



Synchronizing Time on Cisco Remote PHY Devices

This section explains how to synchronize time on the Remote PHY (R-PHY) devices and CCAP core of the Cisco cBR Router.

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Hardware Compatibility Matrix for Cisco Remote PHY Device



Note Unless otherwise specified, the hardware components introduced in a given Cisco Remote PHY Device Software Release are supported in all subsequent releases.

Table 1: Hardware Compatibility Matrix for the Cisco Remote PHY Device

Cisco HFC Platform	Remote PHY Device
Cisco GS7000 Super High Output Node	Cisco 1x2 / Compact Shelf RPD Software 2.1 and Later Releases
Cisco GS7000 Super High Output Intelligent Node (iNode)	Cisco 1x2 / Compact Shelf RPD Software 4.1 and Later Releases Cisco Intelligent Remote PHY Device 1x2 <ul style="list-style-type: none">• PID—iRPD-1X2=• PID—iRPD-1X2-PKEY=



Note The -PKEY suffix in the PID indicates units that enable the SCTE-55-2 Out-of-Band protocol support.

Information about Time Synchronization

In a Remote PHY system, synchronizing its local timestamp and reference frequency to the cable converged access platform core function (CCAP Core) is important. The protocol used for this feature, the Precision Time Protocol (PTP), helps in synchronizing time between a CCAP core function and a series of remote PHY devices (RPD) that enable R-PHY and provides support for converged DOCSIS, video, and out-of-band (OOB) services.

Cisco CBR-8 supports PTP Ordinary Clock (OC) subordinate mode, in which the PTP subordinate ports are from the backhaul 10 GE Ethernet ports or the management Ethernet ports of SUP PIC.

Remote DTI

Remote DOCSIS Timing Interface (R-DTI) is the network synchronization protocol used between CCAP-core and R-PHY. When traffic from the CCAP-Core is received on the downstream receiver, the following processes occur:

- Terminates DEPI framing
- Extracts the payload, frames it, modulates, and transmits it out

During the upstream process, the signal is received from the coax and the system demodulates it. From the FEC payload, the DOCSIS frames are extracted and placed in the UEPI encapsulation. The frames are then transmitted through the upstream transmitter to the CCAP core. A local CPU manages DEPI and GCP control planes, and interfaces with network management. A clocking circuit interfaces with the R-DTI and manages clocking for the R-DTI entity.

The GS7000 R-PHY supports map re-stamp option.

Restrictions for Configuring Time Synchronization

The following restrictions are applicable to configuring time synchronization on Cisco cBR-8.

- Cisco cBR-8 supports PTP subordinate on both SUP-PIC and DPIC.
- Cisco RPD PTP does not support pass-through mode. Pass-through mode means RPDs are communicating with PTP server through cBR-8, and cBR-8 is PTP unaware of the communication between RPDs with PTP server.

How to Configure Time Synchronization

Configure Time Interface and PTP Domain

To configure time interface and PTP domain, use the following procedure.

```
enable
configure terminal
interface type [slot_#/]port_#
interface Loopback1588
    ip address <IP Address/subnet>

interface TenGigabitEthernet<slot/port>
    ip address <IP Address/subnet>

ip route < PTP master IP Address/subnet> < loopback IP Address>

ptp clock ordinary domain 0 (This is for CBR PTP connection)
    servo tracking-type R-DTI
    clock-port slave-from-903 slave
    delay-req interval -4
    sync interval -5
    sync one-step
    transport ipv4 unicast interface Lo1588 negotiation
    clock source < PTP master loopback IP Address>
```

The following table explains the parameters used in this example:

Table 2: Parameters for Time Interface and PTP Domain Configuration

Parameter	Description	Value Range	Default Value
ptp r-dti [id]		1-64	
description	R-DTI name or description		
ptp-domain [id]	Domain number of IEEE 1588	0-127	
local-priority [value]	Set local priority	128	128
priority1 [value]	Set priority1	0-255	128
priority2 [value]	Set priority2	0-255	255
mode [value]	R-DTI mode	other, subordinate primary	subordinate
profile [value]	Set PTP ITU-T profile	default/G.8275.2	default
clock-port [id]	Configure clock port	1-32	
state [value]	Set Ethernet port admin status	other, up, down, testing	up

Parameter	Description	Value Range	Default Value
ethenet [value]	Set Ethernet port for clock port	0-32	The default value is clock port index
clock source [ip] gateway [ip]	Set clock address	ipv4 address, ipv6 address	
clock alternate-first	Select alternate source first		
transport [value]	Set transport encapsulation	other, ipv4, ipv6	ipv4
transport cos [value]	COS of 802.1Q	0-7	6
transport dscp [value]	DSCP of IP differentiated services	0-63	47
local-priority [value]	Set local priority	1-255	128
sync interval [value]	Set an interval for sync packets	0-7(-7 -0)	
announce interval [value]	Set an interval for announcement packets	0-3(-3 -0)	
delay-req interval [value]	Set an interval for PTP delay-req packets	0-7(-7 -0)	
announce timeout [value]	Set timeout interval for announcement packets	3-255	
unicast grant-duration [value]	Set the grant duration time in seconds for unicast	60-1000	300
description	Clock port name or description		

Verifying Time Interface and PTP Domain Configuration

The following example shows how to verify the time interface and PTP domain configuration:

```
Router# show ptp clock running domain 0
Load for five secs: 5%/2%; one minute: 6%; five minutes: 6%
No time source, 15:16:20.421 CST Wed Mar 15 2017

                PTP Ordinary Clock [Domain 0]
State           Ports Pkts sent Pkts rcvd Redundancy Mode
PHASE_ALIGNED  1      3687693  11177073 Hot standby
                PORT SUMMARY
                PTP Master
Name           Tx Mode Role  Transport State Sessions Port Addr
slave-from-903 unicast slave Lo1588  Slave 2      10.10.10.11
```

```

                                SESSION INFORMATION
slave-from-903 [Lo1588] [Sessions 2]
Peer addr      Pkts in Pkts out In Errs Out Errs
10.10.10.11    5588900 1843789 0      0
10.10.10.12    5588173 1843904 0      0

```

Configure RPD PTP Connection

To configure RPD PTP connection, use the following commands.

```

enable
configure terminal
interface type [slot_#/]port_#
ptp r-dti 1 (RPD PTP connection)
ptp-domain 0 /* same domain number with ptp server */
    clock-port 1
        ethernet 1 /* default value is same index with clock-port index, for RPD, ethernet
1=vbh0, ethernet 2=vbh1 */
            clock source ip <IP Address> gateway ip <IP Address>
            clock source ip <IP Address> gateway ip <IP Address> alternate
            !--<clock-source is PTP master loopback ip, gw is the next hop to reach the ptp master
--!
>--!

```

Verifying RPD PTP Connection Configuration

The following example shows how to verify the RPD PTP Connection configuration:

```

Router# show ptp clock 0 config
Domain/Mode      : 0/OC_SLAVE
Priority 1/2/local : 128/255/128
Profile          : 001b19000100-000000 E2E
Total Ports/Streams : 1 /2
--PTP Port 1, Enet Port 1 ----
Port local Address :10.10.10.11
Unicast Duration :300 Sync Interval : -4
Announce Interval : 0 Timeout : 11
Delay-Req Intreval : -4 Pdelay-req : -4
Priority local :128 COS: 6 DSCP: 47
==Stream 0 : Port 1 Master IP: 10.10.10.11
==Stream 1 : Port 1 Master IP: 10.10.10.11

```

Associate R-DTI with RPD

To associate R-DTthe local prefix SID associated to the segment ID, use the following commands.

```

enable
configure terminal
interface type [slot_#/]port_#
cable rpd node1
identifier 0044.4f04.0044 (node vbh0 mac)
    core-interface Te3/1/0
    rpd-ds 0 downstream-cable 3/0/0 profile 3
    rpd-us 0 upstream-cable 3/0/0 profile 3
r-dti 1
rpd-event profile 0
rpd-55d1-us-event profile 0

```

Verifying Associating R-DTI with RPD

The following example shows how to verify whether the RPD is associated to R-DTI:

```
Router# show running-config
Load for five secs: 8%/2%; one minute: 9%; five minutes: 9%
Time source is user configuration, 11:00:17.381 CST Wed Mar 22 2017
Building configuration...
Current configuration : 107879 bytes
!
! Last configuration change at 10:59:23 CST Wed Mar 22 2017
!
version 16.6
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
service internal
no platform punt-keepalive disable-kernel-core
platform ipcc1 log-history 0
platform punt-policer 10 10
platform punt-policer 10 10 high
platform punt-policer 80 10
platform punt-sbr1 subscriber rate no-drop
platform shell
!
hostname RphyNode-L09
!
boot-start-marker
boot system harddisk:cbrsup-universalk9.16.05.01prd9.SPA.bin
boot-end-marker
!
!
----
!
cable tag 10
  name docsis1.0
  docsis-version docsis10
!
cable tag 11
  name docsis1.1
  docsis-version docsis11
!
-----
cable load-balance docsis-group 1
  restricted
  upstream Upstream-Cable 3/0/3 us-channel 0-3
  method utilization
  threshold load 15
  threshold load minimum 2
  policy pure-ds-load
  init-tech-list 4
  interval 60
  tag docsis1.0
  tag docsis1.1
  tag docsis2.0
  tag docsis3.0
!
---
cable metering ipdr-d3 session 1 type 1
cable metering source-interface TenGigabitEthernet4/1/1
cable modem remote-query 30 public
cable modem vendor 00.02.00 "Apache-ACB"
cable modem vendor E8.6D.52 "Motorola"
cable modem vendor 00.1F.E1 "Ambit"
cable modem vendor 00.1F.E2 "Ambit"
```

```
cable modem vendor 00.D0.DD "Sunrise"
!
!
----
!
no network-clock synchronization automatic
!
ptp clock boundary domain 0
  servo tracking-type R-DTI
  clock-port slave-from-903 slave
  delay-req interval -4
  sync interval -5
  sync one-step
  transport ipv4 unicast interface Lol1588 negotiation
  clock source 10.10.10.11
  clock source 192.168.0.0
  clock-port master-local master
  transport ipv4 unicast interface Lol1588 negotiation
!
-----
r-dti 2
  rpd-event profile 0
  rpd-55dl-us-event profile 0
!
ptp r-dti 2
  ptp-domain 0
  clock-port 1
    clock source ip 10.10.10.11
    clock source ip 192.168.0.0 alternate
!
ptp r-dti 3
  ptp-domain 0
  clock-port 1
    clock source ip 10.10.10.11
    clock source ip 192.168.0.0 alternate
!
ptp r-dti 10
  ptp-domain 0
  clock-port 1
    clock source ip 10.10.10.11
    clock source ip 192.168.0.0 alternate
  announce interval -3
  announce timeout 3
!
ptp r-dti 11
  ptp-domain 0
  priority1 101
  priority2 102
  local-priority 100
  clock-port 2
    ethernet 1
    clock alternate-first
    clock source ip 10.10.10.11
    clock source ip 192.168.0.0 alternate
  transport cos 0
  transport dscp 63
  sync interval -1
  announce timeout 255
  delay-req interval -7
  unicast grant-duration 60
  local-priority 255
!
ptp r-dti 12
  ptp-domain 0
```

```

clock-port 1
  ethernet 0
  clock source ip 10.10.10.11
!
ptp r-dti 60
  ptp-domain 0
!
cable video
!
end

```

Verifying PTP Clock Functioning

To verify whether the PTP Clock is running, use the following commands:

```

Router#show ptp clock running
Load for five secs: one minute: 5%; five minutes:
Time source is NTP, 14 CST Fri Feb 17 2017
PTP Ordinary clock [Domain 0]
State          Ports pkts sent pkts rcvd Redundancy Mode
PHASE-ALIGNED 1      7339500  22245593  Hot standby
  Port Summary
Name          Tx Mode Role  Transport State Sessions PTP Master Port Addr
slave-from-903 unicast slave  L01588  Slave 2      10.10.10.11

```

Verifying PTP Clock Running Domain

The following example shows how to verify the PTP clock running domain:

```

Router#show ptp clock running domain 0
Load for five secs: 5%/2%; one minute: 6%; five minutes: 6%
No time source, 15:16:20.421 CST Wed Mar 15 2017
          PTP Ordinary Clock [Domain 0]
State          Ports Pkts sent Pkts rcvd Redundancy Mode
PHASE_ALIGNED 1      3687693  11177073  Hot standby
  PORT SUMMARY
          PTP Master
Name          Tx Mode Role  Transport State Sessions Port Addr
slave-from-903 unicast slave  L01588  Slave 2      10.10.10.11

          SESSION INFORMATION
slave-from-903 [L01588] [Sessions 2]
Peer addr      Pkts in Pkts out In Errs Out Errs
10.10.10.11    5588900 1843789 0      0
192.168.0.10   5588173 1843904 0      0

```

Verifying Time Sync State

To verify the status of time synchronization, use the show ptp clock <n> state command as given in the following example:

```

Router# show ptp clock 0 state
apr state      : PHASE_LOCK
clock state    : SUB_SYNC
current tod    : 1485414295   Thu Jan 26 07:04:55 2017
active stream  : 0
==stream 0    :
  port id     :                0
  master ip   :                10.10.10.11
  stream state :                PHASE_LOCK

```



```

Master offset :          -405
Path  delay   :          -17071
Forward delay :          -17476
Reverse delay :          -16623
Freq offset  :          -291143
1Hz  offset   :           -676
==stream  1   :
port id      :            0
master ip    :          192.168.0.11
stream state :          PHASE_LOCK
Master offset :          -369
Path  delay   :          -1619
Forward delay :          -1988
Reverse delay :          -1260
Freq offset  :          -297905
1Hz  offset   :          -664

```

Verifying Time Sync Statistics

To verify the statistics of the time synchronization, use the `show ptp clock <n> state` command as given in the following example:

```

Router# show ptp clock 0 statistics
AprState 4 :
2@0-00:06:51.568 1@0-00:06:41.930 0@0-00:04:17.925
4@0-00:03:58.724
ClockState 5 :
5@0-00:07:12.640 4@0-00:07:10.182 3@0-00:07:06.825
2@0-00:06:51.825 1@0-00:06:51.530
BstPktStrm 1 :
0@0-00:06:42.029
SetTime 1 :
1000000000@0-00:04:00.045
StepTime 1 :
125126755@0-00:06:14.670
AdjustTime 64 :
-676@0-07:34:32.546 -733@0-07:33:31.545 -838@0-07:32:30.546
-892@0-07:31:29.545 -935@0-07:30:28.545 -1033@0-07:29:27.545
-914@0-07:28:26.546 916@0-07:26:24.545 2507@0-07:25:18.170
streamId  msgType      rx      rxProcessed  lost      tx
0          SYNC          433439 433439      4294574083 0
0          DELAY REQUEST    0        0            0      433439
0          P-DELAY REQUEST    0        0            0        0
0          P-DELAY RESPONSE    0        0            0        0
0          FOLLOW UP      0        0            0        0
0          DELAY RESPONSE    433437 433437      4294548766 0
0          P-DELAY FOLLOWUP    0        0            0        0
0          ANNOUNCE      27098 27098        0        0
0          SIGNALING      285    285          0      285
0          MANAGEMENT    0        0            0        0
TOTAL      894259 894259      8589122849 433724
1          SYNC          433435 433435      4294574085 0
1          DELAY REQUEST    0        0            0      433439
1          P-DELAY REQUEST    0        0            0        0
1          P-DELAY RESPONSE    0        0            0        0
1          FOLLOW UP      0        0            0        0
1          DELAY RESPONSE    10351 10351        4104      0
1          P-DELAY FOLLOWUP    0        0            0        0
1          ANNOUNCE      27098 27098        4294901760 0
1          SIGNALING      285    285          0      285
1          MANAGEMENT    0        0            0        0
TOTAL      471169 471169      8589479949 433724

```

Configuration Examples

This section provides examples for configuring Cisco cBR for time synchronization.

Example: Configure Time Interface and PTP Domain

The following example shows how to configure time interface and PTP domain:

```
enable
configure terminal
interface Loopback1588
ip address 10.10.10.11 255.255.255.224

interface TenGigabitEthernet5/1/3 (connect to PTP primary)
ip address 192.168.0.13 255.255.255.224

ip route 10.10.10.11 255.255.255.224 192.168.0.12 (route to PTP primary loopback ip)

ptp clock ordinary domain 0 (This is for cbr ptp connection)
servo tracking-type R-DTI
clock-port slave-from-903 slave
delay-req interval -4
sync interval -5
sync one-step
transport ipv4 unicast interface Lo1588 negotiation
clock source 10.10.1.11 (PTP primary loopback ip)
```

Example: Configure RPD PTP Connection

The following example shows how to configure RPD PTP connection:

```
enable
configure terminal
ptp r-dti 1
ptp-domain 0
mode slave
priority1 128
priority2 255
local-priority 128
clock-port 1
  ethernet 1
  ...
clock-port 2
  ethernet 2
  ...
clock-port 1
  ethernet 1
  state up
  transport ipv4
  clock source ip 10.10.1.12 gw 10.10.1.1
  clock source ip 192.168.0.0 gateway ip 10.10.1.2 alternate
  transport cos 6
  transport dscp 47
  sync interval -4
  announce interval 0
  announce timeout 11
  delay-req interval -4
  unicast grant-duration 300
  local-priority 128
```

Example: Associate R-DTI with RPD

The following example shows how to associate R-DTI with RPD:

```
enable
configure terminal
cable rpd node1
  identifier 0004.9f03.0061 (node vbh0 mac)
  core-interface Te3/1/0
  rpd-ds 0 downstream-cable 3/0/0 profile 3
  rpd-us 0 upstream-cable 3/0/0 profile 3
r-dti 1
  rpd-event profile 0
  rpd-55d1-us-event profile 0
```

Feature Information for Synchronizing Time on R-PHY Devices

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 <https://cfmg.cisco.com/> 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 3: Feature Information for Synchronizing Time on R-PHY Devices

Feature Name	Releases	Feature Information
Synchronizing Time on R-PHY Devices	Cisco 1x2 / Compact Shelf RPD Software 3.1	This feature was integrated into the Cisco Remote PHY Device.

