



## G.8275.1 Profile

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- [Information About G.8275.1, on page 1](#)
- [Configuring the G.8275.1 Profile, on page 3](#)
- [Verifying the Configuration, on page 4](#)
- [Debugging Commands, on page 7](#)

### Information About G.8275.1

The IEEE 1588-2008 standard, in which the Precision Time Protocol (PTP) is defined, allows for separate profiles to be defined in order to adapt PTP for use in different scenarios. ITU-T G.8275.1 with full timing support from the network is a PTP profile for use in telecom networks where phase or time-of-day synchronization is required and where each network device participates in the PTP protocol and provide PHY-layer frequency support.

### Synchronization Model

The model adopted for G.8275.1 is “hop-by-hop” synchronization. Each network element on the path from master to slave synchronizes its local clock to upstream devices and provides synchronization to downstream devices.

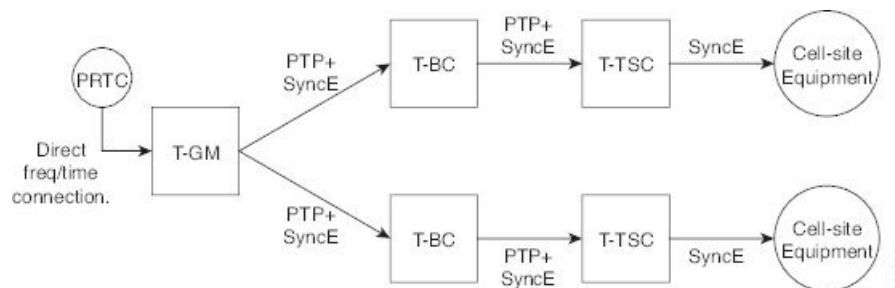
There are three types of clocks allowed in G.8275.1:

- **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 GPS antenna. It does not synchronize its local clock to other network elements.
- **Telecom Time Slave Clock (T-TSC):** A slave clock synchronizes its local clock to another PTP clock, and does not provide synchronization via PTP to any other devices.
- **Telecom Boundary Clock (T-BC):** A telecom boundary clock synchronizes its local clock to a T-GM or upstream T-BC, and provides timing information to downstream T-BCs or T-TSCs. If at a given point in time there are no higher-quality clocks available to a T-BC to synchronize to, it may act as a grandmaster. G.8275.1 introduces the concept of a virtual port on the T-BC. A virtual port is an external frequency, phase and time input interface on a T-BC, which can participate in the source selection. Sumatra has gns module on the timing card. When gns is locked we can configure the T-BC to have a virtual port which takes time, phase and frequency from GNSS.

Non-participant devices (devices that merely forward PTP packets) and PTP transparent clocks are not permitted.

PTP is used to provide phase/time-of-day synchronization throughout the network. It is expected (although not required) that SyncE will be used in G.8275.1 deployments to provide better frequency stability for the phase/time-of-day synchronization (so called “hybrid mode”).

**Figure 1: A Sample G.8275.1 Topology**



## PTP Domains

The allowed PTP domain numbers for use within G.8275.1 networks are in the range 24-43, inclusive. The default domain is 24.

## PTP Messages and Transport

The following PTP transport parameters are defined in G.8275.1:

- Multicast PTP over Ethernet must be used. Either the forwardable multicast MAC address (01-1B-19-00-00-00) or the non-forwardable multicast MAC address (01-80-C2-00-00-0E) may be used. The MAC address in use is selected on a per-port basis via configuration.
- Either one- or two-step clock mode may be used.
- Two-way PTP operation is required, in order to allow phase/time-of-day delivery. The Delay-request-response mechanism is used for propagation delay measurement; the peer-delay mechanism is not used.
- The minimum packet rate for Announce messages is 8 packets-per-second. For Sync, Follow-Up, Delay-Req and Delay-Resp messages, the minimum rate is 16 packets-per-second.
- Signaling and management messages are not used.




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**Note** G8275.1 is not supported for sub-interface, dot1q and port-channel.

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## Best Master Clock Algorithm

G.8275.1 specifies an alternate best master clock algorithm (BMCA), used by each device to select which clock (if any) to synchronize to, and to decide the port states of its local ports.

The following new parameters are defined as part of G.8275.1's alternate BMCA:

- **“notSlave”** flag: The notSlave flag is a per-port, configurable Boolean value which indicates whether a port can be placed in slave mode. If this is set on one of a PTP clock's ports, the clock will never synchronize to a clock received on that port.
- **Local priority**: Local priority is a per-port configuration item which is used as a tie-breaker when a PTP clock is selecting between clocks received on different ports, within the scope of a single network element. The network element's local clock also has a configurable local priority.

The G.8275.1 BMCA's clock comparison algorithm is based on the following parameters:

1. **Clock Class**: The profile defines a set of clock-classes for use by compliant clocks. The clock class selected depends on the type of clock, the clock's traceability and holdover status.
2. **Clock Accuracy**: The following clock accuracy values are used by G.8275.1:
  - 0x21: A T-GM locked to a PRTC uses this value.
  - 0xFE: A T-GM in holdover, or a T-BC, uses this value.
3. **Offset Scaled Log Variance**: The following offset scaled log variance values are used by G.8275.1:
  - 0x4E5D: A T-GM locked to a PRTC uses this value.
  - 0xFFFF: A T-GM in holdover, or a T-BC, uses this value.
4. **Priority 2**: Used as in the original 1588v2 BMCA. Note that priority 1 is not used.
5. **Local Priority**: Used as described above.
6. **Clock Identity**: The clock identity is used as a tie-breaker between different clocks (as in the original 1588v2 BMCA).
7. **Steps Removed**: The steps removed value is used to select between different ports which are receiving the same clock (as in the original 1588v2 BMCA).
8. **Port Identity**: The port identity is used as a tie-breaker between different ports on the same clock.

A G.8275.1-compliant clock ignores the following values in received Announce messages:

- The alternate master, unicast and the profile-specific members of the flag field.
- The control field.
- Priority1

## Configuring the G.8275.1 Profile

### Configuration On T-GM

PTP-OC-T-GM can take frequency and 1PPS input to synchronize itself with an upstream Grand Master.

The following example shows the configuration on T-GM:

```
ptp clock ordinary domain 24 profile G.8275.1
```

```

tod R0 ubx
input lpps R0 //GNSS is locked and TOD+1PPS are feeding into T-GM G.8275.1.
clock-port master-port master
transport ethernet multicast interface Gig 0/0/1

```

## Configuration On T-TSC

The following example shows the configuration on T-TSC:

```

ptp clock ordinary domain 24 hybrid g.8275.1
tod R0 cisco
output lpps R0
clock-port slave-port slave
transport ethernet multicast interface Gig 0/0/0

```

## Configuration On T-BC

The following example shows the configuration on T-BC:

```

ptp clock boundary domain 24 hybrid profile g.8275.1
tod R0 cisco
output lpps R0
clock-port bc-port-1
transport ethernet multicast interface Gig 0/0/0
clock-port bc-port-2
transport ethernet multicast interface Gig 0/0/1

```

## Verifying the Configuration

You can use the following 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

```

IR8340#show ptp clock running domain 24
PTP Ordinary Clock [Domain 24] [Hybrid] [Profile: g8275.1]
      State           Ports           Pkts sent      Pkts rcvd      Redundancy Mode

```

```

          FREQ_LOCKED      1                56                146                Hot standby
                                PORT SUMMARY
Name Tx Mode      Role      Transport  State      Sessions      PTP Master
slave mcast      slave     Ethernet   Slave      1            Port Addr
IR8340#                                     UNKNOWN

IR8340#show ptp clock running
          PTP Ordinary Clock [Domain 24] [Hybrid] [Profile: g8275.1]
          State      Ports      Pkts sent      Pkts rcvd      Redundancy Mode
PHASE_ALIGNED    1                1176           2946           Hot standby
                                PORT SUMMARY
                                PTP Master
Name Tx Mode      Role      Transport  State      Sessions      Port Addr
slave mcast      slave     Ethernet   Slave      1            UNKNOWN
IR8340#

IR8340#show ptp clock dataset default
CLOCK [Ordinary Clock, domain 24]
  Profile: g8275.1
  Two Step Flag: No
  Clock Identity: 0x6C:03:09:FF:FE:18:5F:03
  Number Of Ports: 1
  Priority1: 128
  Priority2: 128
  Local Priority: 128
  Domain Number: 24
  Slave Only: Yes
  Clock Quality:
    Class: 255
    Accuracy: Unknown
    Offset (log variance): 65535
IR8340#

IR8340#show ptp clock dataset parent
CLOCK [Ordinary Clock, domain 24]
  Profile: g8275.1
  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: 248
      Accuracy: Unknown
      Offset (log variance): 65535
IR8340#

IR8340#show ptp port dataset port
PORT [slave]
  Clock Identity: 0x6C:03:09:FF:FE:18:5F:03
  Clock Profile: g8275.1
  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): -3
  Announce Receipt Timeout: 3
  Sync Interval (log base 2): -4

```

```

Delay Mechanism: End to End
Peer Delay Request Interval (log base 2): -4
PTP version: 2
Local Priority: 128
Not-slave: False
IR8340#

IR8340#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
Offset from master : +0.000000000          Units      Within tolerance?
Mean Path Delay    : +0.000000027         seconds    Yes
Forward Path Delay : +0.000000027         seconds    Yes
Reverse Path Delay : +0.000000028         seconds    Yes
Steps Removed 1
IR8340#

IR8340#show ptp wan tod
PTPd ToD information:

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

IR8340#

IR8340#show network-clocks synchronization detail
Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock State : Frequency Locked
Clock Mode : QL-Enable
ESMC : Enabled
SSM Option : 1
T0 : GigabitEthernet0/0/1
Hold-off (global) : 300 ms
Wait-to-restore (global) : 10 sec
Tsm Delay : 180 ms
Revertive : No
Force Switch: FALSE
Manual Switch: FALSE
Number of synchronization sources: 1
Squelch Threshold: QL-SEC

```

```

sm(netsync NETCLK_QL_ENABLE), running yes, state 1A
Last transition recorded: (begin)-> 2A (ql_mode_enable)-> 1A (src_added)-> 1A (sf_change)->
1A (ql_change)-> 1A
Nominated Interfaces
Interface          SigType    Mode/QL    Prio  QL_IN  ESMC Tx  ESMC Rx
Internal          NA        NA/Dis     251   QL-SEC NA       NA
*Gi0/0/1         NA        Sync/En    1     QL-PRC -       -

```

## Debugging Commands

Use the following commands to debug your configuration:

- show esmc details
- show platform hardware network-clocks
- show network-clock synchronization detail
- show clocking details

### Examples

```

IR8340#show esmc detail
Interface: GigabitEthernet0/0/0
Administrative configurations:
  Mode: Asynchronous
  ESMC TX: Disable
  ESMC RX: Disable
  QL TX: -
  QL RX: -
Operational status:
  Port status: UP
  QL Receive: QL-DNU
  QL Transmit: -
  QL rx overridden: -
  ESMC Information rate: 1 packet/second
  ESMC Expiry: 5 second
  ESMC Tx Timer: Stopped
  ESMC Rx Timer: Stopped
  ESMC Tx interval count: 1
  ESMC INFO pkts in: 777
  ESMC INFO pkts out: 1068
  ESMC EVENT pkts in: 0
  ESMC EVENT pkts out: 2

```

```

IR8340#show esmc detail
IInterface: GigabitEthernet0/0/1
Administrative configurations:
  Mode: Synchronous
  ESMC TX: Enable
  ESMC RX: Enable
  QL TX: -
  QL RX: -
Operational status:
  Port status: UP
  QL Receive: QL-PRC
  QL Transmit: QL-DNU
  QL rx overridden: -
  ESMC Information rate: 1 packet/second
  ESMC Expiry: 5 second
  ESMC Tx Timer: Running

```

```

ESMC Rx Timer: Running
ESMC Tx interval count: 1
ESMC INFO pkts in: 1169
ESMC INFO pkts out: 1486
ESMC EVENT pkts in: 0
ESMC EVENT pkts out: 2
IR8340#

IR8340#show network-clocks synchronization detail
Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock State : Frequency Locked
Clock Mode : QL-Enable
ESMC : Enabled
SSM Option : 1
T0 : GigabitEthernet0/0/1
Hold-off (global) : 300 ms
Wait-to-restore (global) : 10 sec
Tsm Delay : 180 ms
Revertive : No
Force Switch: FALSE
Manual Switch: FALSE
Number of synchronization sources: 1
Squelch Threshold: QL-SEC
sm(netsync NETCLK_QL_ENABLE), running yes, state 1A
Last transition recorded: (begin)-> 2A (ql_mode_enable)-> 1A (src_added)-> 1A (sf_change)->
1A (ql_change)-> 1A
Nominated Interfaces
  Interface          SigType      Mode/QL      Prio  QL_IN  ESMC Tx  ESMC Rx
  Internal           NA           NA/Dis       251   QL-SEC NA       NA
  *Gi0/0/1          NA           Sync/En      1     QL-PRC -        -

IR8340#show platform hardware network-clocks
Chassis Manager Netclk Status
-----
DPLL1 Status:
-----
Bandwidth: 1.7 Hz
Phase Slope Limit: 7500 ns/s
Current PLL1 Mode: MANUAL NORMAL
Current Input Selected: REF7 (CLK_REC_25M_WAN2)
Current PLL1 Holdover Status: OFF
Current PLL1 Lock Status: ON

IR8340#show platform hardware network-clocks
DPLL2 Status:
-----
Bandwidth: 0.029 Hz
Phase Slope Limit: 750 ns/s
Current PLL2 Mode: TOP CLIENT (NCO)
Current Input Selected: none
Current PLL2 Holdover Status: OFF
Current PLL2 Lock Status: OFF

IR8340#show platform hardware network-clocks
Current Input Status:
  REF0 (CLK_LOOPBACK1) : OK
  REF1 (CLK_LOOPBACK2) : OK
  REF2 ((TDM_SYNC_MB_PLL) : FAIL (SCM, CFM, GST, PFM failed)
  REF3 (RSV_2_M_PLL) : FAIL (SCM, CFM, GST, PFM failed)
  REF4 (CLK_PPS_GPS_PLL) : FAIL (SCM, CFM, GST, PFM failed)
  REF5 (CLK_PPS_MB_PLL) : FAIL (SCM, CFM, GST, PFM failed)
  REF6 (CLK_REC_25M_WAN1) : FAIL (SCM, CFM, GST, PFM failed)
  REF7 (CLK_REC_25M_WAN2) : OK

```



```
REF8 (CLK20M_OCXO)      : OK
REF9 (RSV_1_MB_PLL)     : FAIL (SCM, CFM, GST, PFM failed)
```

```
IR8340#show platform hardware network-clocks
```

```
REF0 Freq Configured   : 25 Mhz
REF1 Freq Configured   : 25 Mhz
REF2 Freq Configured   : 8 Khz
REF3 Freq Configured   : 10 Mhz
REF4 Freq Configured   : 1 Hz
REF5 Freq Configured   : 1 Hz
REF6 Freq Configured   : 25 Mhz
REF7 Freq Configured   : 25 Mhz
REF8 Freq Configured   : 20 Mhz
REF9 Freq Configured   : 25 Mhz
```

