

G.8265.1 profile

The G.8265.1 is a frequency distribution profile that:

- ensures accurate clock quality level (QL) representation through clock advertisement,
- uses an alternate BMCA for precise clock and port state selection,
- statically assigns primary or secondary roles for reliable operation,
- supports higher packet rates for improved performance compared to IEEE 1588-2008,
- enhances scalability and reliability by using IPv4 unicast communication, and
- restricts clock types and domain numbers for streamlined network operation.

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G.8265.1 profile features

G.8265.1 specifies PTP deployment in telecom networks to provide precise and dependable time synchronization through:

- clock functions
- Port configuration and behavior
- network and transmission requirements.

Clock functions

G.8265.1 clock functions are:

- Clock advertisement: G.8265.1 updates Announce messages for PTP clocks. It uses the clock class value to advertise clock QL and ignores other values.
- Clock selection: G.8265.1 defines an alternate Best Master Clock Algorithm (BMCA) to select port states and clocks. It requires Sync messages (and optionally Delay-Response messages) to qualify a clock for selection.

- Clock types: G.8265.1 supports only ordinary clocks, each with a single PTP port. For a G.8265.1 secondary, all PTP ports on a device operate independently, with clock selection functioning separately for each Ordinary Clock.

Port configuration and behavior

G.8265.1 port configurations are:

- Port state decision: Ports are statically configured as primary or secondary and bypass the FSM for dynamic port state selection.
- Port numbers: G.8265.1 requires that all PTP port numbers be set to 1, since all clocks in the network are ordinary clocks as per G.8265.1.

Network and transmission requirements

G.8265.1 network and transmission requirements are:

- Packet rates: Packet rates exceed those specified in the IEEE 1588-2008 standard include:
  - Sync or Follow-Up packets: Average packet rates range from 128 packets per second to 16 seconds per packet.
  - Delay-Req or Delay-Resp packets: Average packet rates range from 128 packets per second to 16 seconds per packet.
  - Average packets: Average packet rates range from eight packets per second to 64 seconds per packet.
- Transport mechanism: G.8265.1 limits the PTP transport mechanism to IPv4 and mandates unicast transmission for all packets instead of multicast.
- Domain numbers: G.8265.1 limits domain numbers to the range from 4 to 23, with a default of 4.
- Supported clocks: G.8265.1 supports only primary and secondary clocks, excluding boundary and transparent clocks.

G.8265.1 profile map

This table maps Synchronization Status Messaging (SSM) Quality Levels (QL) codes to ITU-T G.781 synchronization quality levels and their corresponding clock classes for G.8265.1-compliant networks.

Table 1: G.8265.1 Profile Mapping

SSM QL	ITU-T G.781			Clock Class
—	Option I	Option II	Option III	—
0001	—	QL-PRS	—	80
0000	—	QL-STU	QL-UNK	82
0010	QL-PRC	—	—	84

SSM QL	ITU-T G.781			Clock Class
0111	—	QL-ST2	—	86
0011	—	—	—	88
0100	QL-SSU-A	QL-TNC	—	90
0101	—	—	—	92
0110	—	—	—	94
1000	QL-SSU-B	—	—	96
1001	—	—	—	98
1101	—	QL-ST3E	—	100
1010	—	QL-ST3 or QL-EEC2	—	102
1011	QL-SEC/QL-EEC1	—	QL-SEC	104
1100	—	QL-SMC	—	106
1110	—	QL-PROV	—	108
1111	—	QL-DUS	—	110

Restrictions for G.8265.1 profile

G.8265.1 doesn't support on

- sub-interface
- vrf interface
- port-channel interface

Configure G.8265.1 server and client Ordinary Clock

G.8265.1 server configuration includes:

- Server configuration to operate as an Ordinary clock
- Client configuration to operate as an Ordinary clock
- PTP commands

Configure a server to operate as an ordinary clock

Perform these steps to configure a server as an ordinary clock within a network setup to ensure correct time synchronization among devices.

Procedure

Step 1 Use the**enable** command to enter into EXEC mode.

Example:

```
Router# enable
```

Enter your password if prompted.

Step 2 Use the **configure terminal** command to enter into configuration mode.

Example:

```
Router# configure terminal
```

Step 3 Use the **ptp clock ordinary domain** command to configure the PTP ordinary clock.

Example:

```
Router(config)# ptp clock ordinary domain 4 profile g8265.1
```

Configures the PTP ordinary clock. The **profile** keyword configures the clock to use the G.8265.1 profile. Using a telecom profile requires that the clock have a domain number of 4–23.

Step 4 Use the **priority1** command to set the preference-level for the server clock.

Example:

```
Router(config-ptp-clk)# priority1 priorityvalue
```

Sets the preference level for a clock. Client devices use the priority1 value when selecting a server clock: a lower priority1 value indicates a preferred clock. The priority1 value is considered above all other clock attributes.

Valid values are from 0-255. The default value is 128.

Step 5 Use the **priority2** command to set a secondary preference level for a clock when router is unable to use **priority1** value.

Example:

```
Router(config-ptp-clk)# priority1 priorityvalue
```

Sets a secondary preference level for a clock. Subordinate devices use the priority2 value when selecting a server clock: a lower priority2 value indicates a preferred clock. The priority2 value is considered only when the router cannot use priority1 and other clock attributes to select a clock.

Valid values are from 0-255. The default value is 128.

Step 6 Use the **clock-port** command to set the clock port to PTP server mode.

Example:

```
Router(config-ptp-clk)# clock-port master master
```

Step 7 Use the **transport ipv4 unicast interface** command to specify the transport mechanism for clocking traffic.

Example:

```
Router(config-ptp-port)# transport ipv4 unicast interface GigabitEthernet 0/0/0 negotiation
```

A Loopback interface can be used as well as the WAN ports.

The client router IP address should be reachable via the WAN interface (GigabitEthernet 0/0/0 or GigabitEthernet 0/0/1) so that PTP packets can be sent or received on the WAN ports.

The **negotiation** keyword configures the router to discover a PTP server clock from all available PTP clock sources.

Step 8 Use the **sync interval** command to specify the interval used to send PTP synchronization messages.

Example:

```
Router(config-ptp-port)# sync interval -4
```

The intervals are set using log base 2 values, and they are:

- 1: one packet every 2 seconds
- 0: one packet every second
- -1: one packet every 1/2 second, or 2 packets per second
- -2: one packet every 1/4 second, or 4 packets per second
- -3: one packet every 1/8 second, or 8 packets per second
- -4: one packet every 1/16 seconds, or 16 packets per second.
- -5: one packet every 1/32 seconds, or 32 packets per second.
- -6: one packet every 1/64 seconds, or 64 packets per second.
- -7: one packet every 1/128 seconds, or 128 packets per second.

Step 9 Use the **announce interval** command to specify the interval for PTP announce message.

Example:

```
Router(config-ptp-port)# announce interval 2
```

The intervals are set using log base 2 values, and they are:

- 3: one packet every 8 seconds
- 2: one packet every 4 seconds
- 1: one packet every 2 seconds
- 0: one packet every second
- -1: one packet every 1/2 second, or 2 packets per second
- -2: one packet every 1/4 second, or 4 packets per second
- -3—1 packet every 1/8 second, or 8 packets per second

Step 10 Use the **end** command to exit the configuration mode.

Example:

```
Router(config-ptp-port)# end
```

Configure a client to operate as an Ordinary Clock

Perform these steps to configure a client as an ordinary clock within a network setup to ensure correct time synchronization among devices.

Procedure

Step 1 Use the**enable** command to enter into EXEC mode.

Example:

```
Router# enable
```

Enter your password if prompted.

Step 2 Use the **configure terminal** command to enter into configuration mode.

Example:

```
Router# configure terminal
```

Step 3 Use the **ptp clock ordinary domain** command to configure the PTP ordinary clock.

Example:

```
Router(config)# ptp clock ordinary domain 4 profile g8265.1
```

The **profile** keyword configures the clock to use the G.8265.1 profile. Using a telecom profile requires that the clock have a domain number from 4 to 23.

Step 4 Use the **clock-port** command to set the clock port to PTP client mode.

Example:

```
Router(config-ptp-clk)# clock-port client slave
```

Step 5 Use the **transport ipv4 unicast interface** command to specify the transport mechanism to clock rate.

Example:

```
Router(config-ptp-port)# transport ipv4 unicast interface GigabitEthernet 0/0/0 negotiation
```

A loopback interface can be used as well as the WAN ports.

The IP address of the server router should be reachable via the WAN interface (GigabitEthernet 0/0/0 or GigabitEthernet 0/0/1) so that PTP packets can be sent or received on the WAN ports.

The **negotiation** keyword configures the router to discover a PTP server clock from all available PTP clock sources.

Step 6 Use the **delay-req interval** command to configure the minimum interval allowed between PTP Delay-Req messages.

Example:

```
Router(config-ptp-port)# delay-req interval -4
```

The intervals are set using log base 2 values. They are:

- 3: one packet every 8 seconds
- 2: one packet every 4 seconds
- 1: one packet every 2 seconds

- 0: one packet every second
- -1: one packet every 1/2 second, or 2 packets per second
- -2: one packet every 1/4 second, or 4 packets per second
- -3: one packet every 1/8 second, or 8 packets per second
- -4: one packet every 1/16 seconds, or 16 packets per second.
- -5: one packet every 1/32 seconds, or 32 packets per second.
- -6: onepacket every 1/64 seconds, or 64 packets per second.
- -7: one packet every 1/128 seconds, or 128 packets per second.

Step 7 Use the **announce timeout** command to specify the number of PTP announcement intervals before the session times out.

Example:

```
Router(config-ptp-port)# announce timeout 8
```

Valid values are from 1 to 10.

Step 8 Use the **clock source** command to specify the address of a PTP server clock.

Example:

```
Router(config-ptp-port)# clock-source 8.8.8.1
```

Step 9 Use the **end** command to exit the configuration mode.

Example:

```
Router(config-ptp-port)# end
```

Verify the configuration

You can use these commands to verify a clocking configuration:

- show ptp clock running domain <domain no>
- show ptp clock dataset default
- show ptp clock dataset parent
- show ptp port <name of virtual port>
- show ptp wan stat stream <stream id>
- show network-clock synchronization
- show ptp port dataset port
- show ptp wan tod
- show gnss time
- show gnss status

Examples

```
Router#  show ptp clock running domain 4
                    PTP Ordinary Clock [Domain 4]  [Profile: g8265.1]
         State          Ports          Pkts sent      Pkts rcvd      Redundancy Mode
         ACQUIRING      1              1543           4680           Hot standby
                              PORT SUMMARY
                                                                      PTP Master
Name  Tx Mode      Role         Transport    State        Sessions     Port Addr
slave unicast      slave        Gi0/0/1      Slave        1            2.3.1.1
                            SESSION INFORMATION
slave [Gi0/0/1] [Sessions 1]
 Peer addr          Pkts in    Pkts out   In Errs    Out Errs
 2.3.1.1            4680       1543       0          0

Router#  show ptp clock running domain 4
                    PTP Ordinary Clock [Domain 4]  [Profile: g8265.1]
         State          Ports          Pkts sent      Pkts rcvd      Redundancy Mode
         PHASE_ALIGNED  1              44752          135639         Hot standby
                              PORT SUMMARY
                                                                       PTP Master
Name  Tx Mode      Role         Transport    State        Sessions     Port Addr
slave unicast      slave        Gi0/0/1      Slave        1            2.3.1.1
                            SESSION INFORMATION
slave [Gi0/0/1] [Sessions 1]
 Peer addr          Pkts in    Pkts out   In Errs    Out Errs
 2.3.1.1            135639     44752      0          0

Router#  show ptp clock dataset default
CLOCK [Ordinary Clock, domain 4]
  Profile: g8265.1
  Two Step Flag: No
  Clock Identity: 0x6C:03:09:FF:FE:18:5F:03
  Number Of Ports: 1
  Priority1: 128
  Priority2: 128
  Domain Number: 4
  Slave Only: Yes
  Clock Quality:
    Class: 255
    Accuracy: Unknown
    Offset (log variance): 0

Router#  show ptp clock dataset parent
CLOCK [Ordinary Clock, domain 4]
  Profile: g8265.1
  Parent Clock Identity: 0x44:B6:BE:FF:FE:42:EF:13
  Parent Port Number: 0
  Parent Stats: No
  Observed Parent Offset (log variance): 0
  Observed Parent Clock Phase Change Rate: 0
  Grandmaster Clock:
    Identity: 0x44:B6:BE:FF:FE:42:EF:13
    Priority1: 128
    Priority2: 128
    Clock Quality:
      Class: 104
      Accuracy: Unknown
      Offset (log variance): 52592

Router#  show ptp clock dataset time-properties
CLOCK [Ordinary Clock, domain 4]

  Current UTC Offset Valid: FALSE
  Current UTC Offset: 37
  Leap 59: FALSE
```

```
  Leap 61: FALSE
  Time Traceable: FALSE
  Frequency Traceable: TRUE
  PTP Timescale: TRUE
  Time Source: Internal Oscillator

Router#  show ptp port dataset port
PORT [slave]
  Clock Identity: 0x6C:03:09:FF:FE:18:5F:03
  Clock Profile: g8265.1
  Transport Interface: GigabitEthernet0/0/1
  Port Number: 1
  Port State: Slave
  Min Delay Req Interval (log base 2): -4
  Peer Mean Path Delay: 0
  Announce interval (log base 2): 1
  Announce Receipt Timeout: 3
  Sync Interval (log base 2): -5
  Delay Mechanism: End to End
  Peer Delay Request Interval (log base 2): -4
  PTP version: 2

Router#  show ptp wan stat stream 0
LOCK STATUS : PHASE LOCKED
SYNC Packet Stats
  Time elapsed since last packet: 0.0
  Configured Interval : -5, Acting Interval -5
  Tx packets : 0,  Rx Packets : 96215
  Last Seq Number : 30678,  Error Packets : 0
Delay Req Packet Stats
  Time elapsed since last packet: 0.0
  Configured Interval : -4, Acting Interval : -4
  Tx packets : 48107, Rx Packets : 0
  Last Seq Number : 0, Error Packets : 0
Delay Response Packet Stats
  Time elapsed since last packet: 0.0
  Configured Interval : -4, Acting Interval : -4
  Tx packets : 0, Rx Packets : 48107
  Last Seq Number : 48106, Error Packets : 0
Announce Packet Stats
  Time elapsed since last packet: 0.0
  Configured Interval : 1, Acting Interval : 1
  Tx packets : 0, Rx Packets :  1509
  Last Seq Number 1508 Error Packets 0
Signalling Packet Stats
  Time elapsed since last packet: 0.0
  Configured Interval : 0, Acting Interval : 0
  Tx packets : 12, Rx Packets : 12
  Last Seq Number : 0, Error Packets : 0
Current Data Set                            Units     Within tolerance?
  Offset from master :  +0.000000000       seconds          Yes
  Mean Path Delay    :  +0.000000027       seconds          Yes
  Forward Path Delay :  +0.000000027       seconds          Yes
  Reverse Path Delay :  +0.000000028       seconds          Yes
  Steps Removed 1

Router#  show ptp wan tod
PTPd ToD information:

Time: 01/05/22 11:35:21
```