PTP Multiprofile

The Precision Time Protocol (PTP) is a protocol used to synchronize clocks throughout a network. Clock synchronization is achieved by these three elements: Frequency, Phase and Time. Every node in a network must be synchronized with every other node for these three elements..

PTP allows for separate profiles to be defined for it to be adaptable in different scenarios. A profile is a specific selection of PTP configuration options, which are selected to meet the requirements of a particular application.

Based on the synchronization requirements of telecommunication networks, ITU-T defines standard profiles based on PTPv2. Some profiles defined by ITU-T for telecom industry are:

- ITU-T G.8265.1: Precision time protocol telecom profile for frequency synchronization.
- ITU-T G.8275.1: Precision time protocol telecom profile for phase/time synchronization with full timing support from the network.
- ITU-T G.8275.2: Precision time protocol telecom profile for phase/time synchronization with partial timing support from the network.

This chapter explains how a PTP Boundary Clock which works with multiple PTP profiles, can be configured on the Cisco router.

In a typical PTP network deployment all the participating network elements run on the same PTP profile (1588 / ITU-T G.8275.1 / ITU-T G.8275.2). However, due to differences in capabilities or functional requirements, some network elements might require a PTP translation from one profile to another. The PTP multiprofile feature caters to this requirement.

PTP Multiprofile support is achieved in a PTP boundary clock by translating one PTP profile at a PTP subordinate port to another PTP profile at a PTP primary port.

To translate PTP properties from one profile to other, a special type of "inter-op" clock-port is introduced. This special clock-port is configured with the required profile and domain information.

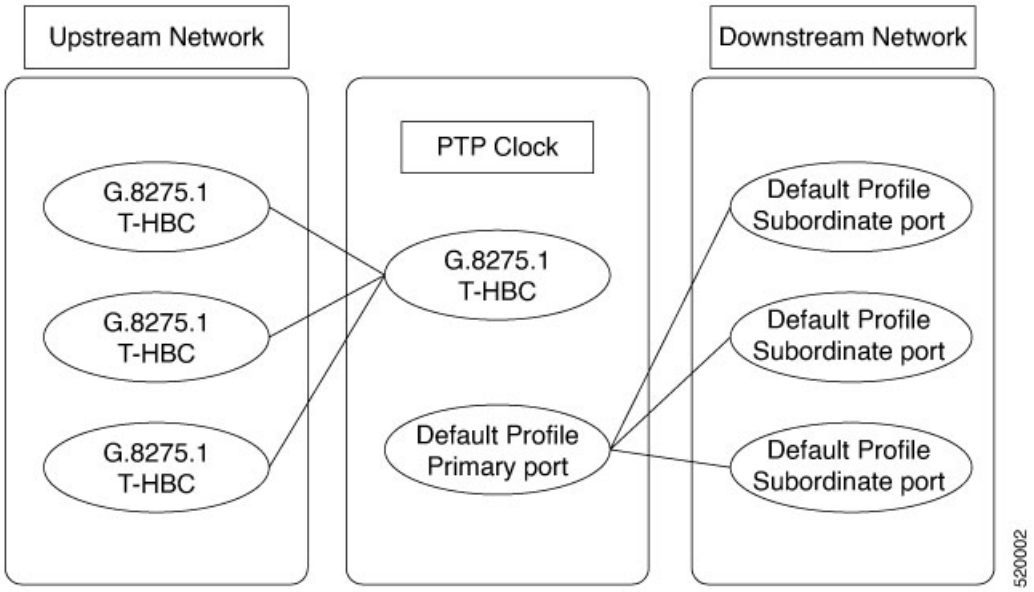
With PTP Multiprofile support, the Boundary Clock can run its subordinate port in one profile or domain and provide the PTP clock to a downstream node in a different profile or domain by using the new "inter-op" port.

PTP Multiprofile is configured on the Cisco router with the following command:

clock-port port-name <*inter-op-port*> domain <*0-127*> inter-op-profile {*1588* |*g8275.1* |*g8275.2*}

transport *{ipv4/ethernet} {multicast |unicast}* interface *interface-type interface-number*.

The following diagram which depicts how PTP Multiprofile works on a Cisco router:



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PTP Multiprofile Restrictions

- A maximum of **three** interop profiles with different domain numbers can be supported on the Cisco router.
- The server clock profile must be mutually exclusive with the interop profile. For example, if the server clock profile is default profile, then the interop profile must **not** be the default profile.
- The Interop port works as the server port. It cannot be used as a client port.
- **ITU-T G.8265.1** is not supported as the Interop profile.
- All interop ports with the 1588-default profile or the G.8275.2 profile must use the same loopback interface as the server server port.
- A server clock and port must be created before creating an Interop port.
- The server clock must be hybrid if the interop port is running the G.8275.1 profile.
- While configuring the PTP multiprofile, the best practice is to reduce the number of hops between the PTP grandmaster clock and the PTP slave router. We recommend a maximum of eight hops to mitigate network delays. You can check the number of hops between the PTP grandmaster and the PTP slave by executing the following command in the PTP slave router:

```
Router#show ptp clock dataset current
CLOCK [Boundary Clock, domain 44]
Steps Removed: 7
Offset From Master: -1981ns
Mean Path Delay: -443ns
```

Combination Matrix for PTP over MPLS with Multiprofile Configuration

This section lists the various supported combinations for PTP Multiprofiles:

Table 1: Supported Combinations for the Cisco ASR-920-12SZ-A, Cisco ASR-920-12SZ-D, and Cisco ASR-920-20SZ-M Cisco ASR-903 RSP3 and Cisco ASR-907 RSP3

Primary Port Type	Interop Port Type	G8275.1 Profile Configured (Primary or Interop)	PTP Over MPLS Support
1G	1G	Yes	No
10G	1G	Yes	No
1G	10G	Yes	No
10G	10G	Yes	Yes
1G	1G	No	Yes
10G	1G	No	Yes
1G	10G	No	Yes
10G	10G	No	Yes

Configure PTP Multiprofile

The following sections describe how to configure PTP Multiprofile on the Cisco router; for more information see the *Cisco IOS Interface and Hardware Component Command Reference*.

Default Profile to G8275.1 Profile

```
ptp clock boundary domain 0 hybrid
 clock-port subordinate-port slave
  transport ipv4 unicast interface Lo0 negotiation
  clock source 16.16.16.2
clock-port primary-port master
  transport ipv4 unicast interface Lo1 negotiation
clock-port inter_75_1  inter-op-port domain 24 inter-op-profile g8275.1
  transport ethernet multicast interface Te0/3/1
```

Default Profile to G8275.2 Profile

```
ptp clock boundary domain 0 hybrid
 clock-port subordinate-port slave
  transport ipv4 unicast interface Lo0 negotiation
  clock source 16.16.16.2
clock-port primary-port master
  transport ipv4 unicast interface Lo1 negotiation
```

```
clock-port inter_75_2 inter-op-port domain 45 inter-op-profile g8275.2
  transport ipv4 unicast interface Lo1 negotiation
```

G8275.1 Profile to Default Profile

```
ptp clock boundary domain 24 hybrid
 clock-port subordinate-port profile g8275.1 local-priority 1
  transport ethernet multicast interface GigabitEthernet0/1/1
 clock-port primary-port profile g8275.1 local-priority 2
  transport ethernet multicast interface GigabitEthernet0/1/2
clock-port inter_default inter-op-port domain 0 inter-op-profile 1588
  transport ipv4 unicast interface Lo1 negotiation
```

G8275.2 Profile to Default Profile

```
ptp clock boundary domain 45 hybrid
clock-port subordinate_calnex profile g8275.2 local-priority 1
  transport ipv4 unicast interface Lo0 negotiation
  clock source 16.16.16.2
clock-port primary-port profile g8275.2 local-priority 2
  transport ipv4 unicast interface Lo0 negotiation
clock-port inter_default inter-op-port domain 0 inter-op-profile 1588
  transport ipv4 unicast interface Lo0 negotiation
```

G8275.1 Profile to G8275.2 Profile

```
ptp clock boundary domain 24 hybrid
 clock-port subordinate-port profile g8275.1 local-priority 1
  transport ethernet multicast interface GigabitEthernet0/1/1
 clock-port primary-port profile g8275.1 local-priority 2
  transport ethernet multicast interface GigabitEthernet0/1/2
clock-port inter_75_2  inter-op-port domain 45 inter-op-profile g8275.2
  transport ipv4 unicast interface Lo1 negotiation
```

G8275.2 Profile to G8275.1 Profile

```
ptp clock boundary domain 45 hybrid
clock-port subordinate_calnex profile g8275.2 local-priority 1
  transport ipv4 unicast interface Lo0 negotiation
  clock source 16.16.16.2
clock-port primary-port profile g8275.2 local-priority 2
  transport ipv4 unicast interface Lo0 negotiation
clock-port inter_75_1 inter-op-port domain 24 inter-op-profile g8275.1
  transport ethernet multicast interface Te0/3/1
```

Troubleshooting PTP Multiprofile

Effective from Cisco release 17.1.x, you can troubleshoot PTP multiprofile on the Cisco router by using the following command:

show ptp port dataset inter-op-mp-port

```
Clock Identity: 0x74:26:AC:FF:FE:FA:4D:3F <valid clock identity of primary master>
Port Number: 0
Port State: <Master/Unknown >
Profile: <g8275.2/g8275.1/default >
Priority1: 128
Priority2: 128
Local Priority: 128
Domain Number: 24
```

```
Slave Only: Yes
Clock Quality:
Class: 255
Accuracy: 250
Offset (log variance): 65535
```