



G.8275.2 Telecom Profile

This document provides information on the support for G.8275.2 telecom profile and how to configure Cisco cBR series routers to avail the support.

Finding Feature Information

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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G.8275.2 Telecom Profile

Information About G.8275.2 Telecom Profile

Precision Time Protocol (PTP) is a protocol for distributing precise time and frequency over packet networks. PTP is defined in the IEEE Standard 1588. It defines an exchange of timed messages.

PTP allows for separate profiles to be defined in order to adapt PTP for use in different scenarios. A profile is a specific selection of PTP configuration options that are selected to meet the requirements of a particular application.

Effective Cisco IOS XE Fuji 16.8.1, Cisco cBR Converged Broadband routers support the ITU-T G.8275.2 telecom profile (PTP telecom profile for Phase/Time-of-day synchronization with partial timing support from the network).

The G.8275.2 is a PTP profile for use in telecom networks where phase or time-of-day synchronization is required. It differs from G.8275.1 in that it is not required that each device in the network participates in the PTP protocol. Also, G.8275.2 uses PTP over IPv4 and IPv6 in unicast mode.

Why G.8275.2 Telecom Profile?

The G.8275.2 profile is based on the partial timing support from the network. Hence nodes using G.8275.2 are not required to be directly connected.

The G.8275.2 profile is used in mobile cellular systems that require accurate synchronization of time and phase. For example, the fourth generation (4G) of mobile telecommunications technology.

PTP Clocks

Two types of ordinary clocks are used in this profile:

Ordinary Clocks (OCs)

- **Telecom Grandmaster (T-GM)**—A telecom grandmaster provides timing for other devices in the network, and is usually connected to a primary reference time source, such as a GNSS receiver. It does not synchronize its local clock to other network elements. Considerations for a T-GM:
 - Only one PTP port can be configured as a primary port.
 - One T-GM primary port can have multiple subordinates associated with it.
 - The T-GM OC primary port is a fixed port; that is, it always acts as a primary clock and its role does not change by negotiating with its peer.
- **Partial-Support Telecom Time Subordinate Clocks (T-TSC-P and T-TSC-A)**—A subordinate clock synchronizes its local clock to another PTP clock (GM, T-GM or T-BC), and does not provide synchronization through PTP to any other device. Considerations for a T-TSC-P:
 - An ordinary clock with single subordinate port can be configured.
 - Only one peer clock address can be configured as clock source.



Note

- Ordinary clocks (OC) always have only one PTP port.
 - In G.8275.2 (02/2016), PTP transparent clocks are not permitted.
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PTP Domain

A PTP domain is a logical grouping of clocks that communicate with each other using the PTP protocol.

A single computer network can have multiple PTP domains operating separately, for example, one set of clocks synchronized to one time scale and another set of clocks synchronized to another time scale. PTP can run over either Ethernet or IP, so a domain can correspond to a local area network or it can extend across a wide area network.

The allowed domain numbers of PTP domains within a G.8275.2 network are in the range of 44 and 63 (both inclusive). The default domain number is 44.

PTP Messages and Transport

The following PTP transport parameters are defined:

- In Cisco IOS XE Fuji 16.8.1, PTP over IPv4 in unicast mode must be used.
- One-step clock mode must be used.
- The G.8275.2 profile supports unicast message negotiation.

PTP Ports

A port can be configured to perform either fixed primary or subordinate role or can be configured to change its role dynamically. If no role is assigned to a port, it can dynamically assume a primary, passive, or subordinate role based on the BMCA.

In G.8275.2, PTP ports are not tied to any specific physical interfaces, but are tied to a loopback (virtual) interface. Traffic from a PTP port is routed through any physical interface based on the routing decision.

For a dynamic port, only one clock source can be configured.

Alternate BPCA

The BPCA (Best Primary Clock Algorithm, which is also known as Best Master Clock Algorithm (BMCA [RFC 7273]) implementation in G.8275.2 is different from that in the default PTP profile. The G.8275.2 implementation specifies an alternate best primary clock algorithm (ABPCA), which is used by each device to select a clock to synchronize to, and to decide the port states of its local ports.

The following considerations apply to the G.8275.2 implementation of the BPCA:

- PrimaryOnly—A per port attribute, PrimaryOnly defines the state of the port. If this attribute is true, the port is never placed in the subordinate state.
- Priority 1—Priority 1 is always static in this profile and is set to 128. Priority 1 is not used in BPCA.
- Priority 2—Priority 2 is a configurable value and its range is from 0 to 255.
- Local Priority—Local priority is configured locally on clock ports to set the priority on nominated clocks. The default value is 128 and valid range is from 1 to 255.

Benefits

With upcoming technologies like LTE-TDD, LTE-A CoMP, LTE MBSFN and Location-based services, eNodeBs (base station devices) are required to be accurately synchronized in phase and time. Having GNSS systems at each node is not only expensive, but also introduces vulnerabilities. The G.8275.2 profile meets the synchronization requirements of these new technologies.

Restrictions for Using the G.8275.2 Profile

- In G.8275.2, PTP can be used in both hybrid mode and non-hybrid mode. In hybrid mode, PTP is used to provide phase and time-of-day throughout the network synchronization along with PHY layer frequency support (SyncE). In non hybrid mode, PTP is used without PHY layer frequency support (SyncE).

- A G.8275.2 PTP clock can have redundant clock sources configured (through multiple PTP ports). However, at any given time, a G.8275.2 PTP clock synchronizes to only one clock source, which is selected by BMCA.
- The G.8275.2 does not provide any recommendations for performance analysis and network limits for the clocks.

How to Configure the G.8275.2 Profile

Creating an Ordinary Subordinate (T-TSC-P)

Cisco cBR-8 supports PTP ordinary clock subordinate mode with G8275.2 profile. In this mode, PTP ports are either on the Supervisor PIC cards or on the 10GE Ethernet ports on the DPIC cards.

To create an ordinary subordinate, run the following steps:

```
ptp clock Ordinary domain 44
    clock-port slave-port slave profile G.8275.2
    transport ipv4 unicast interface lo 0 negotiation
    clock source 10.1.1.1
```

Creating a Boundary Clock

To create a boundary clock, run the following steps:

```
ptp clock boundary domain 44
    clock-port port1 profile G.8275.2
    transport ipv4 unicast interface lo 0 negotiation
    clock source 10.1.1.1
    clock-port port2 profile G.8275.2
    transport ipv4 unicast interface lo 0 negotiation
    clock source 10.1.1.2
```

Configuring Dual PTP Primary Clocks

Dual PTP primary clocks must connect to the same grandmaster. Both PTP primary clocks and the grandmaster must be set to Priority 2 configuration. You must set the minimum Priority 2 value for the grandmaster to keep the highest priority. The PTP primary clocks connected to the grandmaster must have a Priority 2 value.

The following example shows a grandmaster in the Dual PTP primary clocks configuration:

```
Router# show run | se ptp
license feature ptp
ptp clock ordinary domain 44
    priority2 2
    clock-port master-to-two903 master profile g8275.2
    sync interval -5
    sync one-step
    transport ipv4 unicast interface Lo1588 negotiation
```

Configuring the G.8275.2 Profiles

To configure G.8275.2 Profiles, run the following steps:

```
Router# config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# ptp clock ordinary domain 55
Router(config-ptp-clk)#servo tracking-type R-DTI
Router(config-ptp-clk)#clock-port slave-port slave profile g8275.2
Router(config-ptp-port)# delay-req interval -4
Router(config-ptp-port)# sync interval -4
Router(config-ptp-port)# sync one-step
Router(config-ptp-port)# transport ipv6 unicast interface Lo1588 negotiation
Router(config-ptp-port)# clock source ipv6 2001:158:158:158::158
```

Configuring an IPv4 Single Clock Source

To configure IPv4 single clock source, run the following steps:

```
ptp clock ordinary domain <domain id>
servo tracking-type R-DTI
clock-port <name> slave profile g8275.2
delay-req interval < Interval>
sync interval < Interval>
sync one-step
transport ipv4 unicast interface <loopback name> negotiation
clock source <clock ip>
```

Configuring an IPv6 Single Clock Source

To configure IPv6 single clock source, run the following steps:

```
ptp clock ordinary domain <domain id>
servo tracking-type R-DTI
clock-port <name> slave profile g8275.2
delay-req interval < Interval>
sync interval < Interval>
sync one-step
transport ipv6 unicast interface <loopback name> negotiation
clock source ipv6 <clock ip>
```

Configuring IPv4 Multiple Clock Sources

To configure IPv4 multiple clock sources, run the following steps:

```
ptp clock boundary domain <domain id>
servo tracking-type R-DTI
clock-port <name> profile g8275.2
delay-req interval < Interval>
sync interval < Interval>
sync one-step
transport ipv4 unicast interface <loopback name> negotiation
clock source <clock ip>
clock-port <name> profile g8275.2
delay-req interval < Interval>
sync interval < Interval>
sync one-step
transport ipv4 unicast interface <loopback name> negotiation
clock source <clock ip>
```

Configuring IPv6 Multiple Clock Sources

To configure IPv6 multiple clock sources, run the following steps:

```
ptp clock boundary domain <domain id>
servo tracking-type R-DTI
clock-port <name> profile g8275.2
  delay-req interval < Interval>
  sync interval < Interval>
  sync one-step
transport ipv6 unicast interface <loopback name> negotiation
clock source ipv6 <clock ip>
clock-port <name> profile g8275.2
  delay-req interval < Interval>
  sync interval < Interval>
  sync one-step
transport ipv6 unicast interface <loopback name> negotiation
clock source ipv6 <clock ip>
```

Verifying the G.8275.2 Profile

To verify the G.8275.2 profile, run the following command:

```
Router# show run | se ptp
ptp clock ordinary domain 55
servo tracking-type R-DTI
clock-port slave-port slave profile g8275.2
  delay-req interval -4
sync interval -4
  sync one-step
transport ipv6 unicast interface Lo1588
negotiation
clock source ipv6 2001:158:158:158::158
```

Configuration Examples

The following example shows IPv4 single clock source configuration:

```
ptp clock ordinary domain 55
servo tracking-type R-DTI
clock-port slave-from-903 slave profile g8275.2
  delay-req interval -4
  sync interval -5
  sync one-step
transport ipv4 unicast interface Lo1588 negotiation
clock source 10.90.3.93
```

The following example shows IPv6 single clock source configuration:

```
ptp clock ordinary domain 55 profile g8275.2
servo tracking-type R-DTI
clock-port slave-from-903 slave profile g8275.2
  delay-req interval -4
  sync interval -5
  sync one-step
transport ipv6 unicast interface Lo1588 negotiation
clock source ipv6 2001:10:90:3::93
```

Feature Information for G.8275.2 Profile

Use Cisco Feature Navigator to find information about the platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to the www.cisco.com/go/cfn link. An account on the Cisco.com page is not required.



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 1: Feature Information for G.8275.2 Profile

Feature Name	Releases	Feature Information
G.8275.2 Profile	Cisco IOS XE Everest 16.8.1	This feature was introduced in Cisco IOS XE Everest 16.8.1 on Cisco cBR Series Converged Broadband Router.

