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>
<thead>
<tr>
<th>Cisco HFC Platform</th>
<th>Remote PHY Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco GS7000 Super High Output Node</td>
<td>Cisco 1x2 / Compact Shelf RPD Software 2.1 and Later Releases</td>
</tr>
<tr>
<td></td>
<td>Cisco Remote PHY Device 1x2</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cisco 1x2 / Compact Shelf RPD Software 2.1a and Later Releases</td>
</tr>
<tr>
<td></td>
<td>Cisco Remote PHY Device 1x2</td>
</tr>
<tr>
<td></td>
<td></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-8.

- Cisco cBR-8 supports PTP slave 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

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
clock source <PTP master loopback IP Address>

sync interval -5
sync one-step
transport ipv4 unicast interface Lo1588 negotiation
```

The following table explains the parameters used in this example:

<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>R-DTI name or description</td>
<td>1-64</td>
<td></td>
</tr>
<tr>
<td>description</td>
<td>Domain number of IEEE 1588</td>
<td>0-127</td>
<td></td>
</tr>
<tr>
<td>local-priority [value]</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>
</tbody>
</table>
## Verifying Time Interface and PTP Domain Configuration

The following example shows how to verify the 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>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>ethernet [value]</td>
<td>Set Ethernet port for clock port</td>
<td>0-32</td>
<td>The default value is clock port index</td>
</tr>
<tr>
<td>clock source [ip] gateway [ip]</td>
<td>Set clock address</td>
<td>ipv4 address, ipv6 address</td>
<td></td>
</tr>
<tr>
<td>clock alternate-first</td>
<td>Select alternate source first</td>
<td></td>
<td></td>
</tr>
<tr>
<td>transport [value]</td>
<td>Set transport encapsulation</td>
<td>other, ipv4, ipv6</td>
<td>ipv4</td>
</tr>
<tr>
<td>transport cos [value]</td>
<td>COS of 802.1Q</td>
<td>0-7</td>
<td>6</td>
</tr>
<tr>
<td>transport dscp [value]</td>
<td>DSCP of IP differentiated services</td>
<td>0-63</td>
<td>47</td>
</tr>
<tr>
<td>local-priority [value]</td>
<td>Set local priority</td>
<td>1-255</td>
<td>128</td>
</tr>
<tr>
<td>sync interval [value]</td>
<td>Set an interval for sync packets</td>
<td>0-7(-7 -0)</td>
<td></td>
</tr>
<tr>
<td>announce interval [value]</td>
<td>Set an interval for announcement packets</td>
<td>0-3(-3 -0)</td>
<td></td>
</tr>
<tr>
<td>delay-req interval [value]</td>
<td>Set an interval for PTP delay-req packets0-7(-7 -0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>announce timeout [value]</td>
<td>Set timeout interval for announcement packets</td>
<td>3-255</td>
<td></td>
</tr>
<tr>
<td>unicast grant-duration [value]</td>
<td>Set the grant duration time in seconds for unicast</td>
<td>60-1000</td>
<td>300</td>
</tr>
<tr>
<td>description</td>
<td>Clock port name or description</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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
  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_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 Interval : -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.

```
enable
configure terminal
interface type [slot_#/]port_
cable rpd node1
```
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 ipcl log-history 0
platform punt-policer 10 10
platform punt-policer 10 10 high
platform punt-policer 80 10
platform punt-abr1 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
!
-----
r-dti 2
 rpd-event profile 0
 rpd-55di-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
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: 5%
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
Name          Tx Mode Role        Transport State Sessions Port Addr
slave-from-903  unicast slave    L01588 Slave 2 10.10.10.11
```

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:

```
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
```
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 :
200-00:00:51.568 100-00:06:41.930 000-00:04:17.925
400-00:03:58.724
ClockState 5 :
500-00:07:12.640 400-00:07:10.182 300-00:07:06.825
200-00:06:51.825 100-00:06:51.530
BstPktStrm 1 :
000-00:06:42.029
SetTime 1 :
100000000000-00:00:04:00.045
StepTime 1 :
1251267580-00:06:14.670
AdjustTime 64 :
StreamId msgType rx rxProcessed lost tx
0 000 433439 433439 4294574083 0
0 010 0 0 0 433439
0 00 0 0 0 0
0 000 433437 433437 4294548766 0
0 000 0 0 0 0
0 000 433437 433437 4294548766 0
0 000 0 0 0 0
0 000 27098 27098 0 0
0 000 285 285 0 0
0 000 0 0 0 0
TOTAL 894259 894259 8589122849 433724
1 100 433435 433435 4294574085 0
1 100 0 0 0 433439
1 100 0 0 0 0

Synchronizing Time on Cisco Remote PHY Devices
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 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 10.10.1.11 (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 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
```
Example: Associate R-DTI with RPD

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

```bash
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 [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn) link. An account on the Cisco.com page is not required.

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>
<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 / Compact Shelf RPD Software 3.1</td>
<td>This feature was integrated into the Cisco Remote PHY Device.</td>
</tr>
</tbody>
</table>