Model-Driven Telemetry

This document provides information on the support for Model-Driven Telemetry and how to configure Cisco cBR series routers to avail the support.

Your software release may not support all the features that are documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. The Feature Information Table at the end of this document provides information about the documented features and lists the releases in which each feature is supported.

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Hardware Compatibility Matrix for the Cisco cBR Series Routers

Note The hardware components that are introduced in a given Cisco IOS-XE Release are supported in all subsequent releases unless otherwise specified.

Table 1: Hardware Compatibility Matrix for the Cisco cBR Series Routers

Cisco CMTS Platform	Processor Engine	Interface Cards
Cisco cBR-8 Converged Broadband Router	**Cisco IOS-XE Release 16.5.1 and Later Releases** Cisco cBR-8 Supervisor: • PID—CBR-SUP-250G • PID—CBR-CCAP-SUP-160G	**Cisco IOS-XE Release 16.5.1 and Later Releases** Cisco cBR-8 CCAP Line Cards: • PID—CBR-LC-8D30-16U30 • PID—CBR-LC-8D31-16U30 • PID—CBR-RF-PIC • PID—CBR-RF-PROT-PIC • PID—CBR-CCAP-LC-40G • PID—CBR-CCAP-LC-40G-R • PID—CBR-CCAP-LC-G2-R • PID—CBR-SUP-8X10G-PIC • PID—CBR-2X100G-PIC Digital PICs: • PID—CBR-DPIC-8X10G • PID—CBR-DPIC-2X100G Cisco cBR-8 Downstream PHY Module: • PID—CBR-D31-DS-MOD Cisco cBR-8 Upstream PHY Modules: • PID—CBR-D31-US-MOD

Note Do not use DPICs (8X10G and 2x100G) to forward IP traffic, as it may cause buffer exhaustion, leading to line card reload.

The only allowed traffic on a DPIC interface is DEPI, UEPI, and GCP traffic from the Cisco cBR-8 router to Remote PHY devices. Other traffic such as DHCP, SSH, and UTSC should flow via another router, since DPICs cannot be used for normal routing.

Information About Model-Driven Telemetry

Model-driven telemetry allows Cisco cBR-8 Converged Broadband Router to continuously stream real time configuration and operating state information to collectors. This module describes model-driven telemetry and provides sample telemetry RPCs.

Model-driven telemetry uses YANG models to express available data. Contents of supported YANG files can be retrieved from cBR8 directly. Collectors can subscribe to specific data items they need, by using these standard-based YANG data models. Telemetry can continuously stream data to the collector with periodical or on-change mode.

YANG-filed MIBs models, following DOCSIS MIBs are converted to YANG models, and they are automatically converted from legacy MIB file to YANG file. All the data for a converted MIB is received from the legacy SNMP agent and then sent to Telemetry receiver by gRPC/NETCONF.

Cisco IOS XE Gibraltar 16.12.1 on Cisco cBR Series Converged Broadband Router includes a native **Cisco-IOS-XE-docsis-oper** YANG file along with the YANG-filed MIB models. In the **Cisco-IOS-XE-docsis-oper** YANG file the output of some show commands will be modeled.

Note Ensure that you have enabled the **cable bgsync active** CLI for **Cisco-IOS-XE-docsis-oper**. The **Cisco-IOS-XE-docsis-oper** is required to get the correct data for cable modems.

- CISCO-CABLE-SPECTRUM-MIB
- CISCO-CABLE-WIDEBAND-MIB
- CISCO-DOCS-EXT-MIB
- DOCS-IF-MIB
- DOCS-IF3-MIB
- DOCS-QOS-MIB
- DOCS-SUBMGT3-MIB
- CISCO-ENVMON-MIB
- CISCO-PROCESS-MIB
- OLD-CISCO-INTERFACES-MIB
- SNMPv2-MIB
- ENTITY-MIB
- IF-MIB

Restrictions for Model Driven Telemetry

Following are the restrictions on using the Model-Driven Telemetry:

- All DOCSIS-specific models are supported for periodical push. On-change push is not supported.
- For the same MIB model, a NETCONF subscription's performance is lower than the legacy SNMP walk.

Prerequisites to Enable Telemetry

Run the following command to ensure that the prerequisites are in place to configure Telemetry:

```
conf t
ip ssh version 2
netconf-yang
netconf-yang cisco-ia snmp-community-string testing-mib-yang
snmp-server community testing-mib-yang RO
end
```

Ensure that you go through the following recommendations before configuring telemetry:

- Use the **show platform software yang-management process** command to verify that all related processes are running.
- The default listening tcp port number for NECCONF is 830. You can change the default port by using the **netconf-yang ssh port** CLI.
- An snmp-community-string is needed for gRPC/NETCONF to retrieve YANG filed MIB. The default snmp-community-string is 'private'.

Configuring Telemetry

The following Telemetry protocols are supported on Cisco cBR-8 Converged Broadband Router:

- **gRPC**: gRPC only supports Dial-Out (Configured/Static). Initial connection starts from cBR8 triggered by CLI configuration.
- **NETCONF**: NETCONF only supports Dial-In (Dynamic). Initial connection starts from telemetry collectors.

Configuring Telemetry using gRPC

The gRPC only supports the dial-out method. You need CLI configurations on cBR-8 to create a gRPC subscription.

To create a dial-out subscription, go through the following sample. Note that the patameteres in bold cannot be changed.

```
Conf t
telemetry ietf subscription 100
 encoding encode-kvgpb
 filter xpath /IF-MIB:IF-MIB/ifTable/ifEntry[ifIndex=263975]
 source-address 172.22.9.102
 stream yang-push
 update-policy periodic 3000
```

```
 receiver ip address 10.79.41.133 57566 protocol grpc-tcp
end
```

Note Multiple target XPaths is not supported.

To delete a subscription, run the **no telemetry ietf subscription 100** command.

The following show commands are supported for gRPC:

- **show telemetry ietf subscription configured detail**
- **show telemetry ietf subscription 100 receiver**

The following examples illustrate the usage of the show commands:

```
router# show telemetry ietf subscription configured detail

Telemetry subscription detail:
  Subscription ID: 100
  State: Valid
  Stream: yang-push
  Filter:
    Filter type: xpath
    XPath: /IF-MIB:IF-MIB/ifTable/ifEntry[ifIndex=263975]
  Update policy:
    Update Trigger: periodic
    Period: 3000
  Encoding: encode-kvgpb
  Source VRF: Mgmt-intf
  Source Address: 172.22.9.102
  Notes:

  Receivers:
    Address                                     Port     Protocol         Protocol Profile

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    10.79.41.133                                57566    grpc-tcp


router# show telemetry ietf subscription 100 receiver
Telemetry subscription receivers detail:

  Subscription ID: 100
  Address: 10.79.41.133
  Port: 57566
  Protocol: grpc-tcp
  Profile:
  State: Connected
  Explanation:
```

Note

- A **Valid** state denotes that the configuration is good and accepted.
- A **Connected** state denotes that the TCP connection is established.

Configuring Telemetry using NETCONF

The NETCONF communication happens in the followong sequence:

1. Connect to device. Say **<hello>**.
2. Retrieve **<capabilities>**.
3. Investigate and choose the appropriate model.
4. Compose operation.
5. Send message **<rpc>**.
6. Retrieve **<rpc-reply>**.
7. Process **<data>**.

The following example lists how a Telemetry subscriber subscribes to an instances in an MIB:

```
<establish-subscription
          xmlns="urn:ietf:params:xml:ns:yang:ietf-event-notifications"
          xmlns:yp="urn:ietf:params:xml:ns:yang:ietf-yang-push">
        <stream>yp:yang-push</stream>

<yp:xpath-filter>/IF-MIB:IF-MIB/ifTable/ifEntry[ifIndex=&quot;263975&quot;]</yp:xpath-filter>
        <yp:period>3000</yp:period>
</establish-subscription>


<rpc-reply xmlns="urn:ietf:params:xml:ns:netconf:base:1.0" message-id="2">
<subscription-result xmlns='urn:ietf:params:xml:ns:yang:ietf-event-notifications'
xmlns:notif-bis="urn:ietf:params:xml:ns:yang:ietf-event-notifications">notif-bis:ok</subscription-result>
<subscription-id
xmlns='urn:ietf:params:xml:ns:yang:ietf-event-notifications'>2147483655</subscription-id>
</rpc-reply>
```

Note

- The **ifIndex** option lists the model defined in the YANG file.
- The **yp:period** lists the expected time interval between push updates (3000 centisecond in this example).

The following is an example of the show or delete NETCONF subscription option:

```
Router# show telemetry ietf subscription 2147483655 detail
Telemetry subscription detail:
  Subscription ID: 2147483655
  Type: Dynamic
  State: Valid
  Stream: yang-push
  Filter:
    Filter type: xpath
    XPath: /IF-MIB:IF-MIB/ifTable/ifEntry[ifIndex="263975"]
  Update policy:
    Update Trigger: periodic
    Period: 3000
  Encoding: encode-xml
  Source VRF:
```

```
  Source Address:
  Notes:
  Receivers:
    Address                                   Port     Protocol         Protocol Profile

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    10.79.41.133                              38914    netconf

Router# clear telemetry ietf subscription 2147483655
```

Feature Information for Model-Driven Telemetry

Note The following table lists the software release in which a given feature is introduced. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 2: Feature Information for Model-Driven Telemetry

Feature Name	Releases	Feature Information
Model-Driven Telemetry	Cisco IOS XE Gibraltar 16.12.1	This feature was introduced in Cisco IOS XE Gibraltar 16.12.1 on Cisco cBR Series Converged Broadband Router.