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.

- Hardware Compatibility Matrix for Cisco Remote PHY Device, page 1
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Hardware Compatibility Matrix for Cisco Remote PHY Device

**Note**

The hardware components introduced in a given Cisco Remote PHY Device Software Release are supported in all subsequent releases unless otherwise specified.

<table>
<thead>
<tr>
<th>Cisco HFC Platform</th>
<th>Remote PHY Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco GS7000 Node</td>
<td>Cisco 1x2 RPD Software 1.1 and Later Releases</td>
</tr>
<tr>
<td></td>
<td>Cisco Remote PHY Device 1x2</td>
</tr>
<tr>
<td></td>
<td>• PID—RPD-1X2=</td>
</tr>
</tbody>
</table>
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.

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.

- Cisco cBR does not support the following components for this feature:
  - PTP on port-channels
  - G.8275.2 profile

- Cisco cBR and RPD do not support PTP over IPv6
- Cisco cBR supports only the PTP slave on SUP-PIC

How to Configure Time Synchronization

To know more about the commands referenced in this module, see the Cisco IOS Master Command List.
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 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Value Range</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ptp r-dti [id]</td>
<td></td>
<td>1-64</td>
<td></td>
</tr>
<tr>
<td>description</td>
<td>R-DTI name or description</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ptp-domain [id]</td>
<td>Domain number of IEEE 1588</td>
<td>0-127</td>
<td></td>
</tr>
<tr>
<td>local-priority</td>
<td>Set local priority</td>
<td>128</td>
<td>128</td>
</tr>
<tr>
<td>priority1 [value]</td>
<td>Set priority1</td>
<td>0-255</td>
<td>128</td>
</tr>
<tr>
<td>priority2 [value]</td>
<td>Set priority2</td>
<td>0-255</td>
<td>255</td>
</tr>
<tr>
<td>mode [value]</td>
<td>R-DTI mode</td>
<td>other, slave master</td>
<td>slave</td>
</tr>
<tr>
<td>profile [value]</td>
<td>Set PTP ITU-T profile</td>
<td>default/G.8275.2</td>
<td>default</td>
</tr>
<tr>
<td>clock-port [id]</td>
<td>Configure clock port</td>
<td>1-32</td>
<td></td>
</tr>
<tr>
<td>state [value]</td>
<td>Set Ethernet port admin status</td>
<td>other, up, down, testing</td>
<td>up</td>
</tr>
<tr>
<td>ethenet [value]</td>
<td>Set Ethernet port for clock port</td>
<td>0-32</td>
<td>The default value is clock port index</td>
</tr>
</tbody>
</table>
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 PHASE_ALIGNED Pkts sent Pkts rcvd Redundancy Mode
Port ADDR 1 3687693 11177073 Hot standby
```

```
PORT SUMMARY
PTP Master
Name Tx Mode Role Transport State Sessions Port Addr
```
Configure RPD PTP Connection

To configure RPD PTP connection, use the following commands.

```plaintext
enable
configure terminal
interface type [slot_#]/port_
ptp r-dti 1 (RPD PTP connection)
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:

```plaintext
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 Inteval : -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-DTI the local prefix SID associated to the segment ID, use the following commands.

```plaintext
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
```

Verifying Associating R-DTI with RPD

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

```plaintext
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 ipcl log-history 0
platform punt-policer 10 10
platform punt-policer 10 10 high
platform punt-policer 80 10
platform punt-sbrl 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 Lo1588 negotiation
clock source 10.10.10.11
clock source 192.168.0.0
clock-port master-local master
transport ipv4 unicast interface Lo1588 negotiation
!
-----
rdti 2
rpd-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 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
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:
   200-00:00:00:51.568 180-00:00:06:41.930 080-00:00:04:17.925
   480-00:00:03:58.724
ClockState 5:
   580-00:07:12.640 480-00:07:10.182 380-00:07:06.825
   280-00:06:51.825 180-00:06:51.530
BestPktStrm 1:
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
cfg terminal
interface Loopback1588
ip address 10.10.10.11 255.255.255.224

interface TenGigabitEthernet5/1/3 (connect to PTP master)
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 master 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 10.10.11.11 (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 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
```

Feature Information for Synchronizing Time on R-PHY Devices

Use Cisco Feature Navigator to find information about 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 http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note

The table below lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.
<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronizing Time on R-PHY Devices</td>
<td>Cisco 1x2 RPD Software 1.1</td>
<td>This feature was introduced on the Cisco Remote PHY Device.</td>
</tr>
</tbody>
</table>