



Synchronizing Time on Cisco Smart PHY 7200

This section explains how to synchronize time on the RPD and CCAP core of the Cisco cBR Router.

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Hardware Compatibility Matrix for Cisco Smart PHY 7200



Note Unless otherwise specified, the hardware components introduced in a given Cisco Smart PHY 7200 Software Release are supported in all subsequent releases.

Table 1: Hardware Compatibility Matrix for the Cisco Smart PHY 7200

Cisco CMTS Platform	Cisco Smart PHY 7200
Cisco cBR-8 Converged Broadband Router with Cisco IOS XE Gibraltar 16.10.1 and Later Releases	Cisco Smart PHY 7200 Software 1.x and Later Releases Cisco Smart PHY 7200 <ul style="list-style-type: none">• PID—HA-RPHY

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) slave mode, in which the PTP slave ports are from the backhaul 10GE 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.

How to Configure Time Synchronization

Configuring 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 55 (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	

Parameter	Description	Value Range	Default Value
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
ethernet [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	

Parameter	Description	Value Range	Default Value
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 55
                PTP Ordinary Clock [Domain 55]
                State          Ports          Pkts sent    Pkts rcvd    Redundancy Mode
                PHASE_ALIGNED  1              16012        45126        Hot standby

                PORT SUMMARY

Name           Tx Mode      Role          Transport    State         Sessions     Port Addr
slave-from-903 unicast      slave         Lo1588       Uncalibrated 1            10.10.1.11
                SESSION INFORMATION
slave-from-903 [Lo1588] [Sessions 1]
Peer addr      Pkts in     Pkts out     In Errs     Out Errs
10.10.1.11    45126      16012        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 55(RPD PTP connection)
profile G.8275.2
ptp-domain 0
clock-port <same domain number with PTP server>
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_MASTER
Priority 1/2/local : 128/255/128
Profile          : 001b19000100-000000 E2E
Total Ports/Streams : 1 /0
--PTP Port 188, Enet Port 0 ----
Port local Address :192.168.100.100
Unicast Duration :300 Sync Interval : -4
Announce Interval : 1 Timeout : 3
Delay-Req Intreval : -4 Pdelay-req : -4
```

```
Priority local :128 COS: 3 DSCP: 47
```

```
Router# show ptp clock 1 config
Domain/Mode      : 55/OC_SLAVE
Priority 1/2/local : 128/255/128
Profile          : 001b19000100-000000 E2E
Total Ports/Streams : 1 /1
--PTP Port 22, Enet Port 1 ----
Port local Address :40.3.6.185
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 4 : Port 22 Master IP: 10.10.1.11
```

```
Router# show ptp clock 2 config
Domain/Mode      : 55/OC_SLAVE
Priority 1/2/local : 128/255/128
Profile          : 001b19000100-000000 E2E
Total Ports/Streams : 1 /1
--PTP Port 22, Enet Port 1 ----
Port local Address :40.3.6.187
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 22 Master IP: 10.10.1.11
```

```
Router# show ptp clock 3 config
Domain/Mode      : 55/OC_SLAVE
Priority 1/2/local : 128/255/128
Profile          : 001b19000100-000000 E2E
Total Ports/Streams : 1 /1
--PTP Port 22, Enet Port 1 ----
Port local Address :40.3.6.189
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 2 : Port 22 Master IP: 10.10.1.11
```

```
Router# show ptp clock 4 config
Domain/Mode      : 55/OC_SLAVE
Priority 1/2/local : 128/255/128
Profile          : 001b19000100-000000 E2E
Total Ports/Streams : 1 /1
--PTP Port 22, Enet Port 1 ----
Port local Address :40.3.6.191
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 6 : Port 22 Master IP: 10.10.1.11
```

```
Router# show ptp clock 5 config
Domain/Mode      : 55/OC_SLAVE
Priority 1/2/local : 128/255/128
Profile          : 001b19000100-000000 E2E
Total Ports/Streams : 1 /1
--PTP Port 22, Enet Port 1 ----
Port local Address :40.3.6.193
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 8 : Port 22 Master IP: 10.10.1.11

Router# show ptp clock 6 config
Domain/Mode       : 55/OC_SLAVE
Priority 1/2/local : 128/255/128
Profile           : 001b19000100-000000 E2E
Total Ports/Streams : 1 /1
--PTP Port 22, Enet Port 1 ----
Port local Address :40.3.6.194
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 10: Port 22 Master IP: 10.10.1.11

```

Associate R-DTI with RPD

To associate the RPD with R-DTI, use the following commands..

```

enable
configure terminal
interface type [slot_#/]port_#
cable rpd node1
identifier badb.ad17.4820 (node vbh0 mac)
core-interface Te7/1/4
rpd-ds 0 downstream-cable 7/0/16 profile 0
rpd-us 0 upstream-cable 7/0/16 profile 0
r-dti 20
rpd-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 | sec r-dti
r-dti 20
r-dti 20
r-dti 20
r-dti 20
r-dti 20
r-dti 20
ptp r-dti 20
profile G.8275.2
ptp-domain 55
clock-port 22
ethernet 1
clock source ip 10.10.1.11

Router# show running-config | sec cable rpd
cable rpd nh13-00
identifier badb.ad17.4820
core-interface Te7/1/4
principal
rpd-ds 0 downstream-cable 7/0/16 profile 0
rpd-us 0 upstream-cable 7/0/16 profile 0
r-dti 20
rpd-event profile 0
cable rpd nh13-01

```

```

identifier badb.ad17.4821
core-interface Te7/1/4
principal
  rpd-ds 0 downstream-cable 7/0/17 profile 0
  rpd-us 0 upstream-cable 7/0/17 profile 0
r-dti 20
rpd-event profile 0
cable rpd nh13-02
identifier badb.ad17.4822
core-interface Te7/1/4
principal
  rpd-ds 0 downstream-cable 7/0/18 profile 0
  rpd-us 0 upstream-cable 7/0/18 profile 0
r-dti 20
rpd-event profile 0
cable rpd nh13-03
identifier badb.ad17.4823
core-interface Te7/1/4
principal
  rpd-ds 0 downstream-cable 7/0/19 profile 0
  rpd-us 0 upstream-cable 7/0/19 profile 0
r-dti 20
rpd-event profile 0
cable rpd nh13-04
identifier badb.ad17.4824
core-interface Te7/1/4
principal
  rpd-ds 0 downstream-cable 7/0/20 profile 0
  rpd-us 0 upstream-cable 7/0/20 profile 0
r-dti 20
rpd-event profile 0
cable rpd nh13-05
identifier badb.ad17.4825
core-interface Te7/1/4
principal
  rpd-ds 0 downstream-cable 7/0/21 profile 0
  rpd-us 0 upstream-cable 7/0/21 profile 0
r-dti 20
rpd-event profile 0

```

Verifying PTP Clock Functioning

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

```

Router#show ptp clock running

```

PTP Ordinary Clock [Domain 55]					
State	Ports	Pkts sent	Pkts rcvd	Redundancy Mode	
PHASE_ALIGNED	1	40979	120805	Hot standby	

```


```

PORT SUMMARY						
Name	Tx Mode	Role	Transport	State	Sessions	PTP Master Port Addr
slave-from-903	unicast	slave	Lo1588	Slave	1	10.10.1.11

Verifying PTP Clock Running Domain

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

```

Router# show ptp clock running domain 55

```

PTP Ordinary Clock [Domain 55]					
State	Ports	Pkts sent	Pkts rcvd	Redundancy Mode	

```

          PHASE_ALIGNED 1          16012          45126          Hot standby
                                PORT SUMMARY
Name      Tx Mode   Role      Transport  State      Sessions  PTP Master
slave-from-903 unicast  slave    Lo1588    Uncalibrated 1      10.10.1.11
                                SESSION INFORMATION
slave-from-903 [Lo1588] [Sessions 1]
Peer addr      Pkts in   Pkts out  In Errs    Out Errs
10.10.1.11    45126    16012    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    : CLOCK_VERIFY
current tod    : 1541653898  Thu Nov  8 05:11:38 2018
active stream  : 0
==stream 0 :
  port id      :          0
  master ip    :    10.10.1.11
  local ip     :    40.3.6.187
  stream state :    PHASE_LOCK
  Master offset :         -698
  Path delay   :    63314
  Forward delay :    62616
  Reverse delay :    62973
  Freq offset  :   -88276
  1Hz offset   :         -34
==stream 2 :
  port id      :          1
  master ip    :    10.10.1.11
  local ip     :    40.3.6.189
  stream state :    PHASE_LOCK
  Master offset :          490
  Path delay   :    72755
  Forward delay :    73471
  Reverse delay :    72039
  Freq offset  :   -85798
  1Hz offset   :   -5123
==stream 4 :
  port id      :          2
  master ip    :    10.10.1.11
  local ip     :    40.3.6.185
  stream state :    PHASE_LOCK
  Master offset :         -604
  Path delay   :    63017
  Forward delay :    62413
  Reverse delay :    62997
  Freq offset  :   -87014
  1Hz offset   :          70
==stream 8 :
  port id      :          4
  master ip    :    10.10.1.11
  local ip     :    40.3.6.193
  stream state :    PHASE_LOCK
  Master offset :          664
  Path delay   :    63231
  Forward delay :    63691
  Reverse delay :    62771
  Freq offset  :   -86365

```



```

1Hz offset : -6

Router# show ptp clock 1 state
apr state : PHASE_LOCK
clock state : CLOCK_VERIFY
current tod : 1541653902 Thu Nov 8 05:11:42 2018
active stream : 0

Router# show ptp clock 2 state
apr state : PHASE_LOCK
clock state : CLOCK_VERIFY
current tod : 1541653906 Thu Nov 8 05:11:46 2018
active stream : 0

Router# show ptp clock 3 state
apr state : PHASE_LOCK
clock state : CLOCK_VERIFY
current tod : 1541653909 Thu Nov 8 05:11:49 2018
active stream : 0

Router# show ptp clock 4 state
apr state : PHASE_LOCK
clock state : CLOCK_VERIFY
current tod : 1541653912 Thu Nov 8 05:11:52 2018
active stream : 0

Router# show ptp clock 5 state
apr state : PHASE_LOCK
clock state : CLOCK_VERIFY
current tod : 1541653918 Thu Nov 8 05:11:58 2018
active stream : 0

Router# show ptp clock 6 state
apr state : PHASE_LOCK
clock state : CLOCK_VERIFY
current tod : 1541653920 Thu Nov 8 05:12:00 2018
active stream : 0

```

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 7 :
    2@0-01:12:30.128          1@0-01:11:03.722          3@0-00:31:02.762
    2@0-00:06:42.742        1@0-00:06:23.496          0@0-00:05:25.894
    4@0-00:05:07.269
ClockState 3 :
    3@0-00:06:50.180          2@0-00:06:43.180          1@0-00:06:42.697
BstPktStrm 1 :
    0@0-00:05:01.875
SetTime 1 :
    1000000000@0-00:05:05.337
StepTime 1 :
    72273313@0-00:05:57.337
AdjustTime 124 :
    -312@0-03:06:25.962          3@0-03:05:24.961          -50@0-03:04:23.961
    238@0-03:03:22.961          19@0-03:02:21.961          -106@0-03:01:20.961
    -48@0-03:00:19.961          211@0-02:59:18.961          54@0-02:58:17.962
streamId  msgType      rx      rxProcessed  lost      tx
0          SYNC           41030   41030         0          0
0          DELAY REQUEST  0        0             0         41031

```

Verifying Time Sync Statistics

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	41028	41028	4294891017	0
0	P-DELAY FOLLOWUP	0	0	0	0
0	ANNOUNCE	2565	2565	0	0
0	SIGNALING	27	27	0	27
0	MANAGEMENT	0	0	0	0
	TOTAL	84650	84650	4294891017	41058
2	SYNC	40980	40980	0	0
2	DELAY REQUEST	0	0	0	40981
2	P-DELAY REQUEST	0	0	0	0
2	P-DELAY RESPONSE	0	0	0	0
2	FOLLOW UP	0	0	0	0
2	DELAY RESPONSE	40608	40608	4294891243	0
2	P-DELAY FOLLOWUP	0	0	0	0
2	ANNOUNCE	2561	2561	0	0
2	SIGNALING	27	27	0	27
2	MANAGEMENT	0	0	0	0
	TOTAL	84176	84176	4294891243	41008
4	SYNC	41074	41074	0	0
4	DELAY REQUEST	0	0	0	41074
4	P-DELAY REQUEST	0	0	0	0
4	P-DELAY RESPONSE	0	0	0	0
4	FOLLOW UP	0	0	0	0
4	DELAY RESPONSE	41072	41072	4294891140	0
4	P-DELAY FOLLOWUP	0	0	0	0
4	ANNOUNCE	2567	2567	0	0
4	SIGNALING	27	27	0	27
4	MANAGEMENT	0	0	0	0
	TOTAL	84740	84740	4294891140	41101
6	SYNC	0	0	0	0
6	DELAY REQUEST	0	0	0	0
6	P-DELAY REQUEST	0	0	0	0
6	P-DELAY RESPONSE	0	0	0	0
6	FOLLOW UP	0	0	0	0
6	DELAY RESPONSE	0	0	0	0
6	P-DELAY FOLLOWUP	0	0	0	0
6	ANNOUNCE	2609	2609	0	0
6	SIGNALING	9	9	0	9
6	MANAGEMENT	0	0	0	0
	TOTAL	2618	2618	0	9
8	SYNC	40902	40902	0	0
8	DELAY REQUEST	0	0	0	40903
8	P-DELAY REQUEST	0	0	0	0
8	P-DELAY RESPONSE	0	0	0	0
8	FOLLOW UP	0	0	0	0
8	DELAY RESPONSE	38773	38773	4294892784	0
8	P-DELAY FOLLOWUP	0	0	0	0
8	ANNOUNCE	2556	2556	0	0
8	SIGNALING	27	27	0	27
8	MANAGEMENT	0	0	0	0
	TOTAL	82258	82258	4294892784	40930
10	SYNC	0	0	0	0
10	DELAY REQUEST	0	0	0	0
10	P-DELAY REQUEST	0	0	0	0
10	P-DELAY RESPONSE	0	0	0	0
10	FOLLOW UP	0	0	0	0
10	DELAY RESPONSE	0	0	0	0
10	P-DELAY FOLLOWUP	0	0	0	0
10	ANNOUNCE	2598	2598	0	0
10	SIGNALING	9	9	0	9
10	MANAGEMENT	0	0	0	0
	TOTAL	2607	2607	0	9

Configuration Examples

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

Example: Configuring Time Interface and PTP Domain

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

```
enable
configure terminal
interface Loopback1588
ip address 100.100.100.40 255.255.255.255

interface TenGigabitEthernet4/1/7.1 (connect to PTP master)
ip address 100.100.10.92 255.255.255.0
route 10.10.10.11 255.255.255.224 192.168.0.12 (route to PTP master loopback ip)
ptp clock ordinary domain 55 (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 master loopback ip)
```

Example: Configure RPD PTP Connection

The following example shows how to configure RPD PTP connection:

```
enable
configure terminal
ptp r-dti 20
profile G.8275.2
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 badb.ad17.4820 (node vbh0 mac)
  core-interface Te7/1/4
  rpd-ds 0 downstream-cable 7/0/16 profile 0
  rpd-us 0 upstream-cable 7/0/16 profile 0
r-dti 20
rpd-event profile 0
```

Feature Information for Synchronizing Time on Cisco Smart PHY 7200

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 3: Feature Information for Synchronizing Time on Cisco Smart PHY 7200

Feature Name	Releases	Feature Information
Synchronizing Time	Cisco Smart PHY 7200 Software 1.x	This feature was introduced on the Cisco Smart PHY 7200.