media/state/application-bitrate
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/media/state/lane-count
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/media/state/signal-bitrate
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/media/state/modulation-format
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/media/state/bits-per-unit-interval
    ipi:/components/component[name]/transceiver/cmis-
module/advertisement/applications/application[id]/media/state/lane-assignment
```

## Transceiver CMIS Module State

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-module/module-
state/datapaths/datapath[lane=LANE_ID]/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-module/module-state/datapaths/datapath
[lane]/state/current-state
    ipi:/components/component[name]/transceiver/cmis-module/module-state/datapaths/datapath
[lane]/state/host-rate
    ipi:/components/component[name]/transceiver/cmis-module/module-state/datapaths/datapath
[lane]/state/interface-name
    ipi:/components/component[name]/transceiver/cmis-module/module-state/datapaths/datapath
[lane]/state/lane
    ipi:/components/component[name]/transceiver/cmis-module/module-state/datapaths/datapath
[lane]/state/media-rate
```

## Transceiver CMIS Module Monitor States

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-module/module-
monitors/monitors/monitor[id=MONITOR_ID]/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-module/module-
monitors/monitors/monitor[id]/state/description
    ipi:/components/component[name]/transceiver/cmis-module/module-
monitors/monitors/monitor[id]/state/high-alarm
    ipi:/components/component[name]/transceiver/cmis-module/module-
monitors/monitors/monitor[id]/state/high-warning
    ipi:/components/component[name]/transceiver/cmis-module/module-
monitors/monitors/monitor[id]/state/id
    ipi:/components/component[name]/transceiver/cmis-module/module-
monitors/monitors/monitor[id]/state/low-alarm
    ipi:/components/component[name]/transceiver/cmis-module/module-
monitors/monitors/monitor[id]/state/low-warning
    ipi:/components/component[name]/transceiver/cmis-module/module-
monitors/monitors/monitor[id]/state/value
```

## Transceiver CMIS Module Monitor Alarms

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-module/module-
monitors/monitor-alarm/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-module/module-monitors/monitor-
alarm/state/alarm-id
    ipi:/components/component[name]/transceiver/cmis-module/module-monitors/monitor-
alarm/state/alarm-type
    ipi:/components/component[name]/transceiver/cmis-module/module-monitors/monitor-
alarm/state/current-value
    ipi:/components/component[name]/transceiver/cmis-module/module-monitors/monitor-
alarm/state/threshold-minimum
    ipi:/components/component[name]/transceiver/cmis-module/module-monitors/monitor-
alarm/state/threshold-maximum
```

## Transceiver CMIS Host Monitor States

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-module/host-
monitors/lanes/lane[number=LANE_NUMBER]/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/state/dp-assigned
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/state/number
```

## Transceiver CMIS Host Monitoring for Monitors

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-module/host-
monitors/lanes/lane[number=LANE_NUMBER]/monitors/monitor[id=MONITOR_ID]/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/monitors/monitor[id]/state/description
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/monitors/monitor[id]/state/id
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/monitors/monitor[id]/state/value
```

## Transceiver CMIS Host Monitoring for Flags

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-module/host-
monitors/lanes/lane[number=LANE_NUMBER]/flags/flag[id=FLAG_ID]/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/flags/flag[id]/state/description
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/flags/flag[id]/state/id
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/flags/flag[id]/state/value
```

## Transceiver CMIS Host Monitoring for Alarms

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-module/host-
monitors/lanes/lane[number=LANE_NUMBER]/monitor-alarm/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/monitor-alarm/state/alarm-id
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/monitor-alarm/state/alarm-type
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/monitor-alarm/state/current-value
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/monitor-alarm/state/threshold-minimum
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/monitor-alarm/state/threshold-maximum
```

## Transceiver CMIS Host Monitoring for Alarm Flags

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-module/host-
monitors/lanes/lane[number=LANE_NUMBER]/flag-alarm/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-module/host-monitors/lanes/lane
[number]/flag-alarm/state/alarm-id
```

## Transceiver CMIS Media Monitoring for State

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-module/media-
monitors/lanes/lane[number=LANE_NUMBER]/monitor/monitor[id=MONITOR_ID]/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-module/media-monitors/lanes/lane
[number]/monitors/monitor[id]/state/description
    ipi:/components/component[name]/transceiver/cmis-module/media-monitors/lanes/lane
[number]/monitors/monitor[id]/state/high-alarm
    ipi:/components/component[name]/transceiver/cmis-module/media-monitors/lanes/lane
[number]/monitors/monitor[id]/state/high-warning
    ipi:/components/component[name]/transceiver/cmis-module/media-monitors/lanes/lane
[number]/monitors/monitor[id]/state/id
    ipi:/components/component[name]/transceiver/cmis-module/media-monitors/lanes/lane
[number]/monitors/monitor[id]/state/low-alarm
    ipi:/components/component[name]/transceiver/cmis-module/media-monitors/lanes/lane
[number]/monitors/monitor[id]/state/low-warning
    ipi:/components/component[name]/transceiver/cmis-module/media-monitors/lanes/lane
[number]/monitors/monitor[id]/state/value
```

## Transceiver CMIS Media Monitoring for Flags

```
Sensor Path
    ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmis-module/media-
monitors/lanes/lane[number=LANE_NUMBER]/flags/flag[id=FLAG_ID]/state

Leaf Attributes
    ipi:/components/component[name]/transceiver/cmis-module/media-monitors/lanes/lane
[number]/flags/flag[id]/state/description
    ipi:/components/component[name]/transceiver/cmis-module/media-monitors/lanes/lane
```

```
[number]/flags/flag[id]/state/id
      ipi:/components/component[name]/transceiver/cmisis-module/media-monitors/lanes/lane
[number]/flags/flag[id]/state/value
```

## Transceiver CMIS Media Monitoring for Alarms

```
Sensor Path
      ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmisis-module/media-
monitors/lanes/lane[number=LANE_NUMBER]/monitor-alarm/state

Leaf Attributes
      ipi:/components/component[name]/transceiver/cmisis-module/media-monitors/lanes/lane
[number]/monitor-alarm/state/alarm-id
      ipi:/components/component[name]/transceiver/cmisis-module/media-monitors/lanes/lane
[number]/monitor-alarm/state/alarm-type
      ipi:/components/component[name]/transceiver/cmisis-module/media-monitors/lanes/lane
[number]/monitor-alarm/state/current-value
      ipi:/components/component[name]/transceiver/cmisis-module/media-monitors/lanes/lane
[number]/monitor-alarm/state/threshold-minimum
      ipi:/components/component[name]/transceiver/cmisis-module/media-monitors/lanes/lane
[number]/monitor-alarm/state/threshold-maximum
```

## Transceiver CMIS Media Monitoring for Alarm Flags

```
Sensor Path
      ipi:/components/component[name=CMIS-MODULE-NAME]/transceiver/cmisis-module/media-
monitors/lanes/lane[number=LANE_NUMBER]/flag-alarm/state

Leaf Attributes
      ipi:/components/component[name]/transceiver/cmisis-module/media-monitors/lanes/lane
[number]/flag-alarm/state/alarm-id
```

# IPI-RIB-VRF

## Pyang Tree: ipi-rib-vrf

```

module: ipi-rib-vrf

  grouping maximum-fib-route-config
    +-- max-limit          uint32
    +-- limit-action       ipi-rib-types:rib_max_route_action_t
    +-- warning-threshold? uint8
  grouping maximum-fib-route-state
    +-- threshold-exceeded? boolean
    +-- utilization-percentage? uint32
  grouping ribs-grouping
    +--ro ribs {feature-list:HAVE_VRF,feature-list:HAVE_RIBD}?
      +--ro ipv4
        | +--ro state
        |   +--ro counters
        |     +--ro total-routes?      yang:counter32
        |     +--ro total-routes-in-fib? yang:counter32
      +--ro ipv6 {feature-list:HAVE_IPV6}?
        +--ro state
          +--ro counters
            +--ro total-routes?      yang:counter32
            +--ro total-routes-in-fib? yang:counter32
  grouping maximum-fib-routes-grouping
    +-- maximum-fib-routes {feature-list:HAVE_VRF,feature-list:HAVE_RIBD}?
      +-- ipv4
        | +-- config!
        | | +-- max-limit          uint32
        | | +-- limit-action       ipi-rib-types:rib_max_route_action_t
        | | +-- warning-threshold? uint8
        | +--ro state
        | | +--ro max-limit          uint32
        | | +--ro limit-action       ipi-rib-types:rib_max_route_action_t
        | | +--ro warning-threshold? uint8
        | | +--ro threshold-exceeded? boolean
        | | +--ro utilization-percentage? uint32
      +-- ipv6 {feature-list:HAVE_IPV6}?
        +-- config!
        | +-- max-limit          uint32
        | +-- limit-action       ipi-rib-types:rib_max_route_action_t
        | +-- warning-threshold? uint8
        +--ro state
          +--ro max-limit          uint32
          +--ro limit-action       ipi-rib-types:rib_max_route_action_t
          +--ro warning-threshold? uint8
          +--ro threshold-exceeded? boolean
          +--ro utilization-percentage? uint32

```

## Sensor Paths: ipi-rib-vrf

### FIB IPv4 Routes

#### Sensor Path

```

    ipi:/network-instances/network-instance[instance-name instance-type]/vrf/maximum-fib-
    routes/ipv4/state

```

#### Leaf Attributes

```

    ipi:/network-instances/network-instance[instance-name instance-type]/vrf/maximum-fib-
    routes/ipv4/state/max-limit

```

```

    ipi:/network-instances/network-instance[instance-name instance-type]/vrf/maximum-fib-
routes/ipv4/state/limit-action
    ipi:/network-instances/network-instance[instance-name instance-type]/vrf/maximum-fib-
routes/ipv4/state/warning-threshold
    ipi:/network-instances/network-instance[instance-name instance-type]/vrf/maximum-fib-
routes/ipv4/state/threshold-exceeded
    ipi:/network-instances/network-instance[instance-name instance-type]/vrf/maximum-fib-
routes/ipv4/state/utilization-percentage

```

## FIB IPv6 Routes

```

Sensor Path
    ipi:/network-instances/network-instance[instance-name instance-type]/vrf/maximum-fib-
routes/ipv6/state

Leaf Attributes
    ipi:/network-instances/network-instance[instance-name instance-type]/vrf/maximum-fib-
routes/ipv6/state/max-limit
    ipi:/network-instances/network-instance[instance-name instance-type]/vrf/maximum-fib-
routes/ipv6/state/limit-action
    ipi:/network-instances/network-instance[instance-name instance-type]/vrf/maximum-fib-
routes/ipv6/state/warning-threshold
    ipi:/network-instances/network-instance[instance-name instance-type]/vrf/maximum-fib-
routes/ipv6/state/threshold-exceeded
    ipi:/network-instances/network-instance[instance-name instance-type]/vrf/maximum-fib-
routes/ipv6/state/utilization-percentage

```

## RIB IPv4 VRF Routes

```

Sensor Path
    ipi:/network-instances/network-instance[instance-name instance-
type]/vrf/ribs/ipv4/state/counters/

Leaf Attributes
    ipi:/network-instances/network-instance[instance-name instance-
type]/vrf/ribs/ipv4/state/counters/total-routes
    ipi:/network-instances/network-instance[instance-name instance-
type]/vrf/ribs/ipv4/state/counters/total-routes-in-fib

```

## RIB IPv6 VRF Routes

```

Sensor Path
    ipi:/network-instances/network-instance[instance-name instance-
type]/vrf/ribs/ipv6/state/counters/

Leaf Attributes
    ipi:/network-instances/network-instance[instance-name instance-
type]/vrf/ribs/ipv6/state/counters/total-routes
    ipi:/network-instances/network-instance[instance-name instance-
type]/vrf/ribs/ipv6/state/counters/total-routes-in-fib

```

## IPI-RIB

### Pyang Tree: ipi-rib

```
module: ipi-rib
  +--rw routing {feature-list:HAVE_RIBD}?
    +--rw global
      +--ro counters
        +--ro total-routes-ipv4-vrf?  yang:counter32
        +--ro total-routes-ipv6-vrf?  yang:counter32
```

### Pyang Tree: ipi-vrf

```
module: ipi-vrf
  +--rw vrf-global {feature-list:HAVE_VRF}?
    +--ro counters
      +--ro total-vrfs?  yang:counter32
```

### Sensor Paths: ipi-rib

#### RIB Global Counters

```
Sensor Path
  ipi:/routing/global/counters/

Leaf Attributes
  ipi:/routing/global/counters/total-routes-ipv4-vrf
  ipi:/routing/global/counters/total-routes-ipv6-vrf
```

#### VRF Global Counters

```
Sensor Path
  ipi:/vrf-global/counters

Leaf Attributes
  ipi:/vrf-global/counters/total-vrfs
```

#### VRF State

```
Sensor Path
  ipi:/network-instances/:network-instance[instance-name instance-type]/vrf/state/

Leaf Attributes
  ipi:/network-instances/:network-instance[instance-name instance-type]/vrf/state/vrf-
name
```

# IPI-IS-IS

## Pyang Tree: ipi-is-is

```

module: ipi-is-is
  +--rw isis {feature-list:HAVE_ISISD}?
    +--rw isis-instances
      | +--rw isis-instance* [instance]
      |   +--rw instance -> ../config/instance
      |   +--rw config
      |     | +--rw instance? string
      |     | +--rw vrf-name string
      |     +--ro state
      |       | +--ro counters
      |       |   | +--ro system-level-1-adjacency-count? uint32
      |       |   | +--ro system-level-2-adjacency-count? uint32
      |       |   | +--ro system-total-adjacency-count? uint32
      |       |   +--ro next-global-update-level-1? uint32
      |       |   +--ro next-global-update-level-2? uint32
      |       |   +--ro overload? ipi-is-is-types:isis_overload_state_t
      |       |   +--ro instance? string
      |       |   +--ro vrf-name string
      |     +--ro level-runtime* [type] {feature-list:HAVE_ISISD}?
      |       | +--ro type -> ../state/type
      |       | +--ro state
      |       |   +--ro counters
      |       |     | +--ro authentication-type-fails? uint32
      |       |     | +--ro authentication-fails? uint32
      |       |     | +--ro corrupted-lsps? uint32
      |       |     | +--ro database-overloads? uint32
      |       |     | +--ro manual-address-drop-from-areas? uint32
      |       |     | +--ro attempt-to-exceed-maximum-sequence-numbers? uint32
      |       |     | +--ro sequence-number-skips? uint32
      |       |     | +--ro own-lsp-purges? uint32
      |       |     | +--ro lsp-sourced? uint32
      |       |     | +--ro maximum-area-address-mismatches? uint32
      |       |     | +--ro id-length-mismatch? uint32
      |       |     | +--ro partition-changes? uint32
      |       |     | +--ro spf-runs? uint32
      |       |     | +--ro partial-route-calculation-count? uint32
      |       |     | +--ro lan-designated-is-changes? uint32
      |       |     +--ro type? ipi-is-is-types:isis_level2_t
      |       |     +--ro topology-type? uint8
      |     +--rw network-entity-title
      |     +--ro state
      |     +--ro net* string
    +--rw interfaces {feature-list:HAVE_ISISD}?
      +--rw interface* [name]
        +--rw name -> ../config/name
        +--ro neighbor-lan* [system-id]
          | +--ro system-id -> ../state/system-id
          | +--ro adjacency* [level]
          |   | +--ro level -> ../state/level
          |   | +--ro state
          |   |   +--ro level? ipi-is-is-types:isis_level_t
          |   |   +--ro adjacency-state? ipi-is-is-types:isis_state_t
          |   +--ro state
          |     +--ro system-id? string
          |     +--ro neighbor-snpa? string
          |     +--ro up-time? string
        +--rw config
          | +--rw name? -> /ipi-interface:interfaces/interface/name
          +--ro neighbor-P2P
            +--ro state

```

```

+--ro adjacency-state?    ipi-isis-types:isis_state_t
+--ro up-time?            string
+--ro system-id?          string
+--ro neighbor-snpa?      string

```

## Sensor Paths: ipi-is-is

### IS-IS State

```

Sensor Path
    ipi:/isis/isis-instances/isis-instance[instance]/state

Leaf Attributes
    ipi:/isis/isis-instances/isis-instance/state/next-global-update-level-1
    ipi:/isis/isis-instances/isis-instance/state/next-global-update-level-2
    /isis/isis-instances/isis-instance/state/overload

```

### IS-IS Counters

```

Sensor Path
    ipi:/isis/isis-instances/isis-instance[instance]/state/counters

Leaf Attributes
    ipi:/isis/isis-instances/isis-instance/state/counters/system-level-1-adjacency-count
    ipi:/isis/isis-instances/isis-instance/state/counters/system-level-2-adjacency-count
    ipi:/isis/isis-instances/isis-instance/state/counters/system-total-adjacency-count

```

### IS-IS LSP State

```

Sensor Path
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime[type]/state

Leaf Attributes
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime[type]/state/topology-
type

```

### IS-IS LSP Counters

```

Sensor Path
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime[type]/state/counters

Leaf Attributes
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/attempt-to-exceed-maximum-sequence-numbers
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/authentication-fails
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/authentication-type-fails
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/corrupted-lsps
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/database-overloads
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/id-length-mismatch
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/lan-designated-is-changes
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/lsp-sourced
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/manual-address-drop-from-areas
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime

```

```
[type]/state/counters/maximum-area-address-mismatches
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/own-lsp-purges
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/partial-route-calculation-count
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/partition-changes
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/sequence-number-skips
    ipi:/isis/isis-instances/isis-instance[instance]/level-runtime
[type]/state/counters/spf-runs
```

## IS-IS Interface State

```
Sensor Path
    ipi:/isis/interfaces/interface[name]/neighbor-lan[system-id]/state

Leaf Attributes
    ipi:/isis/interfaces/interface[name]/neighbor-lan[system-id]/state/neighbor-snpa
    ipi:/isis/interfaces/interface[name]/neighbor-lan[system-id]/state/system-id
    ipi:/isis/interfaces/interface[name]/neighbor-lan[system-id]/state/up-time
```

## IS-IS Interface Adjacency State

```
Sensor Path
    ipi:/isis/interfaces/interface[name]/neighbor-lan[system-id]/adjacency[level]/state

Leaf Attributes
    ipi:/isis/interfaces/interface[name]/neighbor-lan[system-id]/adjacency
    [level]/state/adjacency-state
```

## IS-IS Network Entity State

```
Sensor Path
    ipi:/isis/isis-instances/isis-instance/network-entity-title/state/

Leaf Attributes
    ipi:/isis/isis-instances/isis-instance/network-entity-title/state/net
```

## IS-IS Interface Neighbor State

```
Sensor Path
    ipi:/isis/interfaces/interface[name]/neighbor-P2P/state

Leaf Attributes
    ipi:/isis/interfaces/interface[name]/neighbor-P2P/state/up-time
    ipi:/isis/interfaces/interface[name]/neighbor-P2P/state/adjacency-state
    ipi:/isis/interfaces/interface[name]/neighbor-P2P/state/system-id
    ipi:/isis/interfaces/interface[name]/neighbor-P2P/state/neighbor-snpa
```

# IPI-BGP

## Pyang Tree: ipi-bgp

```

+--rw bgp {feature-list:HAVE_BGPD}?
  +--rw bgp-instances {feature-list:HAVE_BGPD}?
    +--rw bgp-instance* [bgp-as]
      +--rw bgp-as -> ../config/bgp-as
      +--rw config
        | +--rw bgp-as? uint32
      +--rw peer-groups {feature-list:HAVE_BGPD}?
        | +--rw peer-group* [peer-group-tag]
        |   +--rw peer-group-tag -> ../state/peer-group-tag
        |   +--ro state
        |     | +--ro peer-group-tag? string
        |     +--rw address-families
        |       +--rw address-family* [afi safi]
        |         +--rw afi -> ../state/afi
        |         +--rw safi -> ../state/safi
        |         +--ro state
        |           | +--ro afi? ipi-bgp-types:bgp_afi_type_t
        |           | +--ro safi? ipi-bgp-types:bgp_safi_type_t
        |           +--rw maximum-prefixes
        |             +--rw maximum-prefix* [prefix-count]
        |               +--rw prefix-count -> ../state/prefix-count
        |               +--ro state
        |                 +--ro prefix-count? uint32
        |                 +--ro stop-update? boolean
        |                 +--ro maximum-prefix-warning? boolean
        |                 +--ro threshold-percentage? uint8
        |                 +--ro warning-only? boolean
      +--rw peers {feature-list:HAVE_BGPD}?
        | +--rw peer* [peer-address]
        |   +--rw peer-address -> ../config/peer-address
        |   +--rw config
        |     | +--rw peer-address? ipi-bgp-types:bgp_ip_addr_t
        |     | +--rw peer-shutdown? boolean
        |     +--ro state
        |       | +--ro counters
        |       |   | +--ro notification-in? int32
        |       |   | +--ro notification-out? int32
        |       |   | +--ro update-message-in? int32
        |       |   | +--ro update-message-out? int32
        |       |   +--ro peer-address? ipi-bgp-types:bgp_ip_addr_t
        |       |   +--ro peer-shutdown? boolean
        |       |   +--ro connection-established-count? int32
        |       |   +--ro bgp-peer-state? ipi-bgp-types:bgp_peer_status_t
        |       |   +--ro local-ip? ipi-bgp-types:bgp_ip_addr_t
        |       |   +--ro local-as? uint32
        |       +--rw address-families
        |         +--rw address-family* [afi safi]
        |           +--rw afi -> ../config/afi
        |           +--rw safi -> ../config/safi
        |           +--rw config
        |             | +--rw afi? ipi-bgp-types:bgp_afi_type_t
        |             | +--rw safi? ipi-bgp-types:bgp_safi_type_t
        |             +--ro state
        |               | +--ro counters
        |               |   | +--ro keepalive-in-messages? int32
        |               |   | +--ro keepalive-out-messages? int32
        |               |   | +--ro open-messages-in? int32
        |               |   | +--ro open-messages-out? int32
        |               |   | +--ro as-path-count? int32
        |               |   | +--ro as-path-extended-count? int32

```

|                     |  |  |  |                                            |                          |
|---------------------|--|--|--|--------------------------------------------|--------------------------|
|                     |  |  |  | ++ro received-packet-count?                | int32                    |
|                     |  |  |  | ++ro packet-in-queue?                      | int32                    |
|                     |  |  |  | ++ro packet-out-queue?                     | int32                    |
|                     |  |  |  | ++ro sent-packet-count?                    | int32                    |
|                     |  |  |  | ++ro refresh-received-packet-count?        | int32                    |
|                     |  |  |  | ++ro refresh-sent-packet-count?            | int32                    |
|                     |  |  |  | +++ro max-paths-ibgp?                      | int16                    |
|                     |  |  |  | +++ro configured-max-paths-ebgp?           | int16                    |
|                     |  |  |  | +++ro max-paths-ebgp?                      | int16                    |
|                     |  |  |  | +++ro configured-max-paths-ibgp?           | int16                    |
|                     |  |  |  | +++ro max-paths-eibgp?                     | int16                    |
|                     |  |  |  | +++ro configured-max-paths-eibgp?          | int16                    |
|                     |  |  |  | +++ro community-count?                     | int32                    |
|                     |  |  |  | +++ro confederation-id-check?              | boolean                  |
|                     |  |  |  | +++ro peer-and-extended-asn-capability?    | ipi-bgp-types:bgp_adv_   |
| rcv_type_t          |  |  |  |                                            |                          |
|                     |  |  |  | +++ro address-family-capability?           | ipi-bgp-types:bgp_adv_   |
| rcv_type_t          |  |  |  |                                            |                          |
|                     |  |  |  | +++ro ipv6-next-hop-global?                | inet:ipv6-address        |
|                     |  |  |  | +++ro ipv6-next-hop-local?                 | inet:ipv6-address        |
|                     |  |  |  | +++ro remote-port?                         | int32                    |
|                     |  |  |  | +++ro remote-address?                      | ipi-bgp-types:bgp_       |
| hostname_t          |  |  |  |                                            |                          |
|                     |  |  |  | +++ro local-host?                          | ipi-bgp-types:bgp_       |
| hostname_t          |  |  |  |                                            |                          |
|                     |  |  |  | +++ro ipv4-next-hop?                       | inet:ipv4-address        |
|                     |  |  |  | +++ro local-port?                          | int32                    |
|                     |  |  |  | +++ro default-information-originate?       | boolean                  |
|                     |  |  |  | +++ro inbound-path-policy?                 | boolean                  |
|                     |  |  |  | +++ro outbound-path-policy?                | boolean                  |
|                     |  |  |  | +++ro default-originate-information-sent?  | cml-data-types:cml_line_ |
| t                   |  |  |  |                                            |                          |
|                     |  |  |  | +++ro graceful-restart?                    | ipi-bgp-types:bgp_adv_   |
| rcv_type_t          |  |  |  |                                            |                          |
|                     |  |  |  | +++ro address-family-dependent-capability? | boolean                  |
|                     |  |  |  | +++ro peer-address-family-table-version?   | int32                    |
|                     |  |  |  | +++ro address-family-table-version?        | int32                    |
|                     |  |  |  | +++ro forward-status-preserve?             | string                   |
|                     |  |  |  | +++ro orf-type-prefix?                     | cml-data-types:cml_line_ |
| t                   |  |  |  |                                            |                          |
|                     |  |  |  | +++ro orf-type-prefix-send-mode?           | ipi-bgp-types:bgp_adv_   |
| rcv_type_t          |  |  |  |                                            |                          |
|                     |  |  |  | +++ro orf-type-prefix-receive-mode?        | ipi-bgp-types:bgp_adv_   |
| rcv_type_t          |  |  |  |                                            |                          |
|                     |  |  |  | +++ro orf-type-prefix-old?                 | cml-data-types:cml_line_ |
| t                   |  |  |  |                                            |                          |
|                     |  |  |  | +++ro orf-type-prefix-send-mode-old?       | ipi-bgp-types:bgp_adv_   |
| rcv_type_t          |  |  |  |                                            |                          |
|                     |  |  |  | +++ro orf-type-prefix-receive-mode-old?    | ipi-bgp-types:bgp_adv_   |
| rcv_type_t          |  |  |  |                                            |                          |
|                     |  |  |  | +++ro prefix-count?                        | int32                    |
|                     |  |  |  | +++ro send-prefix-count?                   | int32                    |
|                     |  |  |  | +++ro flag-shut-down?                      | ipi-bgp-types:bgp_       |
| peerflag_shutdown_t |  |  |  |                                            |                          |
|                     |  |  |  | +++ro count?                               | int32                    |
|                     |  |  |  | +++ro notify-info?                         | boolean                  |
|                     |  |  |  | +++ro notify-last-reset-time?              | string                   |
|                     |  |  |  | +++ro connection-type?                     | ipi-bgp-types:bgp_       |
| connection_type_t   |  |  |  |                                            |                          |
|                     |  |  |  | +++ro next-connection-timer?               | int32                    |
|                     |  |  |  | +++ro connection-dropped-count?            | int32                    |
|                     |  |  |  | +++ro graceful-restart-status?             | string                   |
|                     |  |  |  | +++ro graceful-restart-time?               | int32                    |
|                     |  |  |  | +++ro bgp-established-up-time?             | string                   |
|                     |  |  |  | +++ro last-read-time?                      | string                   |
|                     |  |  |  | +++ro link-type?                           | ipi-bgp-types:bgp_link_  |
| type_t              |  |  |  |                                            |                          |
|                     |  |  |  | +++ro ebgp-hop-away-count?                 | int32                    |

```

| | +--ro router-id? inet:ipv4-address
| | +--ro advertisement-interval? int32
| | +--ro calculated-hold-time? int32
| | +--ro calculated-keepalive? int32
| | +--ro dynamic-capability? cml-data-types:cml_line_
t
| | +--ro route-refresh-capability? ipi-bgp-types:bgp_route_
refresh_cap_type_t
| | +--ro no-interface-binding? boolean
| | +--ro additional-path-receive-capability? string {feature-
list:HAVE_BGP_ADD_PATH}?
| | +--ro additional-path-send-capability? string {feature-
list:HAVE_BGP_ADD_PATH}?
| | +--ro capability-ipv4-unicast? ipi-bgp-types:bgp_
capability_type_t
| | +--ro capability-label-unicast? ipi-bgp-types:bgp_
capability_type_t {feature-list:HAVE_BGP_LU}?
| | +--ro capability-ipv4-multicast? ipi-bgp-types:bgp_
capability_type_t
| | +--ro capability-vpnv4-unicast? ipi-bgp-types:bgp_
capability_type_t
| | +--ro capability-vpnv6-unicast? ipi-bgp-types:bgp_
capability_type_t
| | +--ro capability-rtfilter-unicast? ipi-bgp-types:bgp_
capability_type_t
| | +--ro capability-l2vpn-evpn? ipi-bgp-types:bgp_
capability_type_t
| | +--ro capability-ipv6-unicast? ipi-bgp-types:bgp_
capability_type_t
| | +--ro capability-ipv6-multicast? ipi-bgp-types:bgp_
capability_type_t
| | +--ro capability-ipv6-label-unicast? ipi-bgp-types:bgp_
capability_type_t
| | +--ro evpn-ad-route-count? uint32 {feature-
list:HAVE_BGP_EVPN}?
| | +--ro evpn-mac-ip-route-count? uint32 {feature-
list:HAVE_BGP_EVPN}?
| | +--ro evpn-inclusive-multicast-route-count? uint32 {feature-
list:HAVE_BGP_EVPN}?
| | +--ro evpn-segment-route-count? uint32 {feature-
list:HAVE_BGP_EVPN}?
| | +--ro evpn-ip-prefix-route-count? uint32 {feature-
list:HAVE_BGP_EVPN}?
| | +--rw maximum-prefixes
| | +--rw maximum-prefix* [prefix-count]
| | +--rw prefix-count -> ../state/prefix-count
| | +--ro state
| | +--ro prefix-count? uint32
| | +--ro stop-update? boolean
| | +--ro maximum-prefix-warning? boolean
| | +--ro threshold-percentage? uint8
| | +--ro warning-only? boolean
+--rw address-family-vrfs {feature-list:HAVE_BGPD}?
+--rw address-family-vrf* [afi safi vrf-name]
+--rw afi -> ../config/afi
+--rw safi -> ../config/safi
+--rw vrf-name -> ../config/vrf-name
+--rw config
| +--rw afi? ipi-bgp-types:bgp_vrf_afi_type_t
| +--rw safi? ipi-bgp-types:bgp_vrf_safi_type_
t
| +--rw vrf-name? string
| +--rw multipath-relax? empty
| +--rw graceful-shutdown? empty
| +--rw graceful-shutdown-capable? empty
| +--rw graceful-shutdown-local-preference? uint32
| +--rw additional-paths-mode? ipi-bgp-types:bgp_additional_
path_type_t {feature-list:HAVE_BGP_ADD_PATH}?
| +--rw additional-path-select-all? empty {feature-list:HAVE_BGP_

```

```

ADD_PATH}?
ADD_PATH}? | +--rw additional-paths-best-select-count? uint8 {feature-list:HAVE_BGP_
ADD_PATH}? | +--rw enable-pic? empty {feature-list:HAVE_BGP_
PIC_CORE_EDGE}? +--ro state
| +--ro afi? ipi-bgp-types:bgp_vrf_afi_type_t
| +--ro safi? ipi-bgp-types:bgp_vrf_safi_type_
t
| +--ro vrf-name? string
| +--ro multipath-relax? empty
| +--ro graceful-shutdown? empty
| +--ro graceful-shutdown-capable? empty
| +--ro graceful-shutdown-local-preference? uint32
| +--ro additional-paths-mode? ipi-bgp-types:bgp_additional_
path_type_t {feature-list:HAVE_BGP_ADD_PATH}?
| +--ro additional-path-select-all? empty {feature-list:HAVE_BGP_
ADD_PATH}? | +--ro additional-paths-best-select-count? uint8 {feature-list:HAVE_BGP_
ADD_PATH}? | +--ro enable-pic? empty {feature-list:HAVE_BGP_
PIC_CORE_EDGE}? +--rw vrf-peers
| +--rw vrf-peer* [peer-address]
| | +--rw peer-address -> ../config/peer-address
| | +--rw config
| | | +--rw peer-address? inet:ip-address
| | | +--rw peer-as? uint32
| | | +--rw source-identifier? string
| | | +--rw bgp-version? uint8
| | | +--rw peer-connection-interval? uint32
| | | +--rw enforce-multihop? empty
| | | +--rw peer-shutdown? empty
| | | +--rw peer-shutdown-description? cml-data-types:cml_line_t
| | | +--rw neighbor-passive? empty
| | | +--rw disable-capability-negotiation? empty
| | | +--rw enable-dynamic-capability? empty
| | | +--rw min-route-advertisement-interval? uint32
| | | +--rw peer-as-origin-interval? uint32
| | | +--rw neighbor-as-override? empty
| | | +--rw peer-interface-name? string {feature-list:HAVE_
VRF}? | | +--rw peer-description? cml-data-types:cml_line_t
| | +--rw peer-restart-time? uint32 {feature-list:HAVE_
RESTART,feature-list:HAVE_VRF}? | | +--rw site-origin-identifier? string {feature-list:HAVE_
VRF}? | | +--rw graceful-shut? empty
| | +--rw graceful-shut-timer? uint32
| | +--rw enable-peer-bfd? empty {feature-list:HAVE_
BFD}? | | +--rw enable-peer-bfd-multihop? empty {feature-list:HAVE_
BFD}? | +--ro state
| | +--ro counters
| | | +--ro notification-in? int32
| | | +--ro notification-out? int32
| | | +--ro update-message-in? int32
| | | +--ro update-message-out? int32
| | +--ro connection-established-count? int32
| | +--ro error-notify-sent? boolean
| | +--ro notify-code-string? cml-data-types:cml_line_t
| | +--ro bgp-peer-state? ipi-bgp-types:bgp_peer_status_t
| +--rw maximum-prefixes
| | +--rw maximum-prefix* [prefix-count]
| | | +--rw prefix-count -> ../state/prefix-count
| | | +--ro state
| | | +--ro prefix-count? uint32

```

```

|             +--ro stop-update?                boolean
|             +--ro maximum-prefix-warning?      boolean
|             +--ro threshold-percentage?        uint8
|             +--ro warning-only?                boolean
+--rw peer-groups
  +--rw peer-group* [peer-group-tag]
    +--rw peer-group-tag    -> ../state/peer-group-tag
    +--ro state
    +--rw maximum-prefixes
      +--rw maximum-prefix* [prefix-count]
        +--rw prefix-count  -> ../state/prefix-count
        +--ro state
          +--ro prefix-count?    uint32
          +--ro stop-update?     boolean
          +--ro maximum-prefix-warning? boolean
          +--ro threshold-percentage? uint8
          +--ro warning-only?    boolean

```

## Sensor Paths: ipi-bgp

### BGP State

```

Sensor Path
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/state

Leaf Attributes
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/state/connection-
established-count
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/state/bgp-peer-
state
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/state/peer-
shutdown
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/state/local-as
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/state/local-ip

```

### BGP Counters

```

Sensor Path
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/state/counters

Leaf Attributes
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-
address]/state/counters/notification-in
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-
address]/state/counters/notification-out
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-
address]/state/counters/update-message-in
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-
address]/state/counters/update-message-out

```

### BGP Address Family State

```

Sensor Path
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
families/address-family[afi=AFI][safi=SAFI]/state

Leaf Attributes
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
families/address-family[afi][safi]/state/bgp-established-up-time
  ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
families/address-family[afi][safi]/state/prefix-count

```

```

    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/send-prefix-count

```

## BGP Address Family Counters

### Sensor Path

```

    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi=AFI][safi=SAFI]/state/counters

```

### Leaf Attributes

```

    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/counters/keepalive-in-messages
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/counters/keepalive-out-messages
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/counters/open-messages-in
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/counters/open-messages-out
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/counters/as-path-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/counters/as-path-extended-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/counters/received-packet-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/counters/packet-in-queue
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/counters/packet-out-queue
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/counters/sent-packet-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/counters/refresh-received-packet-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/address-
    families/address-family[afi][safi]/state/counters/refresh-sent-packet-count

```

## BGP Address Family VRF State

### Sensor Path

```

    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state

```

### Leaf Attributes

```

    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/address-family-table-version
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/advertisement-interval
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/bgp-peer-state
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/calculated-hold-time
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/calculated-keepalive
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/community-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/connection-type
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/flag-shut-down
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/graceful-restart-time
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/link-type
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
    [safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/peer-address-family-table-version

```

```

    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/router-id
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/send-prefix-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
safi vrf-name]/vrf-peers/vrf-peer[peer-address]/state/connection-established-count

```

## BGP Address Family VRF Counters

### Sensor Path

```

    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters

```

### Leaf Attributes

```

    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/keepalive-in-messages
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/keepalive-out-messages
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/open-messages-in
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/open-messages-out
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/as-path-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/as-path-extended-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/received-packet-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/packet-in-queue
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/packet-out-queue
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/sent-packet-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/refresh-received-packet-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/refresh-sent-packet-count
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/notification-in
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/notification-out
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/update-message-in
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/address-family-vrfs/address-family-vrf[afi]
[safi][vrf-name]/vrf-peers/vrf-peer[peer-address]/state/counters/update-message-out

```

# IPI-BFD

## Pyang Tree: ipi-bfd

```

+--rw bfd {feature-list:HAVE_BFD}?
  +--rw global
    | +--ro state
    |   +--ro start-time?          yang:timeticks {feature-list:HAVE_BFD_MONO}?
    |   +--ro administrative-state? ipi-bfd-types:oambfd_admin_state_t {feature-
list:HAVE_BFD_MONO}?
    |   +--ro image-type?          ipi-bfd-types:oambfd_image_type_t {feature-
list:HAVE_BFD_MONO}?
    |   +--ro next-session-discriminator? string {feature-list:HAVE_BFD_MONO}?
    |   +--ro counters
    |     +--ro total-sessions? yang:counter32
  +--rw interfaces {feature-list:HAVE_BFD}?
    | +--rw interface* [name]
    |   +--rw name      -> ../config/name
    |   +--rw config
    |     | +--rw name?  -> /ipi-interface:interfaces/interface/name
    |     +--ro state
    |       +--ro interface-index? uint32
    |       +--ro interface-state? ipi-bfd-types:oambfd_if_state_t
  +--ro sessions {feature-list:HAVE_BFD}?
    +--ro session* [local-discriminator vrf-name]
      +--ro local-discriminator -> ../state/local-discriminator
      +--ro vrf-name            -> ../state/vrf-name
      +--ro state
        | +--ro counters
        | | +--ro packets
        | | | +--ro ipv4
        | | | | +--ro received?          yang:counter64
        | | | | +--ro transmitted?       yang:counter64
        | | | | +--ro echo-transmitted?  yang:counter64
        | | | +--ro ipv6 {feature-list:HAVE_IPV6}?
        | | |   +--ro received?          yang:counter64
        | | |   +--ro transmitted?       yang:counter64
        | | |   +--ro echo-transmitted?  yang:counter64
        | | +--ro up-transitions? yang:counter32
        | +--ro lower-layer-type?      ipi-bfd-types:oambfd_sess_lower_layer_t
        | +--ro uptime?                yang:timeticks
        | +--ro version?                uint32
        | +--ro local-port?             inet:port-number
        | +--ro remote-port?            inet:port-number
        | +--ro negotiated-detection-multiplier? uint8
        | +--ro forward-hello-timer-hits? uint32
        | +--ro remote-heard?           boolean
        | +--ro fate-shared?            boolean
        | +--ro remote-administrative-down? boolean
        | +--ro remote-demand-mode-enabled? boolean
        | +--ro remote-echo-enabled?    boolean
        | +--ro poll-bit?               boolean
        | +--ro storage-type?            ipi-bfd-types:bfd_storage_type_t
        | +--ro downtime?               yang:timeticks
        | +--ro discontinuity-time?      yang:timeticks
        | +--ro authentication-key-id?   uint32
        | +--ro last-up-time?            yang:timeticks
        | +--ro hold-down-timer?         uint32
        | +--ro hold-down-timer-hits?    uint32
        | +--ro session-type-status?     ipi-bfd-types:oambfd_session_type_status_
t
        | +--ro remote-address?          inet:ip-address
        | +--ro local-address?           inet:ip-address
        | +--ro vrf-name?                string

```

```

|   +--ro interface-index?                uint32
|   +--ro interface-name?                 string
|   +--ro remote-discriminator?           string
|   +--ro local-discriminator?            string
|   +--ro session-state?                  ipi-bfd-types:oambfd_session_state_t
|   +--ro session-type?                   ipi-bfd-types:bfd_session_type_state_t
|   +--ro session-diagnostics?            ipi-bfd-types:oambfd_perform_diag_t
|   +--ro negotiated-tx-interval?         uint32
|   +--ro negotiated-rx-interval?         uint32
+--ro micro-bfd-sessions {feature-list:HAVE_BFD_HW_OFFLOAD}?
|   +--ro interface* [member-interface] {feature-list:HAVE_BFD_HW_OFFLOAD}?
|       +--ro member-interface    -> ../state/member-interface
|       +--ro state
|           +--ro member-interface?    -> /ipi-
interface:interfaces/interface/name
|       +--ro remote-session-state?     ipi-bfd-types:oambfd_session_state_t
|       +--ro remote-session-diagnostics? ipi-bfd-types:oambfd_perform_diag_t
|       +--ro interface-index?          uint32
|       +--ro interface-name?           string
|       +--ro remote-discriminator?     string
|       +--ro local-discriminator?      string
|       +--ro session-state?            ipi-bfd-types:oambfd_session_state_t
|       +--ro session-type?             ipi-bfd-types:bfd_session_type_state_t
|       +--ro session-diagnostics?      ipi-bfd-types:oambfd_perform_diag_t
|       +--ro negotiated-tx-interval?   uint32
|       +--ro negotiated-rx-interval?   uint32
+--ro echo
|   +--ro state
|       +--ro local-echo-port?           inet:port-number
|       +--ro echo-desired-minimum-tx-interval? uint32
|       +--ro echo-required-minimum-rx-interval? uint32
|       +--ro negotiated-interval?      uint32
+--ro mpls {feature-list:HAVE_CUSTOM1_MPLS_BFD}?
|   +--ro state {feature-list:HAVE_MPLS_OAM}?
|       | +--ro fec-address?             inet:ipv4-address
|       | +--ro lsp-type?                ipi-bfd-types:oambfd_mpls_lsp_type_t
|       | +--ro tunnel-name?             string
|       | +--ro tunnel-label?            uint32
|       | +--ro ftn-index?               uint32
|       | +--ro lsp-ping-interval?       uint32
|       | +--ro minimum-tx?              uint32
|       | +--ro minimum-rx?              uint32
|       | +--ro detection-multiplier?    uint8
|       +--ro virtual-circuit-connectivity-verification
|           +--ro state {feature-list:HAVE_VCCV}?
|               +--ro vc-identifier?      uint32
|               +--ro incoming-vc-label?  uint32
|               +--ro outgoing-vc-label?  uint32
|               +--ro control-channel-type? ipi-bfd-types:oambfd_mpls_cc_type_t
|               +--ro connectivity-verification-type? ipi-bfd-types:oambfd_mpls_cv_type_t
|               +--ro attachment-circuit-index? uint32
|               +--ro tunnel-label?       uint32
|               +--ro peer-address?       inet:ipv4-address
+--ro packet
|   +--ro state {feature-list:NOT_HAVE_BFD_HW_OFFLOAD}?
|       +--ro packet-version?            uint32
|       +--ro packet-diagnostics?        ipi-bfd-types:oambfd_perform_diag_
t
|       +--ro packet-state?              ipi-bfd-types:oambfd_session_
state_t
|           +--ro demand-enabled?         boolean
|           +--ro poll-sequence-initiated? boolean
|           +--ro final-bit?              boolean
|           +--ro detection-multiplier?    uint8
|           +--ro length?                 uint32
|           +--ro packet-local-discriminator? string
|           +--ro packet-remote-discriminator? string

```

```

+--ro packet-desired-minimum-tx-interval?    uint32
+--ro packet-required-minimum-rx-interval?    uint32
+--ro required-minimum-echo-rx-interval?      uint32

```

## Sensor Paths: ipi-bfd

### BFD State

```

Sensor Path
  ipi:/bfd/global/state

Leaf Attributes
  ipi:/bfd/global/state/start-time
  ipi:/bfd/global/state/administrative-state
  ipi:/bfd/global/state/image-type
  ipi:/bfd/global/state/next-session-discriminator

```

### BFD State Counters

```

Sensor Path
  ipi:/bfd/global/state/counters

Leaf Attributes
  ipi:/bfd/global/state/counters/total-sessions

```

### BFD Interface

```

Sensor Path
  ipi:/bfd/interfaces/interface[name=INTERFACE_NAME]

Leaf Attributes
  ipi:/bfd/interfaces/interface[name]/state/interface-index
  ipi:/bfd/interfaces/interface[name]/state/interface-state

```

### BFD Sessions

```

Sensor Path
  ipi:/bfd/sessions/session[local-discriminator=NAME] [vrf-name=default]

Leaf Attributes
  ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/vrf-name
  ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/local-discriminator

```

### BFD Session State

```

Sensor Path
  ipi:/bfd/sessions/session[local-discriminator=NAME] [vrf-name=default]/state

Leaf Attributes
  ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/state/lower-layer-type
  ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/state/uptime
  ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/state/version
  ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/state/local-port

```

```

        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/remote-port
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/negotiated-
detection-multiplier
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/forward-hello-timer-
hits
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/remote-heard
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/fate-shared
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/remote-
administrative-down
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/remote-demand-mode-
enabled
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/remote-echo-enabled
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/poll-bit
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/storage-type
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/downtime
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/discontinuity-time
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/authentication-key-
id
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/last-uptime
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/hold-down-timer
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/hold-down-timer-hits
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/session-type-status
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/remote-address
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/local-address
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/vrf-name
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/interface-name
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/remote-discriminator
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/local-discriminator
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/session-state
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/session-type
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/session-diagnostics
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/negotiated-
detection-multiplier
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/negotiated-tx-
interval
        ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/negotiated-rx-
interval

```

## BFD Session State Counters

```

Sensor Path
    ipi:/bfd/sessions/session[local-discriminator=NAME][vrf-name=default]/state/counters

Leaf Attributes
    ipi:/bfd/sessions/session[local-discriminator][vrf-name]/state/counters/up-
transitions

```

## BFD Session State Counter IPv4 Packets

```

Sensor Path
    ipi:/bfd/sessions/session[local-discriminator=NAME][vrf-
name=default]/state/counters/packets/ipv4

Leaf Attributes
    ipi:/bfd/sessions/session[local-discriminator][vrf-
name]/state/counters/packets/ipv4/received
    ipi:/bfd/sessions/session[local-discriminator][vrf-
name]/state/counters/packets/ipv4/transmitted
    ipi:/bfd/sessions/session[local-discriminator][vrf-
name]/state/counters/packets/ipv4/echo-transmitted

```

## BFD Session State Counter IPv6 Packets

```
Sensor Path
    ipi:/bfd/sessions/session[local-discriminator=NAME] [vrf-
name=default]/state/counters/packets/ipv6

Leaf Attributes
    ipi:/bfd/sessions/session[local-discriminator] [vrf-
name]/state/counters/packets/ipv6/received
    ipi:/bfd/sessions/session[local-discriminator] [vrf-
name]/state/counters/packets/ipv6/transmitted
    ipi:/bfd/sessions/session[local-discriminator] [vrf-
name]/state/counters/packets/ipv6/echo-transmitted
```

## Micro-BFD Sessions State

```
Sensor Path
    ipi:/bfd/sessions/session[local-discriminator=NAME] [vrf-name=default]/micro-bfd-
sessions/interface[member-interface=NAME]/state

Leaf Attributes
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/micro-bfd-
sessions/interface[member-interface]/state/member-interface
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/micro-bfd-
sessions/interface[member-interface]/state/remote-session-state
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/micro-bfd-
sessions/interface[member-interface]/state/remote-session-diagnostics
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/micro-bfd-
sessions/interface[member-interface]/state/interface-index
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/micro-bfd-
sessions/interface[member-interface]/state/remote-discriminator
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/micro-bfd-
sessions/interface[member-interface]/state/local-discriminator
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/micro-bfd-
sessions/interface[member-interface]/state/session-state
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/micro-bfd-
sessions/interface[member-interface]/state/session-type
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/micro-bfd-
sessions/interface[member-interface]/state/session-diagnostics
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/micro-bfd-
sessions/interface[member-interface]/state/negotiated-tx-interval
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/micro-bfd-
sessions/interface[member-interface]/state/negotiated-rx-interval
```

## BFD Session Echo State

```
Sensor Path
    ipi:/bfd/sessions/session[local-discriminator=NAME] [vrf-name=default]/echo/state

Leaf Attributes
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/echo/state/local-echo-port
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/echo/state/echo-desired-
minimum-tx-interval
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/echo/state/echo-required-
minimum-rx-interval
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/echo/state/negotiated-
interval
```

## BFD Session MPLS State

```

Sensor Path
    ipi:/bfd/sessions/session[local-discriminator=NAME] [vrf-name=default]/mpls/state

Leaf Attributes
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/state/fec-address
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/state/lsp-type
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/state/tunnel-name
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/state/tunnel-label
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/state/ftn-index
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/state/lsp-ping-

interval
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/state/minimum-tx
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/state/minimum-rx
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/state/detection-

multiplier

```

## BFD Session VCCV State

```

Sensor Path
    ipi:/bfd/sessions/session[local-discriminator=NAME] [vrf-name=default]/mpls/virtual-
circuit-connectivity-verification/state

Leaf Attributes
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/virtual-circuit-
connectivity-verification/state/vc-identifier
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/virtual-circuit-
connectivity-verification/state/incoming-vc-label
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/virtual-circuit-
connectivity-verification/state/outgoing-vc-label
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/virtual-circuit-
connectivity-verification/state/control-channel-type
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/virtual-circuit-
connectivity-verification/state/connectivity-verification-type
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/virtual-circuit-
connectivity-verification/state/attachment-circuit-index
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/virtual-circuit-
connectivity-verification/state/tunnel-label
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/mpls/virtual-circuit-
connectivity-verification/state/peer-address

```

## BFD Session Packet State

```

Sensor Path
    ipi:/bfd/sessions/session[local-discriminator=NAME] [vrf-name=default]/packet/state/

Leaf Attributes
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/packet/state/packet-
version
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/packet/state/packet-
diagnostics
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/packet/state/packet-state
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/packet/state/demand-
enabled
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/packet/state/poll-
sequence-initiated
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/packet/state/final_bit
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/packet/state/detection-
multiplier
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/packet/state/length
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/packet/state/packet-local-
discriminator
    ipi:/bfd/sessions/session[local-discriminator] [vrf-name]/packet/state/packet-
remote-discriminator

```

```
    ipi:/bfd/sessions/session[local-discriminator][vrf-name]/packet/state/packet-  
desired-minimum-tx-interval  
    ipi:/bfd/sessions/session[local-discriminator][vrf-name]/packet/state/packet-  
required-minimum-rx-interval  
    ipi:/bfd/sessions/session[local-discriminator][vrf-name]/packet/state/required-  
minimum-echo-rx-interval
```

## IPI-LLDPv2

### Pyang Tree: ipi-lldpv2

```

+--rw lldp
+--rw global
| +--ro state
| | +--ro enable? empty
| | +--ro notification-interval? uint16 {feature-list:HAVE_SNMP}?
| | +--ro system-capabilities-enabled? cml-data-types:cml_line_t
| | +--ro host-name-information? string
| | +--ro counters
| | | +--ro remote-inserts? yang:counter32
| | | +--ro remote-deletes? yang:counter32
| | | +--ro remote-drops? yang:counter32
| | | +--ro remote-ageouts? yang:counter32
+--rw interfaces
+--rw interface* [name]
+--rw name -> ../config/name
+--rw config
| +--rw name? -> /ipi-interface:interfaces/interface/name
| +--rw disable-lldp-agent? empty
| +--rw agent-circuit-id? string
| +--rw med-device-type? ipi-lldp-types:lldp_meddev_t
| +--rw local-name? string
+--ro neighbors
+--ro agent* [agent-type]
+--ro agent-type ipi-lldp-types:lldp_agent_t
+--ro neighbor* [mac-address]
+--ro mac-address -> ../state/mac-address
+--ro state
| +--ro mac-address? cml-data-types:cml_mac_addr_t
| +--ro system-name? string
| +--ro chassis-component? string
| +--ro chassis-id-type? uint8
| +--ro port-component? string
| +--ro port-id? string
| +--ro port-description? string
| +--ro port-sub-type? uint16
| +--ro interface-alias? string
| +--ro interface-agent-circuit-id? string
| +--ro ttl? uint16
| +--ro interface-number? uint32
| +--ro interface-number-sub-type? string
| +--ro port-vlan-id? uint16
| +--ro pp-vlanid? uint16
| +--ro protocol? ipi-lldp-types:lldp_protoid_t
| +--ro vid-usage-digest? uint32
| +--ro management-vlan? uint16
| +--ro auto-negotiation-support? uint8
| +--ro auto-negotiation-capability? uint16
| +--ro operational-mau-type? uint16
| +--ro link-aggregate-capability? cml-data-types:cml_line_t
| +--ro link-aggregate-id? uint32
| +--ro max-frame-size? uint16
| +--ro system-description? string
| +--ro system-capabilities? cml-data-types:cml_line_t
| +--ro system-capabilities-enabled? cml-data-types:cml_line_t
| +--ro vlan-list* [vlan-id]
| | +--ro vlan-id uint16
| | +--ro vlan-name? string
+--ro management-lists
+--ro management-list* [address]
+--ro address -> ../state/address

```

```

+--ro state
  +--ro address?                string
  +--ro address-sub-type?       cml-data-types:cml_line_t
  +--ro interface-number-sub-type? string
  +--ro interface-number?       uint32
  +--ro oid?                     string

```

## Sensor Paths: ipi-lldpv2

### LLDP State

```

Sensor Path
  ipi:/lldp/global/state/

Leaf Attributes
  ipi:/lldp/global/state/host-name-information
  ipi:/lldp/global/state/notification-interval
  ipi:/lldp/global/state/system-capabilities-enabled
  ipi:/lldp/global/state/counters*

```

### LLDP Counters

```

Sensor Path
  ipi:/lldp/global/state/counters

Leaf Attributes
  ipi:/lldp/global/state/counters/remote-ageouts
  ipi:/lldp/global/state/counters/remote-deletes
  ipi:/lldp/global/state/counters/remote-drops
  ipi:/lldp/global/state/counters/remote-inserts

```

### LLDP Interface State

```

Sensor Path
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state

Leaf Attributes
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state/auto-negotiation-capability
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state/auto-negotiation-support
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state/chassis-component
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state/chassis-id-type
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state/link-aggregate-capability
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state/mac-address
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state/management-vlan
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state/max-frame-size
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state/operational-mau-type
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state/port-description
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state/port-id
  ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-address]/state/port-sub-type

```

```

        ipi:lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/port-vlan-id
        ipi:lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/pp-vlanid
        ipi:lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/protocol
        ipi:lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/system-capabilities
        ipi:lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/system-capabilities-enabled
        ipi:lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/system-description
        ipi:lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/system-name
        ipi:lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/ttl
        ipi:lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/vid-usage-digest

```

## LLDP Interface State VLAN

```

Sensor Path
    ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/vlan-list[vlan-id]

Leaf Attributes
    ipi:lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/vlan-list[vlan-id]/vlan-id
    ipi:lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/vlan-list[vlan-id]/vlan-name

```

## LLDP Interface State Management

```

Sensor Path
    ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/management-lists[address]/management-list/state

Leaf Attributes
    ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/management-list[address]/address
    ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/management-list[address]/address-sub-type
    ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/management-list[address]/interface-number-sub-type
    ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/management-list[address]/interface-number
    ipi:/lldp/interfaces/interface[name]/neighbors/agent[agent-type]/neighbor[mac-
address]/state/management-list[address]/oid

```

# IPI-QoS

## Pyang Tree: ipi-qos-if

```

module: ipi-qos-if

  grouping interfaces-grouping
    +-- interfaces {feature-list:HAVE_QOS}?
      +-- interface* [name]
        +-- name?          -> ../config/name
        +-- config
          | +-- name?    -> /ipi-interface:interfaces/interface/name
          +-- service-policy
            +-- ingress
              | +--ro class-maps-level-1
              |   +--ro class-map-level-1* [class-map-name-level-1]
              |   +--ro class-map-name-level-1?  -> ../state/class-map-name-level-1
              |   +--ro state
              |   | +--ro class-map-name-level-1?  string
              |   | +--ro counters
              |   | | +--ro matched-packets?      yang:counter64
              |   | | +--ro matched-octets?      yang:counter64
              |   | | +--ro transmitted-packets?  yang:counter64
              |   | | +--ro transmitted-octets?   yang:counter64
              |   | | +--ro dropped-packets?      yang:counter64
              |   | | +--ro dropped-octets?       yang:counter64
              |   +--ro class-maps-level-2
              |   | +--ro class-map-level-2* [class-map-name-level-2]
              |   | +--ro class-map-name-level-2?  -> ../state/class-map-name-level-2
              |   | +--ro state
              |   | | +--ro class-map-name-level-2?  string
              |   | | +--ro counters
              |   | | | +--ro matched-packets?      yang:counter64
              |   | | | +--ro matched-octets?      yang:counter64
              |   | | | +--ro transmitted-packets?  yang:counter64
              |   | | | +--ro transmitted-octets?   yang:counter64
              |   | | | +--ro dropped-packets?      yang:counter64
              |   | | | +--ro dropped-octets?       yang:counter64
              |   +--ro class-maps-level-3
              |   | +--ro class-map-level-3* [class-map-name-level-3]
              |   | +--ro class-map-name-level-3?  -> ../state/class-map-name-
level-3
              |   | +--ro state
              |   | | +--ro class-map-name-level-3?  string
              |   | | +--ro counters
              |   | | | +--ro matched-packets?      yang:counter64
              |   | | | +--ro matched-octets?      yang:counter64
              |   | | | +--ro transmitted-packets?  yang:counter64
              |   | | | +--ro transmitted-octets?   yang:counter64
              |   | | | +--ro dropped-packets?      yang:counter64
              |   | | | +--ro dropped-octets?       yang:counter64
              +-- egress
                +--ro class-maps-level-1
                | +--ro class-map-level-1* [class-map-name-level-1]
                | +--ro class-map-name-level-1?  -> ../state/class-map-name-level-1
                | +--ro state
                | | +--ro class-map-name-level-1?  string
                | | +--ro queues
                | | | +--ro queue* [id]
                | | | | +--ro id?                uint8
                | | | | +--ro counters
                | | | | | +--ro total-transmitted-packets?  yang:counter64
                | | | | | +--ro total-transmitted-octets?   yang:counter64
                | | | | | +--ro total-dropped-packets?     yang:counter64

```

```

|         | +--ro total-dropped-octets?          yang:counter64
|         | +--ro green-transmitted-packets?     yang:counter64
|         | +--ro non-green-transmitted-packets?  yang:counter64
|         | +--ro green-dropped-packets?         yang:counter64
|         | +--ro yellow-dropped-packets?        yang:counter64
|         | +--ro red-dropped-packets?           yang:counter64
|         | +--ro rate-kbps?                      decimal64
|         | +--ro rate-mbps?                      decimal64
|         | +--ro rate-gbps?                      decimal64
|         +--ro queue-size
|             +--ro state
|                 +--ro max-threshold?            yang:counter64
|                 +--ro max-threshold-type?       ipi-qos-types:qos_threshold_t
+--ro class-maps-level-2
    +--ro class-map-level-2* [class-map-name-level-2]
        +--ro class-map-name-level-2? -> ../state/class-map-name-level-2
        +--ro state
            | +--ro class-map-name-level-2?  string
            | +--ro queues
            |     +--ro queue* [id]
            |         +--ro id?                uint8
            |         +--ro counters
            |             | +--ro total-transmitted-packets?    yang:counter64
            |             | +--ro total-transmitted-octets?    yang:counter64
            |             | +--ro total-dropped-packets?       yang:counter64
            |             | +--ro total-dropped-octets?       yang:counter64
            |             | +--ro green-transmitted-packets?   yang:counter64
            |             | +--ro non-green-transmitted-packets? yang:counter64
            |             | +--ro green-dropped-packets?       yang:counter64
            |             | +--ro yellow-dropped-packets?      yang:counter64
            |             | +--ro red-dropped-packets?         yang:counter64
            |             | +--ro rate-kbps?                   decimal64
            |             | +--ro rate-mbps?                   decimal64
            |             | +--ro rate-gbps?                   decimal64
            |             +--ro queue-size
            |                 +--ro state
            |                     +--ro max-threshold?          yang:counter64
            |                     +--ro max-threshold-type?     ipi-qos-types:qos_
threshold_t
    +--ro class-maps-level-3
        +--ro class-map-level-3* [class-map-name-level-3]
            +--ro class-map-name-level-3? -> ../state/class-map-name-
level-3
                +--ro state
                    +--ro class-map-name-level-3?  string
                    +--ro queues
                        +--ro queue* [id]
                            +--ro id?                uint8
                            +--ro counters
                                | +--ro total-transmitted-
packets?          yang:counter64
                                | +--ro total-transmitted-
octets?          yang:counter64
                                | +--ro total-dropped-
packets?          yang:counter64
                                | +--ro total-dropped-
octets?          yang:counter64
                                | +--ro green-transmitted-
packets?          yang:counter64
                                | +--ro non-green-transmitted-
packets?          yang:counter64
                                | +--ro green-dropped-
packets?          yang:counter64
                                | +--ro yellow-dropped-
packets?          yang:counter64
                                | +--ro red-dropped-
packets?          yang:counter64
                                +--ro rate-kbps?          decimal64

```

```

|   +--ro rate-mbps?           decimal64
|   +--ro rate-gbps?          decimal64
+--ro queue-size
    +--ro state
        +--ro max-threshold?    yang:counter64
        +--ro max-threshold-type? ipi-qos-types:qos_
threshold_t

```

## Pyang Tree: ipi-qos

```

module: ipi-qos
  +--rw qos {feature-list:HAVE_QOS}?
    +--rw global
      +--rw config
        |   +--rw enable-qos?    cml-data-types:cml_enable_disable_t
      +--ro state
        +--ro counters
          +--ro policy-entries?  yang:counter32

```

## Sensor Paths: ipi-qos

### QoS Global State Counters

```

Sensor Path
    ipi:/qos/global/state/counters

Leaf Attributes
    ipi:/qos/global/state/counters/policy-entries

```

### QoS Interface State Counters

```

Sensor Path
    ipi:/qos/interfaces/interface[name=INTERFACE_NAME]/service-policy/ingress/class-maps-
    level-1/class-map-level-1[class-map-name-level-1=NAME1]/state/counters

Leaf Attributes
    ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-
    1/class-map-level-1[class-map-name-level-1]/state/counters/matched-packets
    ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-
    1/class-map-level-1[class-map-name-level-1]/state/counters/matched-octets
    ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-
    1/class-map-level-1[class-map-name-level-1]/state/counters/transmitted-packets
    ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-
    1/class-map-level-1[class-map-name-level-1]/state/counters/transmitted-octets
    ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-
    1/class-map-level-1[class-map-name-level-1]/state/counters/dropped-packets
    ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-
    1/class-map-level-1[class-map-name-level-1]/state/counters/dropped-octets

```

### QoS Interface Ingress Class-Map State

```

Sensor Path
    ipi:/qos/interfaces/interface[name=INTERFACE_NAME]/service-policy/ingress/class-maps-
    level-1/class-map-level-1[class-map-name-level-1=NAME1]/class-maps-level-2/class-map-level-2
    [class-map-name-level-2=NAME2]/state/counters

Leaf Attributes
    ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-
    1/class-map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-
    level-2]/state/counters/matched-packets
    ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-

```

```

1/class-map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-2]/state/counters/matched-octets
    ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-2]/state/counters/transmitted-packets
    ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-2]/state/counters/transmitted-octets
    ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-2]/state/counters/dropped-packets
    ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-2]/state/counters/dropped-octets

```

## QoS Interface Ingress Class-Map State Counters

### Sensor Path

```

ipi:/qos/interfaces/interface[name=INTERFACE_NAME]/service-policy/ingress/class-maps-level-1/class-map-level-1[class-map-name-level-1=NAME1]/class-maps-level-2/class-map-level-2[class-map-name-level-2=NAME2]/class-maps-level-3/class-map-level-3[class-map-name-level-3=NAME3]/state/counters

```

### Leaf Attributes

```

ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/counters/matched-packets
ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/counters/matched-octets
ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/counters/transmitted-packets
ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/counters/transmitted-octets
ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/counters/dropped-packets
ipi:/qos/interfaces/interface[name]/service-policy/ingress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/counters/dropped-octets

```

## QoS Interface Egress Class-Map (Level 1) State Counters

### Sensor Path

```

ipi:/qos/interfaces/interface[name=INTERFACE_NAME]/service-policy/egress/class-maps-level-1/class-map-level-1[class-map-name-level-1=NAME1]/state/queues/queue[id=QUEUE_ID]/counters

```

### Leaf Attributes

```

ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/total-transmitted-packets
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/total-transmitted-octets
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/total-dropped-packets
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/total-dropped-octets
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/green-transmitted-packets
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/green-transmitted-octets

```

```

map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/non-green-transmitted-
packtes
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/green-dropped-packets
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/yellow-dropped-packets
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/red-dropped-packets
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/rate-kbps
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/rate-mbps
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/state/queues/queue[id]/counters/rate-gbps

```

## QoS Interface Egress Class-Map (Level 1-2) State Counters

### Sensor Path

```

ipi:/qos/interfaces/interface[name=INTERFACE_NAME]/service-policy/egress/class-maps-
level-1/class-map-level-1[class-map-name-level-1=NAME1]/class-maps-level-2/class-map-level-2
[class-map-name-level-2=NAME2]/state/queues/queue[id=QUEUE_ID]/counters

```

### Leaf Attributes

```

ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/state/queues/queue[id]/counters/total-transmitted-packets
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/state/queues/queue[id]/counters/total-transmitted-octets
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/state/queues/queue[id]/counters/total-dropped-packets
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/state/queues/queue[id]/counters/total-dropped-octets
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/state/queues/queue[id]/counters/green-transmitted-packtes
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/state/queues/queue[id]/counters/non-green-transmitted-packtes
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/state/queues/queue[id]/counters/green-dropped-packets
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/state/queues/queue[id]/counters/yellow-dropped-packets
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/state/queues/queue[id]/counters/red-dropped-packets
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/state/queues/queue[id]/counters/rate-kbps
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/state/queues/queue[id]/counters/rate-mbps
ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/state/queues/queue[id]/counters/rate-gbps

```

## QoS Interface Egress Class-Map (Level 1-3) State Counters

### Sensor Path

```

ipi:/qos/interfaces/interface[name=INTERFACE_NAME]/service-policy/egress/class-maps-
level-1/class-map-level-1[class-map-name-level-1=NAME1]/class-maps-level-2/class-map-level-2
[class-map-name-level-2=NAME2]/class-maps-level-3/class-map-level-3[class-map-name-level-
3=NAME3]/state/queues/queue[id=QUEUE_ID]/counters

```

## Leaf Attributes

```

    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/queues/queue
[id]/counters/total-transmitted-packets
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/queues/queue
[id]/counters/total-transmitted-octets
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/queues/queue
[id]/counters/total-dropped-packets
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/queues/queue
[id]/counters/total-dropped-octets
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/queues/queue
[id]/counters/green-transmitted-packets
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/queues/queue
[id]/counters/non-green-transmitted-packets
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/queues/queue
[id]/counters/green-dropped-packets
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/queues/queue
[id]/counters/yellow-dropped-packets
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/queues/queue
[id]/counters/red-dropped-packets
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/queues/queue
[id]/counters/rate-kbps
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/queues/queue
[id]/counters/rate-mbps
    ipi:/qos/interfaces/interface[name]/service-policy/egress/class-maps-level-1/class-
map-level-1[class-map-name-level-1]/class-maps-level-2/class-map-level-2[class-map-name-level-
2]/class-maps-level-3/class-map-level-3[class-map-name-level-3]state/queues/queue
[id]/counters/rate-gbps

```

# IPI-MPLS

## Pyang Tree: ipi-mpls

```
+--rw mpls {feature-list:HAVE_MPLS}?
  +--rw interfaces
    +--rw interface* [name]
      +--rw name                -> ../config/name
      +--rw config
        | +--rw name?    -> /ipi-interface:interfaces/interface/name
        +--ro state
        | +--ro name?    -> /ipi-interface:interfaces/interface/name
      +--rw label-switching
        +--ro state
          +--ro enable    boolean
```

## Sensor Paths: ipi-mpls

### MPLS Label-Switching State

```
Sensor Path
  ipi:/mpls/interfaces/interface/label-switching/state

Leaf Attributes
  ipi:/mpls/interfaces/interface/label-switching/state/enable
```

### MPLS Global State Counters

```
Sensor Path
  ipi:/mpls/global/state/counters

Leaf Attributes
  ipi:/mpls/global/state/counters/label-entries
```

## IPI-L2VPN-VPLS

### Pyang Tree: ipi-l2vpn-vpls

```
module: ipi-l2vpn-vpls
  +--rw vpls {feature-list:HAVE_VPLS,feature-list:HAVE_MPLS}?
    +--rw global
      +--ro state
        +--ro counters
          +--ro total-instances?   yang:counter32
```

### Sensor Paths: ipi-l2vpn-vpls

#### L2VPN VPLS Global State Counters

```
Sensor Path
  ipi:/vpls/global/state/counters

Leaf Attributes
  ipi:/vpls/global/state/counters/total-instances
```

## IPI-L2VPN-VPWS

### Pyang Tree: ipi-l2vpn-vpws

```
module: ipi-l2vpn-vpws
  +--rw vpws {feature-list:HAVE_MPLS,feature-list:HAVE_MPLS_VC}?
    +--ro global
      +--ro state
        +--ro counters
          +--ro total-pseudowires?   uint32
```

### Sensor Paths: ipi-l2vpn-vpws

#### L2VPN VPWS Global State Counters

```
Sensor Path
  ipi:/vpws/global/state/counters

Leaf Attributes
  ipi:/vpws/global/state/counters/total-pseudowires
```

## IPI-LDP

### Pyang Tree: ipi-ldp

```
+--rw ldp {feature-list:HAVE_LDPPD}?  
  +--ro peers {feature-list:HAVE_LDPPD}?  
    +--ro peer* [peer-address]  
      +--ro peer-address    -> ../state/peer-address  
      +--ro state  
        +--ro peer-address?   inet:ipv4-address  
        +--ro session-state?  ipi-ldp-types:ldp_session_state_t  
        +--ro session-role?   ipi-ldp-types:ldp_session_role_t
```

### Sensor Paths: ipi-ldp

#### LDP Peers State

```
Sensor Path  
  ipi:/ldp/peers/peer/state/  
  
Leaf Attributes  
  ipi:/ldp/peers/peer/state/session-state  
  ipi:/ldp/peers/peer/state/session-role
```

# IPI-EVPN-MPLS

## Pyang Tree: ipi-evpn-mpls

```

module: ipi-evpn-mpls
  +--rw evpn-mpls {feature-list:HAVE_NVO,feature-list:HAVE_MPLS,feature-list:HAVE_BGP_EVPN}?
    +--rw mpls-tenants
      +--rw mpls-tenant* [tenant-identifier]
        +--rw tenant-identifier -> ../config/tenant-identifier
        +--rw config
          | +--rw tenant-identifier? uint32
          | +--rw vpws-identifier? uint32 {feature-list:HAVE_EVPN_VPWS}?
        +--ro state
          | +--ro tenant-identifier? uint32
          | +--ro vpws-identifier? uint32 {feature-list:HAVE_EVPN_VPWS}?
        +--ro route-count-info
          +--ro state
            +--ro mac-only? uint32

```

## Sensor Paths: ipi-evpn-mpls

### EVPN MPLS Tenant State

```

Sensor Path
  ipi:/evpn-mpls/mpls-tenants/mpls-tenant/route-count-info/state

Leaf Attributes
  ipi:/evpn-mpls/mpls-tenants/mpls-tenant/route-count-info/state/mac-only

```

### EVPN MPLS Global State

```

Sensor Path
  ipi:/evpn-mpls/global/route-count/state

Leaf Attributes
  ipi:/evpn-mpls/global/route-count/state/max-route
  ipi:/evpn-mpls/global/route-count/state/active-route

```

## IPI-VRRP

### Pyang Tree: ipi-vrrp

```

+--rw vrrp {feature-list:HAVE_VRRPD}?
  +--rw ipv4-instances
    +--rw ipv4-instance* [virtual-router-id]
      +--rw virtual-router-id    -> ../config/virtual-router-id
      +--rw config
        | +--rw virtual-router-id?  uint8
        +--ro state
          | +--ro virtual-router-id?  uint8
        +--rw interfaces
          +--rw interface* [interface-name]
            +--rw interface-name    -> ../config/interface-name
            +--rw config
              | +--rw interface-name?      -> /ipi-interface:interfaces/interface/name
              | +--rw disable-preempt-mode?  boolean
              +--ro state
                | +--ro interface-name?      -> /ipi-interface:interfaces/interface/name
                | +--ro disable-preempt-mode?  boolean
                +--ro addresses
                  | +--ro state
                    | +--ro operational-primary-address?  inet:ipv4-address
                    | +--ro operational-master-address?   inet:ipv4-address
                +--ro session-info
                  | +--ro state
                    | +--ro running-priority?      uint8
                    | +--ro virtual-mac-mbyte-word? cml-data-types:cml_mac_addr_t
                    | +--ro administrative-state?   ipi-vrrp-types:vrrp_admin_state_t
                    | +--ro uptime?                string
                +--ro session-status
                  | +--ro state
                    | +--ro vrrp-state?   ipi-vrrp-types:vrrp_session_state_t
                +--ro timers
                  +--ro state
                    +--ro master-advertise-interval?  uint32

```

### Sensor Paths: ipi-vrrp

#### VRRP Interface State

##### Sensor Path

```

  ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
  [interface-name]/state/

```

##### Leaf Attributes

```

  ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
  [interface-name]/state/disable-preempt-mode

```

#### VRRP Session Information State

##### Sensor Path

```

  ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
  [interface-name]/session-info/state

```

##### Leaf Attributes

```

    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
[interface-name]/session-info/state/administrative-state
    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
[interface-name]/session-info/state/running-priority
    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
[interface-name]/session-info/state/virtual-mac-mbyte-word
    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
[interface-name]/session-info/state/uptime

```

## VRRP Session Status State

Sensor Path

```

    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
[interface-name]/session-status/state

```

Leaf Attributes

```

    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
[interface-name]/session-status/state/vrrp-state

```

## VRRP Timers State

Sensor Path

```

    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
[interface-name]/timers/state/

```

Leaf Attributes

```

    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
[interface-name]/timers/state/master-advertise-interval

```

## VRRP Addresses State

Sensor Path

```

    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
[interface-name]/addresses/state/

```

Leaf Attributes

```

    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
[interface-name]/addresses/state/operational-master-address
    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
[interface-name]/addresses/state/operational-primary-address

```

## IPI-IP SLA

### Pyang Tree: ipi-ip-sla

```

module: ipi-ip-sla
  +--rw ip-sla {feature-list:HAVE_IPSLA,feature-list:HAVE_BFD}?
    +--rw processes
      +--rw process* [identifier]
        +--rw identifier          -> ../config/identifier
        +--rw config
          | +--rw identifier?    uint16
        +--ro state
          | +--ro identifier?    uint16
        +--ro ip-sla-statistics
          +--ro state
            +--ro destination?      string
            +--ro packets-sent?     uint32
            +--ro packets-received? uint32
            +--ro packets-lost?     decimal64
            +--ro minimum-round-trip-delay? uint64
            +--ro maximum-round-trip-delay? uint64
            +--ro average-round-trip-delay? uint64

```

### Sensor Paths: ipi-ip-sla

#### IP SLA Statistics

```

Sensor Path
  ipi:/ip-sla/processes/process[identifier]/ip-sla-statistics/state/

Leaf Attributes
  ipi:/ip-sla/processes/process[identifier]/ip-sla-statistics/state/packets-sent
  ipi:/ip-sla/processes/process[identifier]/ip-sla-statistics/state/packets-received
  ipi:/ip-sla/processes/process[identifier]/ip-sla-statistics/state/average-round-trip-
delay
  ipi:/ip-sla/processes/process[identifier]/ip-sla-statistics/state/destination
  ipi:/ip-sla/processes/process[identifier]/ip-sla-statistics/state/packets-lost
  ipi:/ip-sla/processes/process/ip-sla-statistics/state/maximum-round-trip-delay
  ipi:/ip-sla/processes/process/ip-sla-statistics/state/minimum-round-trip-delay

```

## IPI-LAG

### Pyang Tree: ipi-lag

```
module: ipi-if-aggregate

  augment /ipi-interface:interfaces/ipi-interface:interface:
    +--rw member-aggregation {feature-list:HAVE_LACP}?
      +--ro state
        +--ro agg-type          ipi-lag-types:lag_link_agg_type_t
        +--ro aggregate-id      uint16
  augment /ipi-interface:interfaces/ipi-interface:interface:
    +--rw aggregator {feature-list:HAVE_LACP}?
      +--ro state
        +--ro agg-min-links-state? ipi-lag-types:lag_agg_min_links_status
        +--ro agg-up-timestamp?    ipi-lag-types:lag_up_time_t
```

### Sensor Paths: ipi-lag

#### LAG Interface State

```
Sensor Path
  ipi:/interfaces/interface[name]/

Leaf Attributes
  ipi:/interfaces/interface[name]/aggregator/state/agg-min-links-state
  ipi:/interfaces/interface[agg-if-name]/ethernet/state/hw-mac-address
  ipi:/interfaces/interface[name]/member-aggregation/state/aggregate-id
  ipi:/interfaces/interface[name]/member-aggregation/state/agg-type
```

#### LAG Interface Member State

```
Sensor Path
  ipi:/interfaces/interface/member-aggregation/state

Leaf Attributes
  ipi:/interfaces/interface/member-aggregation/state/agg-type
  ipi:/interfaces/interface/member-aggregation/state/aggregate-id
```

## IPI-VLAN

### Pyang Tree: ipi-vlan

```
module: ipi-vlan
  +--rw vlan-global {feature-list:HAVE_VLAN}?
    +--ro counters
      +--ro total-vlans?  yang:counter32
```

## Sensor Paths: ipi-vlan

### VLAN Global Counters

```
Sensor Path
    ipi:/vlan-global/counters/total-vlans

Leaf Attributes
    ipi:/vlan-global/counters/total-vlans/total-vlans
```

## IPI-ACL

### Pyang Tree: ipi-acl

```
module: ipi-acl
  +--rw acl {feature-list:HAVE_ACL}?
    +--rw acl-sets
      | +--rw acl-set* [name type]
      |   +--rw name          -> ../state/name
      |   +--rw type          -> ../state/type
      |   +--ro state
      |   | +--ro name?    string
      |   | +--ro type?    ipi-acl-types:acl_types_t
      |   +--rw acl-entries
      |   | +--rw acl-entry* [sequence-id]
      |   |   +--rw sequence-id  -> ../state/sequence-id
      |   |   +--ro state
      |   |   | +--ro sequence-id?  uint32
      |   |   | +--rw ipv4
      |   |   |   +--ro state
      |   |   |   +--ro counters
      |   |   |   | +--ro matched-packets?  yang:counter64
      |   |   |   +--ro forwarding-action?    ipi-acl-types:acl_forwarding_
      |   |   +--ro vlan-id?                  uint16
      |   |   +--ro monitor-action?            ipi-acl-types:acl_monitor_
      |   +--rw action_t {feature-list:HAVE_SFLOW,feature-list:HAVE_CUSTOM1_ACL}?
      |   | +--ro source-address?              ipi-acl-types:acl_any_ipv4_src_
      |   | +--ro destination-address?         ipi-acl-types:acl_any_ipv4_dest_
      |   | +--ro dscp?                        ipi-acl-types:acl_dscp_t
      |   | +--ro precedence?                  ipi-acl-types:acl_precedence_t
      |   | +--ro inner-vlan-id?               uint16
      |   | +--ro (protocol)?
      |   |   | +--:(tcp)
      |   |   |   +--ro protocol-tcp?         boolean
      |   |   |   +--ro tcp-source-port?      ipi-acl-types:acl_tcp_src_port_t
      |   |   |   +--ro tcp-destination-port? ipi-acl-types:acl_tcp_dest_port_
      |   |   +--:(udp)
      |   |   | +--ro protocol-udp?          boolean
      |   |   | +--ro udp-source-port?       ipi-acl-types:acl_udp_src_port_t
      |   |   | +--ro udp-destination-port?   ipi-acl-types:acl_udp_dest_port_
      |   |   +--:(icmp)
      |   |   | +--ro protocol-icmp?         boolean
      |   |   | +--ro icmp-message?          ipi-acl-types:acl_icmp_options_t
      |   +--rw {feature-list:HAVE_CUSTOM1_ACL}?
      |   | +--ro icmp-type?                  uint8 {feature-list:HAVE_
CUSTOM1_ACL}?
```

```

| | | | +--ro icmp-code? uint8 {feature-list:HAVE_
CUSTOM1_ACL}?
| | | | +---:(other-protocols)
| | | | +--ro protocol-name? ipi-acl-types:acl_ip_protocols_t
| | | | +--ro source-port-operator? ipi-acl-types:acl_src_port_
operations_t
| | | | +--ro lower-source-port-in-range? uint16
| | | | +--ro upper-source-port-in-range? uint16
| | | | +--ro destination-port-operator? ipi-acl-types:acl_dest_port_
operations_t
| | | | +--ro lower-destination-port-in-range? uint16
| | | | +--ro upper-destination-port-in-range? uint16
| | | | +--ro redirect-interface-name? string {feature-list:HAVE_
CUSTOM1_ACL}?
| | | | +--ro fragments? boolean {feature-list:HAVE_
CUSTOM1_ACL}?
| | | | +--rw ipv6 {feature-list:HAVE_IPV6,feature-list:HAVE_ACL}?
| | | | | +--ro state
| | | | | +--ro counters
| | | | | | +--ro matched-packets? yang:counter64
| | | | | +--ro forwarding-action? ipi-acl-types:acl_forwarding_
action_t
| | | | | +--ro vlan-id? uint16
| | | | | +--ro monitor-action? ipi-acl-types:acl_monitor_
action_t {feature-list:HAVE_SFLOW,feature-list:HAVE_CUSTOM1_ACL}?
| | | | | +--ro source-address? ipi-acl-types:acl_any_ipv6_src_
addr_t
| | | | | +--ro destination-address? ipi-acl-types:acl_any_ipv6_dest_
addr_t
| | | | | +--ro dscp? ipi-acl-types:acl_dscp_t
| | | | | +--ro inner-vlan-id? uint16 {feature-list:HAVE_
CUSTOM1_ACL}?
| | | | | +--ro flow-label? uint32 {feature-list:HAVE_
CUSTOM1_ACL}?
| | | | | +--ro (protocol)?
| | | | | | +---:(tcp)
| | | | | | | +--ro protocol-tcp? boolean
| | | | | | | +--ro tcp-source-port? ipi-acl-types:acl_tcp_src_port_t
| | | | | | | +--ro tcp-destination-port? ipi-acl-types:acl_tcp_dest_port_
t
| | | | | | +--ro tcp-flags? ipi-acl-types:acl_tcp_flags_t
{feature-list:HAVE_CUSTOM1_ACL}?
| | | | | | | +---:(udp)
| | | | | | | | +--ro protocol-udp? boolean
| | | | | | | | +--ro udp-source-port? ipi-acl-types:acl_udp_src_port_t
| | | | | | | | +--ro udp-destination-port? ipi-acl-types:acl_udp_dest_port_
t
| | | | | | | +---:(icmp)
| | | | | | | | +--ro protocol-icmp? boolean
| | | | | | | | +--ro icmp-message? ipi-acl-types:acl_icmpv6_
options_t {feature-list:HAVE_CUSTOM1_ACL}?
| | | | | | | +--ro icmp-type? uint8 {feature-list:HAVE_
CUSTOM1_ACL}?
| | | | | | | +--ro icmp-code? uint8 {feature-list:HAVE_
CUSTOM1_ACL}?
| | | | | | | +---:(sctp)
| | | | | | | | +--ro protocol-sctp? boolean
| | | | | | | | +--ro sctp-source-port? uint16
| | | | | | | | +--ro sctp-destination-port? uint16
| | | | | | | +---:(other-protocols)
| | | | | | | +--ro protocol-name? ipi-acl-types:acl_ipv6_
protocols_t
| | | | | +--ro source-port-operator? ipi-acl-types:acl_src_port_
operations_t
| | | | | +--ro lower-source-port-in-range? uint16
| | | | | +--ro upper-source-port-in-range? uint16
| | | | | +--ro destination-port-operator? ipi-acl-types:acl_dest_port_
operations_t

```

```

| | | +--ro lower-destination-port-in-range? uint16
| | | +--ro upper-destination-port-in-range? uint16
| | | +--ro redirect-interface-name? string {feature-list:HAVE_
CUSTOM1_ACL}?
| | | +--ro fragments? boolean {feature-list:HAVE_
CUSTOM1_ACL}?
| | | +--rw arp {feature-list:HAVE_ACL}?
| | | | +--ro state
| | | | +--ro counters
| | | | | +--ro matched-packets? yang:counter64
| | | | +--ro forwarding-action? ipi-acl-types:acl_forwarding_
action_t
| | | +--ro vlan-id? uint16
| | | +--ro monitor-action? ipi-acl-types:acl_monitor_action_t
{feature-list:HAVE_SFLOW,feature-list:HAVE_CUSTOM1_ACL}?
| | | +--ro inner-vlan-id? uint16
| | | +--ro (source-mac-options)?
| | | | +--:(any-mac)
| | | | | +--ro source-mac-any? boolean
| | | | | +--:(host-mac)
| | | | | | +--ro source-mac-host? ipi-acl-types:acl_mac_addr_t
| | | | | +--:(mac-with-mask)
| | | | | +--ro source-mac-address? ipi-acl-types:acl_mac_addr_t
| | | | | +--ro source-mac-mask? ipi-acl-types:acl_mac_addr_t
| | | | +--ro arp-packet-type? ipi-acl-types:acl_arp_type_t
| | | | +--ro source-ip-address? ipi-acl-types:acl_any_ipv4_src_
addr_t
| | | +--ro destination-ip-address? ipi-acl-types:acl_any_ipv4_dest_
addr_t
| | | +--ro (destination-mac-options)?
| | | | +--:(any-mac)
| | | | | +--ro destination-mac-any? boolean
| | | | | +--:(host-mac)
| | | | | | +--ro destination-mac-host? ipi-acl-types:acl_mac_addr_t
| | | | | +--:(mac-with-mask)
| | | | | +--ro destination-mac-address? ipi-acl-types:acl_mac_addr_t
| | | | | +--ro destination-mac-mask? ipi-acl-types:acl_mac_addr_t
| | | +--rw mac
| | | | +--ro state
| | | | +--ro counters
| | | | | +--ro matched-packets? yang:counter64
| | | | +--ro forwarding-action? ipi-acl-types:acl_forwarding_
action_t
| | | +--ro vlan-id? uint16
| | | +--ro monitor-action? ipi-acl-types:acl_monitor_action_t
{feature-list:HAVE_SFLOW,feature-list:HAVE_CUSTOM1_ACL}?
| | | +--ro inner-vlan-id? uint16
| | | +--ro (source-mac-options)?
| | | | +--:(any-mac)
| | | | | +--ro source-mac-any? boolean
| | | | | +--:(host-mac)
| | | | | | +--ro source-mac-host? ipi-acl-types:acl_mac_addr_t
| | | | | +--:(mac-with-mask)
| | | | | +--ro source-mac-address? ipi-acl-types:acl_mac_addr_t
| | | | | +--ro source-mac-mask? ipi-acl-types:acl_mac_addr_t
| | | | +--ro ethertype? ipi-acl-types:acl_ether_type_t
| | | | +--ro arp-packet-type? ipi-acl-types:acl_arp_packet_type_
t
| | | +--ro cos-value? uint8
| | | +--ro learn-disable? boolean {feature-list:HAVE_DNX}?
| | | +--ro (destination-mac-options)?
| | | | +--:(any-mac)
| | | | | +--ro destination-mac-any? boolean
| | | | | +--:(host-mac)
| | | | | | +--ro destination-mac-host? ipi-acl-types:acl_mac_addr_t
| | | | | +--:(mac-with-mask)
| | | | | +--ro destination-mac-address? ipi-acl-types:acl_mac_addr_t

```

```

| | | | +--ro destination-mac-mask? ipi-acl-types:acl_mac_addr_t
| | | +--rw copp {feature-list:HAVE_COPP_FILTER}?
| | | | +--rw ipv4
| | | | | +--ro state
| | | | | +--ro forwarding-action? ipi-acl-types:acl_forwarding_
| | | | | +--ro log-action? uint32 {feature-list:HAVE_
| | | | | +--ro ttl? uint8
| | | | | +--ro ip-options? boolean
| | | | | +--ro fragments? boolean
| | | | | +--ro (protocol)?
| | | | | | +--:(tcp)
| | | | | | | +--ro protocol-tcp? boolean
| | | | | | | +--ro tcp-source-port? ipi-acl-types:acl_tcp_src_
| | | | | | | +--ro tcp-destination-port? ipi-acl-types:acl_tcp_dest_
| | | | | | | +--ro tcp-flags? ipi-acl-types:acl_tcp_flags_t
| | | | | | | +--:(udp)
| | | | | | | +--ro protocol-udp? boolean
| | | | | | | +--ro udp-source-port? ipi-acl-types:acl_udp_src_
| | | | | | | +--ro udp-destination-port? ipi-acl-types:acl_udp_dest_
| | | | | | | +--:(icmp)
| | | | | | | +--ro protocol-icmp? boolean
| | | | | | | +--ro icmp-type? uint8
| | | | | | | +--:(other-protocols)
| | | | | | | +--ro protocol-name? ipi-acl-types:acl_ip_
| | | | protocols_t
| | | | | +--ro (source-ipv4-type)?
| | | | | | +--:(source-ipv4-address-type)
| | | | | | | +--ro source-address? ipi-acl-types:acl_any_ipv4_
| | | | | | | +--:(source-ipv4-prefix-group-type)
| | | | | | | | +--ro source-prefix-group? string
| | | | | | | +--ro (destination-ipv4-type)?
| | | | | | | | +--:(destination-ipv4-address-type)
| | | | | | | | | +--ro destination-address? ipi-acl-types:acl_any_ipv4_
| | | | | | | | | +--:(destination-ipv4-prefix-group-type)
| | | | | | | | | | +--ro destination-prefix-group? string
| | | | | | | | | +--ro source-port-operator? ipi-acl-types:acl_copp_src_
| | | | | | | | | +--ro destination-port-operator? ipi-acl-types:acl_copp_dest_
| | | | | | | +--ro lower-source-port-in-range? uint16
| | | | | | | +--ro upper-source-port-in-range? uint16
| | | | | | | +--ro lower-destination-port-in-range? uint16
| | | | | | | +--ro upper-destination-port-in-range? uint16
| | | | +--rw ipv6 {feature-list:HAVE_IPV6}?
| | | | | +--ro state
| | | | | +--ro forwarding-action? ipi-acl-types:acl_forwarding_
| | | | | +--ro log-action? uint32 {feature-list:HAVE_
| | | | | +--ro hop-limit? uint8
| | | | | +--ro (protocol)?
| | | | | | +--:(tcp)
| | | | | | | +--ro protocol-tcp? boolean
| | | | | | | +--ro tcp-source-port? ipi-acl-types:acl_tcp_src_
| | | | | | | +--ro tcp-destination-port? ipi-acl-types:acl_tcp_dest_
| | | | | | | +--:(udp)
| | | | | | | +--ro protocol-udp? boolean
| | | | | | | +--ro udp-source-port? ipi-acl-types:acl_udp_src_
| | | port_t

```

```

| | | | +--ro udp-destination-port? ipi-acl-types:acl_udp_dest_
port_t | | | | +--:(icmp)
| | | | | +--ro protocol-icmpv6? boolean
| | | | | +--:(other-protocols)
| | | | | +--ro protocol-name? ipi-acl-types:acl_copp_ipv6_
protocols_t | | | | +--ro (source-ipv6-type)?
| | | | | +--:(source-ipv6-address-type)
| | | | | | +--ro source-address? ipi-acl-types:acl_copp_any_
ipv6_src_addr_t | | | | | +--:(source-ipv6-prefix-group-type)
| | | | | | +--ro source-prefix-group? string
| | | | | +--ro (destination-ipv6-type)?
| | | | | | +--:(destination-ipv6-address-type)
| | | | | | +--ro destination-address? ipi-acl-types:acl_copp_any_
ipv6_dest_addr_t | | | | | +--:(destination-ipv6-prefix-group-type)
| | | | | | +--ro destination-prefix-group? string
| | | | | +--ro source-port-operator? ipi-acl-types:acl_copp_src_
port_operations_t | | | | | +--ro destination-port-operator? ipi-acl-types:acl_copp_dest_
port_operations_t | | | | +--ro lower-source-port-in-range? uint16
| | | | +--ro upper-source-port-in-range? uint16
| | | | +--ro lower-destination-port-in-range? uint16
| | | | +--ro upper-destination-port-in-range? uint16
| | +--ro summary-info {feature-list:HAVE_ACL}?
| | +--ro state
| | | +--ro counters
| | | | +--ro total-acl-entries? yang:counter32
| | | | +--ro statistics-enabled? empty
| | +--ro interfaces
| | +--ro interface* [interface-name]
| | | +--ro interface-name -> ../state/interface-name
| | | +--ro state
| | | | +--ro interface-name? string
| | | | +--ro filter-direction? ipi-acl-types:acl_filter_direction_t
| | | | +--ro interface-type? ipi-acl-types:acl_interface_type_t
| | | | +--ro interface-status? ipi-acl-types:acl_interface_status_t
+--ro global {feature-list:HAVE_ACL}?
+--ro state
+--ro counters
+--ro total-global-acl-entries? yang:counter32

```

## Sensor Paths: ipi-acl

### ACL ARP State

```

Sensor Path
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/arp/state/

Leaf Attributes
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/arp/state/counters/matched-packets
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/arp/state/arp-
packet-type
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/arp/state/destination-mac-any
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/arp/state/destination-mac-host
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/arp/state/destination-mac-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/arp/state/destination-mac-mask

```

```

    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/arp/state/forwarding-action
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/arp/state/inner-vlan-id
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/arp/state/source-ip-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/arp/state/source-mac-any
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/arp/state/source-mac-host
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/arp/state/source-mac-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/arp/state/source-mac-mask
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/arp/state/vlan-
id

```

## ACL CoPP IPv4 State

```

Sensor Path
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/copp/ipv4/state

Leaf Attributes
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/destination-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/destination-prefix-group
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/destination-port-operator
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/forwarding-action
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/fragments
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/ip-options
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/log-action
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/lower-destination-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/lower-source-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/protocol-tcp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/tcp-destination-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/tcp-flags
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/tcp-source-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/protocol-udp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/udp-destination-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/udp-source-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/icmp-type
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/protocol-icmp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/protocol-name
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/source-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/source-prefix-group
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/source-port-operator
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-

```

```

id]/copp/ipv4/state/ttl
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/upper-destination-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv4/state/upper-source-port-in-range

```

## ACL CoPP IPv6 State

```

Sensor Path
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/

Leaf Attributes
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/destination-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/destination-prefix-group
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/destination-port-operator
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/forwarding-action
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/fragments
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/hop-limit
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/log-action
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/lower-destination-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/lower-source-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/protocol-tcp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/tcp-destination-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/tcp-source-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/protocol-udp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/udp-destination-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/udp-source-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/protocol-icmpv6
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/protocol-name
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/source-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/source-prefix-group
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/source-port-operator
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/upper-destination-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/copp/ipv6/state/upper-source-port-in-range

```

## ACL IPv4 State Counters

```

Sensor Path
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/counters

Leaf Attributes
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-

```

```

id]/ipv4/state/counters/matched-packets
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/destination-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/destination-port-operator
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/ipv4/state/dscp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/forwarding-action
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/inner-vlan-id
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/lower-destination-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/lower-source-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/precedence
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/protocol-tcp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/ipv4/state/tcp-
destination-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/ipv4/state/tcp-
flags
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/ipv4/state/tcp-
source-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/protocol-udp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/ipv4/state/udp-
destination-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/ipv4/state/udp-
source-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/icmp-code
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/icmp-message
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/icmp-type
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/protocol-icmp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/protocol-name
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/source-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/source-port-operator
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/upper-destination-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/upper-source-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv4/state/vlan-id

```

## ACL IPv6 State Counters

```

Sensor Path
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/ipv6/state

Leaf Attributes
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/counters/matched-packets
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/destination-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/destination-port-operator
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/ipv6/state/dscp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/forwarding-action
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/lower-destination-port-in-range

```

```

    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/lower-source-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/protocol-tcp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/ipv6/state/tcp-
destination-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/ipv6/state/tcp-
source-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/protocol-udp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/ipv6/state/udp-
destination-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/ipv6/state/udp-
source-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/protocol-icmp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/protocol-sctp
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/sctp-destination-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/sctp-source-port
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/protocol-name
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/source-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/source-port-operator
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/upper-destination-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/upper-source-port-in-range
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/ipv6/state/vlan-id

```

## ACL MAC State

```

Sensor Path
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/mac/state/

Leaf Attributes
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/mac/state/counters/matched-packets
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/mac/state/arp-
packet-type
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/mac/state/cos-
value
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/mac/state/destination-mac-any
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/mac/state/destination-mac-host
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/mac/state/destination-mac-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/mac/state/destination-mac-mask
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/mac/state/ethertype
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/mac/state/forwarding-action
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/mac/state/inner-vlan-id
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/mac/state/learn-disable
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/mac/state/source-mac-any
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/mac/state/source-mac-host
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-

```

```
id]/mac/state/source-mac-address
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-
id]/mac/state/source-mac-mask
    ipi:/acl/acl-sets/acl-set[name][type]/acl-entries/acl-entry[sequence-id]/mac/state/vlan-
id
```

## ACL Summary Information

```
Sensor Path
    ipi:/acl/acl-sets/acl-set[name][type]/summary-info

Leaf Attributes
    ipi:/acl/acl-sets/acl-set[name][type]/summary-info/state/counters/total-acl-entries
    ipi:/acl/acl-sets/acl-set[name][type]/summary-info/interfaces/interface[interface-
name]/state/interface-name
    ipi:/acl/acl-sets/acl-set[name][type]/summary-info/interfaces/interface[interface-
name]/state/filter-direction
    ipi:/acl/acl-sets/acl-set[name][type]/summary-info/interfaces/interface[interface-
name]/state/interface-type
    ipi:/acl/acl-sets/acl-set[name][type]/summary-info/interfaces/interface[interface-
name]/state/interface-status
```

## ACL Global State Counters

```
Sensor Path
    ipi:/acl/global/state/counters

Leaf Attributes
    ipi:/acl/global/state/counters/total-global-acl-entries
```

# On-change Supported Sensor Paths

## IPI-VRRP

### Sensor Paths: ipi-vrrp

#### VRRP State

```
Sensor Path
    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
    [interface-name]/
Leaf Attributes
    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
    [interface-name]/session-info/state/administrative-state
    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
    [interface-name]/session-status/state/vrrp-state
    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
    [interface-name]/addresses/state/operational-master-address
    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
    [interface-name]/addresses/state/operational-primary-address
    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
    [interface-name]/state/disable-preempt-mode
    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
    [interface-name]/session-info/state/running-priority
    ipi:/vrrp/ipv4-instances/ipv4-instance[virtual-router-id]/interfaces/interface
    [interface-name]/session-info/state/virtual-mac-mbyte-word
```

## IPI-IS-IS

### Sensor Paths: ipi-isis

#### IS-IS Neighbors

```
Sensor Path
    ipi:/isis/interfaces/interface[name]/
Leaf Attributes
    ipi:/isis/interfaces/interface[name]/neighbor-lan[system-id]/state/neighbor-snpa
    ipi:/isis/interfaces/interface[name]/neighbor-lan[system-id]/state/system-id
    ipi:/isis/interfaces/interface[name]/neighbor-lan[system-id]/adjacency
    [level]/state/adjacency-state - For broadcast interface neighbors
    ipi:/isis/interfaces/interface[name]/neighbor-P2P/state/adjacency-state
    ipi:/isis/interfaces/interface[name]/neighbor-P2P/state/system-id
    ipi:/isis/interfaces/interface[name]/neighbor-P2P/state/neighbor-snpa
    ipi:/isis/interfaces/interface[name]/neighbor-P2P/state/adjacency-state - For P2P
    interface neighbor
```

## IPI-BGP

### Sensor Paths: ipi-bgp

#### BGP Peers

```
Sensor Path
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/state/
Leaf Attributes
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/state/peer-
shutdown
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/state/bgp-
peer-state
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/state/local-ip
    ipi:/bgp/bgp-instances/bgp-instance[bgp-as]/peers/peer[peer-address]/state/local-as
```

## IPI-Interface

### Sensor Paths: ipi-interface

#### Interfaces State

```
Sensor Path
    ipi:/interfaces/interface[name]/state/
Leaf Attributes
    ipi:/interfaces/interface[name]/state/description
    ipi:/interfaces/interface[name]/state/admin-status
    ipi:/interfaces/interface[name]/state/oper-status
    ipi:/interfaces/interface[name]/state/last-change
    ipi:/interfaces/interface[name]/state/mtu
```

## IPI-Platform

### Sensor Paths: ipi-platform

#### Transceiver State

```
Sensor Path
    ipi:/components/component[name]/transceiver/state/
Leaf Attributes
    ipi:/components/component[name]/transceiver/state/presense
    ipi:/components/component[name]/transceiver/state/vendor-name
    ipi:/components/component[name]/transceiver/state/type
    ipi:/components/component[name]/transceiver/state/vendor-serial-number
    ipi:/components/component[name]/transceiver/state/vendor-part-number
    ipi:/components/component[name]/transceiver/state/vendor-revision-number
    ipi:/components/component[name]/transceiver/state/vendor-manufacturing-date
```

#### Platform State

```
Sensor Path
    ipi:/components/component[name]/state/
```

## Leaf Attributes

```

    ipi:/components/component[name]/state/name
    ipi:/components/component[name]/state/location
    ipi:/components/component[name]/state/mfg-name
    ipi:/components/component[name]/state/mfg-date
    ipi:/components/component[name]/state/description
    ipi:/components/component[name]/state/software-version
    ipi:/components/component[name]/state/serial-no
    ipi:/components/component[name]/state/part-no
    ipi:/components/component[name]/state/oper-status
    ipi:/components/component[name]/state/product-name
    ipi:/components/component[name]/state/parent

```

**CPU State**

## Sensor Path

```

    ipi:/components/component[name="CPU"]/state/

```

## Leaf Attributes

```

    ipi:/components/component[name="CPU"]/state/name
    ipi:/components/component[name="CPU"]/state/location
    ipi:/components/component[name="CPU"]/state/mfg-name
    ipi:/components/component[name="CPU"]/state/mfg-date
    ipi:/components/component[name="CPU"]/state/description
    ipi:/components/component[name="CPU"]/state/software-version
    ipi:/components/component[name="CPU"]/state/serial-no
    ipi:/components/component[name="CPU"]/state/part-no
    ipi:/components/component[name="CPU"]/state/oper-status
    ipi:/components/component[name="CPU"]/state/product-name
    ipi:/components/component[name="CPU"]/state/parent

```

**PSU-1 State**

## Sensor Path

```

    ipi:/components/component[name="PSU-1"]/state/

```

## Leaf Attributes

```

    ipi:/components/component[name="PSU-1"]/state/name
    ipi:/components/component[name="PSU-1"]/state/location
    ipi:/components/component[name="PSU-1"]/state/mfg-name
    ipi:/components/component[name="PSU-1"]/state/mfg-date
    ipi:/components/component[name="PSU-1"]/state/description
    ipi:/components/component[name="PSU-1"]/state/software-version
    ipi:/components/component[name="PSU-1"]/state/serial-no
    ipi:/components/component[name="PSU-1"]/state/part-no
    ipi:/components/component[name="PSU-1"]/state/oper-status
    ipi:/components/component[name="PSU-1"]/state/product-name
    ipi:/components/component[name="PSU-1"]/state/parent

```

**RAM State**

## Sensor Path

```

    ipi:/components/component[name="RAM"]/state/

```

## Leaf Attributes

```

    ipi:/components/component[name="RAM"]/state/name
    ipi:/components/component[name="RAM"]/state/location
    ipi:/components/component[name="RAM"]/state/mfg-name
    ipi:/components/component[name="RAM"]/state/mfg-date
    ipi:/components/component[name="RAM"]/state/description
    ipi:/components/component[name="RAM"]/state/software-version
    ipi:/components/component[name="RAM"]/state/serial-no
    ipi:/components/component[name="RAM"]/state/part-no
    ipi:/components/component[name="RAM"]/state/oper-status
    ipi:/components/component[name="RAM"]/state/product-name
    ipi:/components/component[name="RAM"]/state/parent

```

## Hard-Disk State

```
Sensor Path
  ipi:/components/component[name="HARD-DISK"]/state/
Leaf Attributes
  ipi:/components/component[name="HARD-DISK"]/state/name
  ipi:/components/component[name="HARD-DISK"]/state/location
  ipi:/components/component[name="HARD-DISK"]/state/mfg-name
  ipi:/components/component[name="HARD-DISK"]/state/mfg-date
  ipi:/components/component[name="HARD-DISK"]/state/description
  ipi:/components/component[name="HARD-DISK"]/state/software-version
  ipi:/components/component[name="HARD-DISK"]/state/serial-no
  ipi:/components/component[name="HARD-DISK"]/state/part-no
  ipi:/components/component[name="HARD-DISK"]/state/oper-status
  ipi:/components/component[name="HARD-DISK"]/state/product-name
  ipi:/components/component[name="HARD-DISK"]/state/parent
```

## Fan-1 State

```
Sensor Path
  ipi:/components/component[name="FAN-1"]/state/
Leaf Attributes
  ipi:/components/component[name="FAN-1"]/state/name
  ipi:/components/component[name="FAN-1"]/state/location
  ipi:/components/component[name="FAN-1"]/state/mfg-name
  ipi:/components/component[name="FAN-1"]/state/mfg-date
  ipi:/components/component[name="FAN-1"]/state/description
  ipi:/components/component[name="FAN-1"]/state/software-version
  ipi:/components/component[name="FAN-1"]/state/serial-no
  ipi:/components/component[name="FAN-1"]/state/part-no
  ipi:/components/component[name="FAN-1"]/state/oper-status
  ipi:/components/component[name="FAN-1"]/state/product-name
  ipi:/components/component[name="FAN-1"]/state/parent
```

## FRU State

```
Sensor Path
  ipi:/components/component[name="MAINBOARD_FRU"]/state/
Leaf Attributes
  ipi:/components/component[name="MAINBOARD_FRU"]/state/name
  ipi:/components/component[name="MAINBOARD_FRU"]/state/location
  ipi:/components/component[name="MAINBOARD_FRU"]/state/mfg-name
  ipi:/components/component[name="MAINBOARD_FRU"]/state/mfg-date
  ipi:/components/component[name="MAINBOARD_FRU"]/state/description
  ipi:/components/component[name="MAINBOARD_FRU"]/state/software-version
  ipi:/components/component[name="MAINBOARD_FRU"]/state/serial-no
  ipi:/components/component[name="MAINBOARD_FRU"]/state/part-no
  ipi:/components/component[name="MAINBOARD_FRU"]/state/oper-status
  ipi:/components/component[name="MAINBOARD_FRU"]/state/product-name
  ipi:/components/component[name="MAINBOARD_FRU"]/state/parent
```

## TEMP State

```
Sensor Path
  ipi:/components/component[name=<TEMP>]/state/
Leaf Attributes
  ipi:/components/component[name=<TEMP>]/state/name
  ipi:/components/component[name=<TEMP>]/state/location
  ipi:/components/component[name=<TEMP>]/state/mfg-name
  ipi:/components/component[name=<TEMP>]/state/mfg-date
  ipi:/components/component[name=<TEMP>]/state/description
  ipi:/components/component[name=<TEMP>]/state/software-version
  ipi:/components/component[name=<TEMP>]/state/serial-no
```

```
ipi:/components/component[name=<TEMP>]/state/part-no
ipi:/components/component[name=<TEMP>]/state/oper-status
ipi:/components/component[name=<TEMP>]/state/product-name
ipi:/components/component[name=<TEMP>]/state/parent
```

### Platform State: PSU

```
Sensor Path
    ipi:/components/component[name]/power-supply/state/
Leaf Attributes
    ipi:/components/component[name]/power-supply/state/operational-status
```

### Platform State: Temperature

```
Sensor Path
    ipi:/components/component[name]/state/temperature/
Leaf Attributes
    ipi:/components/component[name]/state/temperature/alarm-threshold
```

### Platform State: Memory

```
Sensor Path
    ipi:/components/component[name]/ram/state/
Leaf Attributes
    ipi:/components/component[name]/ram/state/total-memory
```

### Platform State: Fan

```
Sensor Path
    ipi:/components/component[name]/fan/state/
Leaf Attributes
    ipi:/components/component[name]/fan/state/fan-status
```

# STREAMING TELEMETRY OPENCONFIG DATA MODELS

## Overview

Streaming telemetry incrementally supports all listed OpenConfig data models, providing standardized representations of network configurations and telemetry data.

## Telemetry OpenConfig Pyang Tree

The Pyang tree output illustrates the supported containers or leaf, along with a list of supported container-level paths.

## Container Level Sensor Paths and Leaf Attributes

Lists the container level sensor paths and leaf attributes supported for OpenConfig data models.



**Note:** For details on wildcard support, refer to the [Wildcard Support in Sensor Paths \(page 33\)](#) and [XPath Formatting Rules for Streaming Telemetry \(page 39\)](#) sections.

# OpenConfig-Platform

## Pyang Tree: openconfig-platform

```

+--rw components
  +--rw component* [name]
    +--rw name                                -> ../config/name
    +--rw config
      | +--rw name?    string
    +--ro state
      | +--ro name?          string
      | +--ro id?           string
      | x--ro location?     string
      | +--ro description?  string
      | +--ro mfg-name?     string
      | +--ro mfg-date?     oc-yang:date
      | +--ro hardware-version? string
      | +--ro firmware-version? string
      | +--ro software-version? string
      | +--ro serial-no?    string
      | +--ro part-no?      string
      | +--ro removable?    boolean
      | +--ro oper-status?  identityref
      | +--ro empty?        boolean
      | +--ro parent?       -> ../../../component/config/name
      | +--ro temperature
      | | +--ro instant?    decimal64
      | | +--ro avg?        decimal64
      | | +--ro min?        decimal64
      | | +--ro max?        decimal64
      | | +--ro interval?   oc-types:stat-interval
      | | +--ro alarm-status? boolean
      | | +--ro alarm-threshold? decimal64
      | | +--ro alarm-severity? identityref
      | +--ro memory
      | | +--ro available?  uint64
      | | +--ro utilized?   uint64
      | +--ro allocated-power? decimal64
    +--rw power-supply
      | +--ro state
      | | +--ro oc-platform-psu:enabled?    boolean
      | | +--ro oc-platform-psu:capacity?    decimal64
      | | +--ro oc-platform-psu:input-current? decimal64
      | | +--ro oc-platform-psu:input-voltage? decimal64
      | | +--ro oc-platform-psu:output-current? decimal64
      | | +--ro oc-platform-psu:output-voltage? decimal64
      | | +--ro oc-platform-psu:output-power? decimal64
    +--rw fan
      | +--ro state
      | | +--ro oc-fan:speed?  uint32
    +--rw cpu
      | +--rw oc-cpu:utilization
      | | +--ro oc-cpu:state
      | | | +--ro oc-cpu:instant?    decimal64
      | | | +--ro oc-cpu:avg?        decimal64
      | | | +--ro oc-cpu:interval?   oc-types:stat-interval
    +--rw oc-transceiver:transceiver
      | +--ro oc-transceiver:state
      | | +--ro oc-transceiver:module-functional-type? identityref
      | | +--ro oc-transceiver:form-factor?            identityref
      | | +--ro oc-transceiver:connector-type?         identityref
      | | +--ro oc-transceiver:vendor?                 string
      | | +--ro oc-transceiver:vendor-part?            string
      | | +--ro oc-transceiver:vendor-rev?            string

```

```

|      +--ro oc-transceiver:serial-no?          string
|      +--ro oc-transceiver:date-code?          string
|      +--ro oc-transceiver:supply-voltage
|      | +--ro oc-transceiver:instant?  decimal64
|      +--ro oc-transceiver:output-power
|      | +--ro oc-transceiver:instant?  decimal64
|      +--ro oc-transceiver:input-power
|      | +--ro oc-transceiver:instant?  decimal64
|      +--ro oc-transceiver:laser-bias-current
|      | +--ro oc-transceiver:instant?  decimal64
+--rw oc-opt-term:optical-channel
  +--ro oc-opt-term:state
    +--ro oc-opt-term:output-power
    | +--ro oc-opt-term:instant?  decimal64
    +--ro oc-opt-term:input-power
    | +--ro oc-opt-term:instant?  decimal64
    +--ro oc-opt-term:laser-bias-current
    | +--ro oc-opt-term:instant?  decimal64

```

## Sensor Paths: openconfig-platform

The listed paths below represent telemetry OpenConfig paths for monitoring the platform state of various components, including CPU, RAM, power supply, fans, CMIS, and transceivers.

### CPU

```

Sensor Path
    /components/component[name]/cpu/utilization/state

Leaf Attributes
    /components/component[name]/cpu/utilization/state/avg
    /components/component[name]/cpu/utilization/state/instant
    /components/component[name]/cpu/utilization/state/interval

```

### RAM

```

Sensor Path
    /components/component[name]/state/memory/

Leaf Attributes
    /components/component[name]/state/memory/available
    /components/component[name]/state/memory/used

```

### Power-Supply

```

Sensor Path
    /components/component[name]/power-supply/state/

Leaf Attributes
    /components/component[name]/power-supply/state/capacity
    /components/component[name]/power-supply/state/output-power
    /components/component[name]/power-supply/state/input-voltage
    /components/component[name]/power-supply/state/input-current
    /components/component[name]/power-supply/state/output-voltage
    /components/component[name]/power-supply/state/output-current
    /components/component[name]/power-supply/state/enabled

```

## Fan

```
Sensor Path
    /components/component[name]/fan/state

Leaf Attributes
    /components/component[name]/fan/state/speed
```

## Platform State

```
Sensor Path
    /components/component[name]/state

Leaf Attributes
    /components/component[name]/state/id
    /components/component[name]/state/type
    /components/component[name]/state/location
    /components/component[name]/state/mfg-date
    /components/component[name]/state/description
    /components/component[name]/state/hardware-version
    /components/component[name]/state/firmware-version
    /components/component[name]/state/software-version
    /components/component[name]/state/serial-no
    /components/component[name]/state/part-no
    /components/component[name]/state/removable
    /components/component[name]/state/oper-status
    /components/component[name]/state/parent
    /components/component[name]/state/empty
```

## Platform State: Memory

```
Sensor Path
    /components/component[name]/state/memory

Leaf Attributes
    /components/component[name]/state/memory/available
    /components/component[name]/state/memory/utilized
```

## Platform State: Temperature

```
Sensor Path
    /components/component[name]/state/temperature

Leaf Attributes
    /components/component[name]/state/temperature/instant
    /components/component[name]/state/temperature/min
    /components/component[name]/state/temperature/max
    /components/component[name]/state/temperature/avg
    /components/component[name]/state/temperature/interval
    /components/component[name]/state/temperature/alarm-status
    /components/component[name]/state/temperature/alarm-threshold
    /components/component[name]/state/temperature/alarm-severity
```

## CMIS State

```
Sensor Paths: ipi-platform-cmisTransceiver EEPROM StateSensor Path
```

```
openconfig:/components/component[name=CMIS-MODULE-NAME]/state
```

#### Leaf Attributes

```
/components/component[name]/state/name
/components/component[name]/state/type
/components/component[name]/state/id
/components/component[name]/state/description
/components/component[name]/state/mfg-name
/components/component[name]/state/mfg-date
/components/component[name]/state/hardware-version
/components/component[name]/state/firmware-version
/components/component[name]/state/software-version
/components/component[name]/state/serial-no
/components/component[name]/state/part-no
/components/component[name]/state/model-name
/components/component[name]/state/clei-code
/components/component[name]/state/removable
/components/component[name]/state/oper-status
/components/component[name]/state/empty
/components/component[name]/state/parent
/components/component[name]/state/last-poweroff-time
```

## CMIS Temperature

```
Sensor Paths: ipi-platform-cmisTransceiver EEPROM StateSensor Path
openconfig:/components/component[name=CMIS-MODULE-NAME]/state/temperature
```

#### Leaf Attributes

```
/components/component[name]/state/temperature/instant
```

## CMIS Transceiver State

```
Sensor Paths: ipi-platform-cmisTransceiver EEPROM StateSensor Path
openconfig:/components/component[name=CMIS-MODULE-NAME]/transceiver/state
```

#### Leaf Attributes

```
/components/component[name]/transceiver/state/form-factor
/components/component[name]/transceiver/state/connector-type
/components/component[name]/transceiver/state/vendor
/components/component[name]/transceiver/state/vendor-part
/components/component[name]/transceiver/state/vendor-rev
/components/component[name]/transceiver/state/serial-no
/components/component[name]/transceiver/state/date-code
/components/component[name]/transceiver/state/module-functional-type
/components/component[name]/transceiver/state/supply-voltage/instant
```

## CMIS Optical Channel State

```
Sensor Paths: ipi-platform-cmisTransceiver EEPROM StateSensor Path
openconfig:/components/component[name='OCH-0/<CMIS-PORT>']/optical-channel/state
```

#### Leaf Attributes

```
/components/component[name]/optical-channel/state/input-power/instant
/components/component[name]/optical-channel/state/output-power/instant
/components/component[name]/optical-channel/state/laser-bias-current/instant
```

# OpenConfig-Interface

## Pyang Tree: openconfig-interfaces

```

+--rw interfaces
  +--rw interface* [name]
    +--rw name      -> ../config/name
    +--rw config
      | +--rw name?   string
    +--ro state
      +--ro name?      string
      +--ro ifindex?   uint32
      +--ro admin-status enumeration
      +--ro oper-status enumeration
      +--ro last-change? oc-types:timeticks64
      +--ro logical?    boolean
      +--ro counters
        +--ro in-octets?      oc-yang:counter64
        +--ro in-pkts?        oc-yang:counter64
        +--ro in-unicast-pkts? oc-yang:counter64
        +--ro in-broadcast-pkts? oc-yang:counter64
        +--ro in-multicast-pkts? oc-yang:counter64
        +--ro in-errors?      oc-yang:counter64
        +--ro in-discards?    oc-yang:counter64
        +--ro out-octets?     oc-yang:counter64
        +--ro out-pkts?       oc-yang:counter64
        +--ro out-unicast-pkts? oc-yang:counter64
        +--ro out-broadcast-pkts? oc-yang:counter64
        +--ro out-multicast-pkts? oc-yang:counter64
        +--ro out-discards?   oc-yang:counter64
        +--ro out-errors?     oc-yang:counter64
        +--ro last-clear?     oc-types:timeticks64

```

## Sensor Paths: openconfig-interface

The listed paths below represent telemetry OpenConfig paths for monitoring the interface and counters state.

### Interface State

```

Sensor Path
  /interfaces/interface[name]/state

Leaf Attributes
  /interfaces/interface[name]/state/name
  /interfaces/interface[name]/state/ifindex
  /interfaces/interface[name]/state/admin-status
  /interfaces/interface[name]/state/oper-status
  /interfaces/interface[name]/state/last-change
  /interfaces/interface[name]/state/logical

```

### Counters State

```

Sensor Path
  /interfaces/interface[name]/state/counters

Leaf Attributes
  /interfaces/interface[name]/state/counters/in-octets
  /interfaces/interface[name]/state/counters/in-pkts

```

```
/interfaces/interface[name]/state/counters/in-unicast-pkts
/interfaces/interface[name]/state/counters/in-broadcast-pkts
/interfaces/interface[name]/state/counters/in-multicast-pkts
/interfaces/interface[name]/state/counters/in-discards
/interfaces/interface[name]/state/counters/in-errors
/interfaces/interface[name]/state/counters/in-fcs-errors
/interfaces/interface[name]/state/counters/out-octets
/interfaces/interface[name]/state/counters/out-pkts
/interfaces/interface[name]/state/counters/out-unicast-pkts
/interfaces/interface[name]/state/counters/out-broadcast-pkts
/interfaces/interface[name]/state/counters/out-multicast-pkts
/interfaces/interface[name]/state/counters/out-discards
/interfaces/interface[name]/state/counters/out-errors
/interfaces/interface[name]/state/counters/last-clear
```