Cisco Remote PHY Device IPv6

Finding Feature Information

Your software release may not support all the features that are documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. The Feature Information Table at the end of this document provides information about the documented features and lists the releases in which each feature is supported.

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 Remote PHY Device 1x2 • PID—RPD-1X2= **Cisco 1x2 / Compact Shelf RPD Software 2.1a and Later Releases** Cisco Remote PHY Device 1x2 • PID—RPD-1X2-PKEY=

Cisco HFC Platform	Remote PHY Device
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 • 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 RPD IPv6

The CableLabs' MHAv2 standards requires CCAP Core and RPD must support both IPv4 and IPv6, which means the Remote PHY Signaling between the CCAP Core and RPD is able to run on both IPv4 and IPv6 networks.

Note
- CCAP Core can support IPv4/IPv6 dual stack.
- RPD can support either IPv4 or IPv6 network.
- RPD does not support IPv4/IPv6 Dual Stack at the same time.
- RPD will try IPv6 connection first. When DHCPv6 failed, RPD will try DHCPv4.
- For single RPD, all the server addresses, protocols to communicate with it must be in the same IP version.

Configure RPD IPv6 Unicast Online

This section describes how to configure RPD IPv6 Unicast Online on Cisco cBR-8.

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

Configure Unicast IPv6

To configure Unicast IPv6, complete the following procedure:

1. Enable IPv6 unicast routing.

```
configure terminal
ipv6 unicast-routing
```

2. Configure IPv6 Address on DPIC interface.

```
configure terminal
interface TenGigabitEthernet slot/1/port
ipv6 enable
ipv6 address ipv6_address
```

Configure RPD core interface

To configure RPD core interface, complete the following procedure:

```
configure terminal
cable rpd name
identifier rpd_mac
core-interface tenG_interface
principal
rpd-ds id downstream-cable controller profile id
rpd-us id upstream-cable controller profile id
```

Configure IPv6 PTP Clock Option

To configure the IPv6 PTP Clock Option, complete the following procedure:

1. Configure CBR as PTP slave, see the configuration example below:

```
configure terminal
    interface Loopback1588
        ip address 158.158.158.5 255.255.255.255
    ptp clock ordinary 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 Lo15888 negotiation
        clock source 10.90.3.93
```

Note CCAP-Core as PTP slave can only support IPv4.

2. Configure R-DTI for RPD PTP IPv6.

```
configure terminal
ptp r-dti number
ptp-domain domain
clock-port number
ethernet number
transport ipv6
clock source ipv6 address gateway ipv6 geteway
```

Note

- PTP domain and 1588 master have same domain number.
- Clock source IPv6 address is 1588 master IPv6 address.
- Gateway is next hop to 1588 master, and it is optional.
- For RPD, ethernet 1=vbh0, ethernet 2=vbh1, ethernet 0 will choose either vbh0 or vbh1 which is functional as clock-port.

3. Associate R-DTI with RPD configuration.

```
configure terminal
cable rpd id
r-dti number
```

Verify IPv6 PTP Clock Option Configuration

To display the CBR PTP Status, use the **show ptp clock running** command as shown in the example below:

```
Router# show ptp clock running
Load for five secs: 6%/2%; one minute: 7%; five minutes: 8%
No time source, *05:11:13.610 UTC Sun Oct 22 2017
PTP Ordinary Clock [Domain 0]
         State          Ports          Pkts sent      Pkts rcvd      Redundancy Mode
         PHASE_ALIGNED  1              2478203        7512533        Hot standby
                              PORT SUMMARY
                                                                                PTP Master
Name           Tx Mode      Role         Transport    State        Sessions     Port Addr

slave-from-903 unicast      slave        Lo15888      Slave        1            10.90.3.93
```

To display the RPD PTP Status, use the **show ptp clock** command as shown in the example below:

```
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  /1
--PTP Port  23, Enet Port   1 ----
  Port local Address :2001:120:102:70:7:1b71:476c:70ba
  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 23 Master IP: 2001:10:90:3::93

Router# show ptp clock 0 state
apr state       : PHASE_LOCK
clock state     : SUB_SYNC
current tod     : 1508640223   Sun Oct 22 02:43:43 2017
active stream   : 0
==stream    0   :
  port id       :                0
  master ip     : 2001:10:90:3::93
  stream state  :       PHASE_LOCK
  Master offset :             3490
  Path    delay :           -27209
```

```
  Forward delay :           -27333
  Reverse delay :           -27085
  Freq offset   :          6544364
  1Hz  offset   :               49

Router# show ptp clock 0 statistics
 AprState    4  :
           2@0-00:06:25.027          1@0-00:06:15.382          0@0-00:03:51.377
           4@0-00:03:32.176
 ClockState  5  :
           5@0-00:06:36.141          4@0-00:06:33.684          3@0-00:06:30.510
           2@0-00:06:25.512          1@0-00:06:24.982
 BstPktStrm  1  :
           0@0-00:06:15.987
 StepTime    1  :
   908222863@0-00:05:42.199
 AdjustTime  2589       :
        -339@1-20:18:42.949       -321@1-20:17:41.949         49@1-20:16:40.949
         145@1-20:15:39.949          6@1-20:14:38.949        261@1-20:13:37.949
         327@1-20:12:36.949         76@1-20:11:35.949        157@1-20:10:34.949
streamId  msgType           rx          rxProcessed     lost        tx
 0        SYNC              2549177     2549177         4292476931  0
 0        DELAY REQUEST     0           0               0           2549150
 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    2549144     2549144         4292476934  0
 0        P-DELAY FOLLOWUP  0           0               0           0
 0        ANNOUNCE          159330      159330          4294836225  0
 0        SIGNALING         1662        1662            0           1663
 0        MANAGEMENT        0           0               0           0
   TOTAL                    5259313     5259313         12879790090 2550813
```

Verify RPD IPv6 Configuration

To display the RPD IPv6 Status, use the **show cable rpd ipv6** command as shown in the example below:

```
Router# show cable rpd ipv6
Load for five secs: 7%/2%; one minute: 9%; five minutes: 8%
No time source, *14:03:13.622 UTC Sun Oct 22 2017
MAC Address     I/F       State        Role HA  Auth IP Address
0004.9f03.0226  Te0/1/6   online       Pri  Act N/A  2001:120:102:70:7:1B71:476C:70BA
0004.9f03.0232  Te0/1/7   online       Pri  Act N/A  ---
0004.9f03.0256  Te0/1/2   online       Pri  Act N/A  2001:120:102:70:3:830A:FAEA:CF7E
0004.9f03.0268  Te0/1/6   online       Pri  Act N/A  2001:120:102:70:7:41F1:7CCD:4475
0004.9f03.0268  Te6/1/6   online       Aux  Act N/A  2001:120:102:70:7:41F1:7CCD:4475
badb.ad13.5d7e  Te0/1/2   online       Pri  Act N/A  2001:120:102:70:3:FF46:1FF9:29FE
```

Configure IPv6 DS Splitting

This section describes how to configure RPD IPv6 DS splitting on Cisco cBR-8. In this configuration, different RPDs share the same DS SG traffic. For each DS sharing controller, one unique IPv6 multicast IP is assigned according to multicast pool. When RPD is IPv6 online, all DS sharing Controller associated multicast IPs are IPv6 type. Multiple DS controllers used by one RPD core must be either IPv4 or IPv6 and cannot be mixed. RPD sharing same DS Controller must only be IPv4 or IPv6 online and cannot be mixed. Multiple RPD cores in one RPD must only be IPv4 or IPv6 online and cannot be mixed.

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

Configure the multicast IPv6 DEPI pool

To configure multicast IPv6 DEPI pool, complete the following procedure:

```
configure terminal
cable depi multicast pool id
ipv6 address ip/prefix
```

Enable Multicast Sharing under Downstream Controller Profile

To configure Unicast IPV6, complete the following procedure (same as IPv4 downstream splitting):

```
configure terminal
cable downstream controller-profile id
multicast-pool id
```

Configure the RPD with the Same Downstream Controller and Profile

To configure the RPDs with the same downstream controller and profile, complete the procedure as shown in the example below (same as IPv4 downstream splitting):

```
configure terminal
    cable rpd node_1
        core-interface tenGigabitEthernet 9/1/0
               rpd-ds 0 controller downstream-cable 9/0/0 profile 0
               rpd-us 0 controller upstream-cable 9/0/0 profile 221
    cable rpd node_2
        core-interface tenGigabitEthernet 9/1/0
               rpd-ds 0 controller downstream-cable 9/0/0 profile 0
               rpd-us 0 controller upstream-cable 9/0/0 profile 221
```

Configure the RPDs to different fiber-nodes

To configure the RPDs to different fiber-nodes, complete the procedure as shown in the example below (same as IPv4 downstream splitting):

```
configure terminal
    cable fiber-node 100
           downstream Downstream-Cable 9/0/0
            upstream Upstream-Cable 9/0/0
    cable fiber-node 101
           downstream Downstream-Cable 9/0/0
            upstream Upstream-Cable 9/0/1
```

Configure the RPDs to MAC Domain

To configure the RPDs to the MAC domain, complete the procedure as shown in the example below (same as IPv4 downstream splitting):

```
configure terminal
    interface Cable9/0/0
        downstream Downstream-Cable 9/0/0 rf-channel 0
        downstream Downstream-Cable 9/0/0 rf-channel 8
        upstream 0 Upstream-Cable 9/0/0 us-channel 0
        upstream 1 Upstream-Cable 9/0/0 us-channel 1
        upstream 2 Upstream-Cable 9/0/0 us-channel 2
        upstream 3 Upstream-Cable 9/0/0 us-channel 3
        upstream 4 Upstream-Cable 9/0/1 us-channel 0
        upstream 5 Upstream-Cable 9/0/1 us-channel 1
        upstream 6 Upstream-Cable 9/0/1 us-channel 2
        upstream 7 Upstream-Cable 9/0/1 us-channel 3
        cable upstream bonding-group 1
          upstream 0
          upstream 1
          upstream 2
          upstream 3
          attributes 800000F0
        cable upstream bonding-group 2
          upstream 4
          upstream 5
          upstream 6
          upstream 7
          attributes 8000000F
```

Or use the following example (same as IPv4 downstream splitting):

```
configure terminal
    interface Cable9/0/0
        downstream Downstream-Cable 9/0/0 rf-channel 0
        upstream 0 Upstream-Cable 9/0/0 us-channel 0
        upstream 1 Upstream-Cable 9/0/0 us-channel 1
        upstream 2 Upstream-Cable 9/0/0 us-channel 2
        upstream 3 Upstream-Cable 9/0/0 us-channel 3
        cable upstream bonding-group 1
          upstream 0
          upstream 1
          upstream 2
          upstream 3
          attributes 800000F0
configure terminal
    interface Cable9/0/1
        downstream Downstream-Cable 9/0/0 rf-channel 8
        upstream 0 Upstream-Cable 9/0/1 us-channel 0
        upstream 1 Upstream-Cable 9/0/1 us-channel 1
        upstream 2 Upstream-Cable 9/0/1 us-channel 2
        upstream 3 Upstream-Cable 9/0/1 us-channel 3
        cable upstream bonding-group 1
          upstream 0
          upstream 1
          upstream 2
          upstream 3
          attributes 800000F0
```

Enable IPv6 multicast on Cisco cBR-8 Router

To enable the IPv6 multicast on cBR-8, complete the following procedure:

```
configure terminal
ipv6 multicast-routing
```

If cBR-8 and RPD are connected in L2 network, we recommend to enable MLD Snooping in L2 switches.

Verify the IPv6 DS Splitting Configuration

To display the IPv6 multicast DEPI pool, use the **show cable depi multicast pool ipv6** command as shown in the example below:

```
Router# show cable depi multicast pool ipv6
Load for five secs: 8%/2%; one minute: 7%; five minutes: 8%
No time source, *06:57:11.898 UTC Sun Oct 22 2017
POOL ID    IPv6                                          DESCRIPTION
22         FF3B::8000:0/100
50         FF3A::8000:0/126                              zyq
100        FF39::8000:0/120                              zyq
Infra_C05#show cable depi multicast pool ipv6 id 22
Load for five secs: 8%/2%; one minute: 8%; five minutes: 8%
No time source, *07:00:03.577 UTC Sun Oct 22 2017
POOL ID    IPv6                                          DESCRIPTION
22         FF3B::8000:0/100
```

To display the assigned IPv6 multicast address, use the **show cable depi multicast ipv6** command as shown in the example below:

```
Router# show cable depi multicast ipv6 all
Load for five secs: 10%/3%; one minute: 8%; five minutes: 8%
No time source, *07:01:33.659 UTC Sun Oct 22 2017
IPv6                                          POOL ID    CONTROLLER
FF3A::8000:0                                  50         9/0/2(291)
FF3A::8000:1                                  50         9/0/28(317)
FF39::8000:0                                  100        9/0/29(318)
FF3A::8000:2                                  50         9/0/30(319)
Infra_C05#show cable depi multicast ipv6 FF3A::8000:0
Load for five secs: 7%/2%; one minute: 8%; five minutes: 8%
No time source, *07:01:44.020 UTC Sun Oct 22 2017
IPv6                                          POOL ID    CONTROLLER
FF3A::8000:0                                  50         9/0/2(291)
```

To display the relationship between the downstream controller profile and IPv6 multicast Pool, use the **show cable downstream controller-profile** command as shown in the example below:

```
Router# show cable downstream controller-profile 100
Load for five secs: 24%/3%; one minute: 10%; five minutes: 8%
No time source, *07:10:28.074 UTC Sun Oct 22 2017

Downstream controller-profile 100, type RPHY
Description:
Downstream controller-profile 100 is being used by controller Downstream-Cable:
  0/0/30,
  Admin:  UP
  MaxOfdmSpectrum: 192000000
  MaxCarrier: 158
  Mode: normal
  Free freq block list has 3 blocks:
    45000000  - 449999999
    594000000 - 602999999
    795000000 - 1217999999
  DS Splitting: Yes
  Multicast Pool ID: 50
  OFDM frequency exclusion bands: None

Configured RF Channels:
Chan Admin Frequency  Type        Annex Mod  srate Qam-profile  dcid  output
 0    UP   453000000  DOCSIS       B    256   5361  1           1     NORMAL
 1    UP   459000000  DOCSIS       B    256   5361  1           2     NORMAL
 2    UP   465000000  DOCSIS       B    256   5361  1           3     NORMAL
```

To display the RPD associated with the downstream controller, use the **show controllers downstream-Cable** command as shown in the example below:

```
Router# show controllers downstream-Cable 9/0/2 rpd
Load for five secs: 8%/2%; one minute: 9%; five minutes: 8%
No time source, *07:14:20.326 UTC Sun Oct 22 2017
Controller RPD DS Port List:(2 of 2)
  RPD ID           I/F       Name
  ---------------- --------- ----------------
  badb.ad13.5d7e   Te9/1/2   node_3
  0004.9f03.0256   Te9/1/2   node_5
```

When the DS Controller IPv4/IPv6 type and the RPD IPv4/IPv6 online type conflicts, the RPD log prompts the confliction as shown in the example below:

```
Router# show cable rpd 0004.9f00.0979 Te3/1/0 log reverse
RPD ID I/F Severity Time LOG INFORMATION
---------------- ---------- ------------ ----------------------
-----------------------------------------
0004.9f00.0979 Te3/1/0 ERROR
2017-09-23 21:44:52.851 RPD 0004.9f00.0979 CoreTe 3/1/0 reset connection due to unmatched
IPv4/IPv6 between GCP connection(IPv6) and Downstream Sharing Controllers 3/1/0(IPv4)
0004.9f00.0979 Te3/1/0 ERROR
2017-09-23 21:44:50.817 RPD 0004.9f00.0979 CoreTe 3/1/0 reset connection due to unmatched
IPv4/IPv6 between GCP connection(IPv6) and Downstream Sharing Controllers 3/1/0(IPv4)
```

Feature Information for Remote-PHY Device IPv6

The following table provides release information about the feature or features described in this module. This table 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.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2: Feature Information for Remote-PHY Device IPv6

Feature Name	Releases	Feature Information
Remote-PHY Device IPv6	Cisco 1x2 / Compact Shelf RPD Software 3.1	This feature was introduced on the Cisco Remote PHY Device.