



# Configuring Cloud Native BNG User Plane and Key Features

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This chapter describes the configuration procedures to achieve the cnBNG user plane functionality on Cisco ASR 9000 Series Routers.

For details on cnBNG user plane commands, see the *Cloud Native BNG Command Reference for Cisco ASR 9000 Series Routers*.

- [Configure cnBNG User Plane, on page 1](#)
- [Verify cnBNG User Plane Configuration, on page 9](#)

## Configure cnBNG User Plane

### Before you begin:

You must follow these guidelines for configuring cnBNG user plane:

- You must perform a complete reimage followed by a reboot of the router if you are switching between physical BNG to cnBNG, or the other way around.
- Ensure that the cnBNG package is installed and activated on the user plane. See the *Installing Cloud Native BNG User Plane Packages* chapter for detailed procedure.
- The system does not support the removal of configurations while active sessions are present. You must delete all active sessions and dissociate the CP-UP connection prior to any configuration change or commit replace procedure.

### Configuration Procedure

You must perform the following tasks for the UP to spawn the NAL process, to establish connection with the CP, and to provision the subscriber requests.

## Configure Basic User Plane Settings

The basic user plane configuration for cnBNG involves these high-level tasks:

## Configure Basic User Plane Settings

- Configuring the server endpoints of CP to which UP can send PFCP or GTP-U messages to enable cnBNG on the router.
- Configuring a loopback interface for each VRF.
- Configuring a route tag for subscriber summary routes.
- Configuring the access-interface to enable IPoE and PPPoE subscribers.

The cnBNG endpoint configurations on the UP are delivered to the cnBNG SPA component for initiating connection with the CP.

### Configuration Procedure

This section describes the steps for the basic user plane configuration, which include certain mandatory and optional configurations.

#### Mandatory Configurations:

- Specifying a unique name for the UP-server instance.
- Specifying the details of the UP server (such as IP address, GTP port, and PFCP port) to which the CP can send PFCP or GTP-U messages.
- Specifying the details of CP server to which the UP can send PFCP or GTP-U messages.
- Specifying the retry count for CP-UP association.
- Enabling secondary address programming.
- Specifying a name for the auto-loopback VRF.
- Configuring a loopback interface to associate with the above VRF.
- Specifying a primary address for the loopback interface.

#### Optional Configuration:

- Configuring a route summary tag for the routes to add in the routing table

### Configuration Example

```
Router#configure
Router(config)#cnbng-nal location 0/RSP0/CPU0
Router(config-cnbng-nal-local)#hostidentifier asr9k-1
Router(config-cnbng-nal-local)#cp-server primary ipv4 198.51.100.1
Router(config-cnbng-nal-local)#up-server ipv4 192.0.2.1 gtp-port 15002 pfcp-port 15003 vrf
    default
Router(config-cnbng-nal-local)#secondary-address-update-enable
Router(config-cnbng-nal-local)#cp-association retry-count 10
Router(config-cnbng-nal-local)#auto-loopback vrf test
Router(config-cnbng-nal-local-auto-loopback-vrf)#interface Loopback2
Router(config-cnbng-nal-local-auto-loopback-vrf-int)#primary-address 127.0.0.1
Router(config-cnbng-nal-local-auto-loopback-vrf-int)#exit
Router(config-cnbng-nal-local-auto-loopback-vrf)#exit
/* Auto-loopback configuration for default VRF */
Router(config-cnbng-nal-local)#auto-loopback vrf default
Router(config-cnbng-nal-local-auto-loopback-vrf)#interface Loopback1
Router(config-cnbng-nal-local-auto-loopback-vrf-int)#primary-address 10.0.0.1
```

```

Router(config-cnbng-nal-local-auto-loopback-vrf-int)#exit
Router(config-cnbng-nal-local-auto-loopback-vrf)#exit
Router(config-cnbng-nal-local)#route-summary tag 4
Router(config-cnbng-nal-local)#commit

```

## Running Configuration

```

Router#show running-config cnbng-nal location 0/RSP0/CPU0
cnbng-nal location 0/RSP0/CPU0
  hostidentifier asr9k-1
    up-server ipv4 192.0.2.1 vrf default
      gtp-port 15002
      pfcp-port 15003
    cp-server primary ipv4 198.51.100.1
    secondary-address-update-enable
    cp-association retry-count 10
    auto-loopback vrf test
      interface Loopback2
        primary-address 127.0.0.1
      !
    !
    auto-loopback vrf default
      interface Loopback1
        primary-address 10.0.0.1
      !
    !
  route-summary tag 4
  !

```

# Configure Access-Interface

This section describes how to configure the access-interface and to enable PPPoE on the cnBNG user plane.

## Configuration Example

```

Router#configure
Router(config)#interface Bundle-Ether1.1
Router(config-subif)#ipv4 point-to-point
Router(config-subif)#ipv4 unnumbered Loopback1
Router(config-subif)#ipv6 enable
Router(config-subif)#encapsulation dot1q 1
Router(config-subif)#ipsubscriber
Router(config-cnbng-nal-ipsub)#ipv4 12-connected
Router(config-cnbng-nal-ipsub-12conn)#initiator dhcp
Router(config-cnbng-nal-ipsub-12conn)#exit
Router(config-cnbng-nal-ipsub)#ipv6 12-connected
Router(config-cnbng-nal-ipsub-ipv6-12conn)#initiator dhcp
Router(config-cnbng-nal-ipsub-ipv6-12conn)#exit
Router(config-cnbng-nal-ipsub)#exit

/* Enable PPPoE */
Router(config-subif)#pppoe enable
Router(config-subif)#commit

```

**Running Configuration**

```
Router#show running-config interface b1.1
interface Bundle-Ether1.1
  ipv4 point-to-point
  ipv4 unnumbered Loopback1
  ipv6 enable
  encapsulation dot1q 1
  ipsubscriber
    ipv4 12-connected
      initiator dhcp
    !
    ipv6 12-connected
      initiator dhcp
    !
  !
  pppoe enable
!
```

**Configure Loopback Interface**

This section describes how to configure the loopback interface for cnBNG user plane.



**Note** You must not configure any IP address under loopback interface.

**Configuration Example**

```
Router#configure
Router(config)#interface loopback 2
Router(config-if)#ipv6 enable
Router(config-if)#commit
```

**Running Configuration**

```
Router#show running-config interface loopback 2
interface Loopback2
  ipv6 enable
!
```

**Configure DHCP**

This section describes the steps to configure DHCP for cnBNG BNG user plane.

The basic DHCP configurations include these steps:

- Creating a cnBNG profile
- Assigning the cnBNG profile to access-interfaces

## Configuration Example

```
Router(config)#dhcp ipv4
/* Create a cnBNG profile */
Router(config-dhcpv4)#profile cnbng_1 cnbng
Router(config-dhcpv4-cnbng-profile)#exit
/* Assign the cnBNG profile to access-interfaces */
Router(config-dhcpv4)#interface bundle-Ether 1.1 cnbng profile cnbng_1
Router(config-dhcpv4)#interface bundle-Ether 2.1 cnbng profile cnbng_1
Router(config-dhcpv4)#commit
```

Similarly, you can configure the DHCP IPv6 profiles.

## Running Configuration

```
Router#show run dhcp ipv4
Wed Oct 14 16:48:56.814 UTC
dhcp ipv4
  profile cnbng_1 cnbng
  !
  interface Bundle-Ether1.1 cnbng profile cnbng_1
  interface Bundle-Ether2.1 cnbng profile cnbng_1
!
```

```
Router#show run dhcp ipv6
Wed Oct 14 16:49:19.095 UTC
dhcp ipv6
  profile cnbng_1 cnbng
  !
  interface Bundle-Ether1.1 cnbng profile cnbng_1
  interface Bundle-Ether2.1 cnbng profile cnbng_1
!
```

## Configure Subscriber Gateway Address and Subnet Route

In cnBNG, the IP address management is more dynamic. Hence, the loopback interface for IPoE or PPPoE subscribers isn't provisioned in the user profile of the subscriber with static configuration. cnBNG user plane selects the loopback based on the subnet allocated to a loopback dynamically at cnBNG user plane.



**Note** For every VRF, one loopback must be present on the UP.

Consider this example,

```
On RSP0:
Tue Jul 28 05:55:13.015 UTC
cnbng-nal location 0/RSP0/CPU0
hostidentifier asr9k-1
up-server ipv4 192.0.2.1 vrf default
cp-server primary ipv4 198.51.100.1
auto-loopback vrf default
  interface Loopback1
    primary-address 10.0.0.1
```

## Configure Subscriber Gateway Address and Subnet Route

```
!
On RSP1:
Tue Jul 28 05:56:13.015 UTC
cnbng-nal location 0/RSP1/CPU0
hostidentifier asr9k-1
up-server ipv4 192.0.2.1 vrf default
cp-server primary ipv4 198.51.100.1
auto-loopback vrf default
  interface Loopback1
    primary-address 10.0.0.1
!
!
```

In this example, the CP assigns 10.11.12.0/24 as subnet, and 10.11.12.1/32 as gateway address to subscribers under the default VRF. This gateway address serves as the DHCPv4 server address for DHCPv4 OFFER or ACK messages. The *cnbng-nal* process uses Operations Center (OC) to configure this gateway address as secondary IP address on the loopback and route provision APIs to program the entry in the L3 routing table.



**Note** The system supports a maximum of 32 secondary IP addresses under an interface.

```
Router#show ipv4 interface loopback 1
Tue Jul 28 05:29:58.741 UTC
Loopback1 is Up, ipv4 protocol is Up
  Vrf is default (vrfid 0x60000000)
  Internet address is 10.0.0.1/32
  Secondary address 10.11.12.1/32

Router#show route vrf all ipv4 subscriber
A      10.11.12.0/24 [1/0] via 0.0.0.0, 00:10:29
```



**Note** The dynamic programming of the subnet (secondary gateway) under the loopback causes a major churn on the UP if large scale of active subscribers is present on the node. Hence, the secondary address programming is disabled, by default.

### Enable Secondary Address Programming

It's mandatory to enable the secondary address programming on cnBNG user plane. To enable that, use the **secondary-address-update enable** command under the cnbng-nal configuration mode.

### Configuration Example

```
Router#configure
Router(config)#cnbng-nal location 0/RSP0/CPU0
Router(config-cnbng-nal)#secondary-address-update enable
Router(config-cnbng-nal)#commit
```

## Running Configuration

```
Router#show running-config cnbng-nal location 0/RSP0/CPU0
cnbng-nal location 0/RSP0/CPU0
  secondary-address-update enable
!
```

# Configure Route Summary

This section describes the steps to configure route summary for the cnBNG user plane.

The NAL handles the following routes:

- Individual subscriber routes
- Summary routes for subscriber pool subnet

The subscriber routes are part of the subscriber provisioning message, which includes:

- WAN IP address (/32 or /128 subnet)
- LAN IP (prefix delegation)

The summary routes are for the subscriber pool subnet which are exported to the core network to download traffic towards the subscriber. On physical BNG, the subscriber pool subnets were configured as static routes and redistributed through BGP or IGP. With cnBNG and auto-loopback selection, these subnets for the subscribers are added dynamically to the loopback. Every time a new subscriber pool subnet is added to the loopback, the same is added to the RIB with the tag that is provided by the CP. If tag is ‘0’, the NAL uses the tag configured under the cnbng-nal. Routes with this tag can be exported to the core using the Routing Protocol for Low-Power and Lossy Networks (RPLs).

To configure route summary, use the **route-summary** command under the cnbng-nal configuration mode.

## Configuration Example

```
Router#configure
Router(config)#cnbng-nal location 0/RSP0/CPU0
Router(config-cnbng-nal)#route-summary tag 10
Router(config-cnbng-nal)#commit
```

## Running Configuration

```
Router#show running-config cnbng-nal location 0/RSP0/CPU0
cnbng-nal location 0/RSP0/CPU0
  route-summary tag 10
!
```

After the first subnet is installed on NAL, the following routes are added to the system:

```
A 10.11.12.0/24 [1/0] via 0.0.0.0, 0d01h
```

## Export Routes to Core Network

This section describes how to export routes to core network as part of enabling cnBNG user plane functionality.

### Configuration Example

```
Router#configure
Router(config)#route-policy test-policy-cnbng
Router(config-rpl)#if tag eq 10 then
Router(config-rpl-if)#set community (123:100)
Router(config-rpl-if)#done
Router(config-rpl-if)#endif
Router(config-rpl)#end-policy
Router(config)#commit

Router(config)#router ospf 10
Router(config-ospf)#vrf test-vrf-cnbng
Router(config-ospf-vrf)#redistribute subscriber route-policy test-policy-cnbng
Router(config-ospf-vrf)#commit
```

### Running Configuration

```
Router#show running-config route-policy test-policy-cnbng
route-policy test-policy-cnbng

    if tag eq 10  then

        set community (123:100)

        done

    endif

end-policy
!

Router#show running-config router ospf
router ospf 10
    vrf test-vrf-cnbng
        redistribute subscriber route-policy test-policy-cnbng
    !

```

## Configure ARP Scale Mode

This section describes the steps to configure ARP scale mode for the cloud-native BNG user plane.

To disable interface entry creation by ARP for each subscriber interface on the data plane (line cards), you must enable ARP scale mode for the subscriber using the **arp scale-mode-enable** command in subscriber configuration mode.

### Configuration Example

```
Router#configure
Router(config)#subscriber
Router(config-subscriber)#arp scale-mode-enable
```

```
Router(config-subscriber) #commit
```

### Running Configuration

```
Router#show running-config subscriber
Sat Aug 22 06:36:21.422 UTC
subscriber
arp scale-mode-enable
!
```

## Verify cnBNG User Plane Configuration

This section describes the show commands to be executed on the router to verify cloud native BNG user plane configuration.

For details on cnBNG commands, see the *Cloud Native BNG Command Reference for Cisco ASR 9000 Series Routers*.

## Verify cnBNG NAL Process Information

You can use the following commands to verify the NAL process information on cnBNG user plane.

- ```
Router#show cnbng-nal process-info location 0/RSP0/CPU0
Mon Aug  3 00:12:42.080 UTC

Location: 0/RSP0/CPU0

  HA Pre_Init Role      : PRIMARY
  HA Role                : PRIMARY
  Restart-flag           : FALSE
  card_type              : 0
  Node-Id                : 0
  Disc-Hist File-logging : FALSE
  Test-server config-enabled: FALSE

  Proc-flags       : 8000FFBF

  OT Connection Status: UP
  IM Connection Status: UP
  IPv4 RIB Connection Status: UP
  IPv6 RIB Connection Status: UP
  SUBDB Connection Status: UP
```
- ```
Router#show cnbng-nal process-readiness
Mon Aug  3 00:12:00.778 UTC

Location: 0/RSP1/CPU0

  NAL resync pending flags:
    Service Resync Pending
    Interface Resync Pending
    IPv4 Route Resync Pending
    IPv6 Route Resync Pending
```

## Verify Control Plane Connection Status

```

SIR status: not ready

Location: 0/RSP0/CPU0
NAL resync pending flags:
    NONE

SIR status: ready

•
Router#show processes cnbng_nal
Fri Sep 11 09:22:45.139 UTC
    Job Id: 456
    PID: 1543

Router#show processes memory 1543
Fri Sep 11 09:24:12.398 UTC
  JID      Text(KB)   Data(KB)   Stack(KB) Dynamic(KB) Process
-----+-----+-----+-----+-----+-----+
  456       992     1700604        200      19999  cnbng_nal

```

## Verify Control Plane Connection Status

You can use the following command to verify the connection status of cnBNG control plane.

- ```

Router#show cnbng-nal cp connection status
Fri Feb 19 11:27:31.178 UTC

Location: 0/RSP0/CPU0

User-Plane configurations:
-----
IP          : 10.105.227.96
GTP Port    : 2152
PFCP Port   : 8805
VRF         : default

Control-Plane configurations:
-----
PRIMARY IP   : 10.84.102.235
GTP Port     : 2152
PFCP Port   : 8805

Association retry count: 10

Connection Status: Up
Connection Status time stamp: Thu Feb 11 12:46:19 2021

Connection Prev Status : Down
Connection Prev Status time stamp: Thu Feb 11 12:44:55 2021

Association status: Active
Association status time stamp: Thu Feb 11 12:46:18 2021

```

## Verify Subscriber Information

You can use the following commands to verify subscriber information on the cnBNG user plane.

- ```
Router#show cnbng-nal subscriber access-interface bundle-Ether 1.1
Mon Aug  3 00:04:42.558 UTC
=====
Location: 0/RSP0/CPU0
=====

      Type          PPPoE        IPoE
      ===          =====        ====
Session Counts by State:
    initializing      0            0
    connecting        0            0
    connected         0            0
    activated         0           8000
    idle              0            0
    disconnecting     0            0
    Total:           0           8000

Session Counts by Address-Family:
    none             0            0
    ipv4            0            0
    ipv6            0           8000
    dual             0            0
    Total:           0           8000

=====
Location: 0/RSP1/CPU0
=====

      Type          PPPoE        IPoE
      ===          =====        ====
Session Counts by State:
    initializing      0            0
    connecting        0            0
    connected         0            0
    activated         0           8000
    idle              0            0
    disconnecting     0            0
    Total:           0           8000

Session Counts by Address-Family:
    none             0            0
    ipv4            0            0
    ipv6            0           8000
    dual             0            0
    Total:           0           8000

•
Router#show cnbng-nal subscriber all
Fri Sep 11 06:07:52.343 UTC
Codes: CN - Connecting, CD - Connected, AC - Activated,
ID - Idle, DN - Disconnecting, IN - Initializing
```

**Verify Subscriber Information**

CPID(hex) Interface Ifhandle	State Mac Address	Subscriber IP Addr / Prefix (Vrf)
1005ca0 BE2.500.ip2149474448 AC	0010.942e.3b00 13.0.92.160 (default) 0x225e60 1:4::5c9f (IANA) 2003:db0:0:5c9e::/64 (IAPD)	
10053b2 BE2.500.ip2149466000 AC	0010.942e.3689 13.0.83.175 (default) 0xfdfe0 1:4::53b1 (IANA) 2003:db0:0:53b0::/64 (IAPD)	
1004c81 BE2.600.ip2149013936 AC	0010.942e.5230 13.0.76.129 (default) 0x4079a0 1:4::4c80 (IANA) 2003:db0:0:4c7f::/64 (IAPD)	
1004aaa BE2.500.ip2149353232 AC	0010.942e.3205 13.0.74.169 (default) 0x5192e0 1:4::4aa9 (IANA) 2003:db0:0:4aa8::/64 (IAPD)	
1004927 BE2.600.ip2149518576 AC	0010.942e.50b1 13.0.73.116 (default) 0x219ba0 1:4::4926 (IANA) 2003:db0:0:4925::/64 (IAPD)	
10047e4 BE2.800.ip2149422928 AC	0010.9431.a7c7 13.0.71.228 (default) 0x41ff60 1:4::47e4 (IANA) 2003:db0:0:47e2::/64 (IAPD)	
1004777 BE2.600.ip2149520224 AC	0010.942e.5021 13.0.71.115 (default) 0x41420 1:4::4776 (IANA) 2003:db0:0:4775::/64 (IAPD)	
1003a6d BE2.800.ip2149369728 AC	0010.9431.a3a1 13.0.58.105 (default) 0x141360 1:4::3a6d (IANA) 2003:db0:0:3a6a::/64 (IAPD)	
10038b7 BE2.600.ip2149362240 AC	0010.942e.4bb2 13.0.56.178 (default) 0x259aa0 1:4::38b6 (IANA) 2003:db0:0:38b5::/64 (IAPD)	
10028ba BE2.500.ip2149210768 AC	0010.942e.2873 13.0.40.185 (default) 0x129620	

```

1:4::28b9 (IANA)
2003:db0:0:28b8::/64 (IAPD)

100247b BE2.600.ip2149396320 AC 0010.942e.46a3 13.0.36.113 (default) 0x4b8e0
1:4::2471 (IANA)
2003:db0:0:2470::/64 (IAPD)

100207a BE2.500.ip2149356496 AC 0010.942e.2663 13.0.32.117 (default) 0x1a9460
1:4::2079 (IANA)
2003:db0:0:2078::/64 (IAPD)

1001d3f BE2.600.ip2149251360 AC 0010.942e.44d4 13.0.29.61 (default) 0xcc760

```

- Router#**show cnbng-nal subscriber all summary**

```

Sun Aug  2 16:26:44.281 UTC
=====
Location: 0/RSP0/CPU0
=====

      Type          PPPoE        IPoE
      ===          =====        ====
Session Counts by State:
      initializing    0            0
      connecting      0            0
      connected       0            0
      activated       0           130
      idle            0            0
      disconnecting   0            0
      Total:          0           130

Session Counts by Address-Family:
      none            0            0
      ipv4            0           130
      ipv6            0            0
      dual             0            0
      Total:          0           130
=====

Location: 0/RSP0/CPU0
=====

      Type          PPPoE        IPoE
      ===          =====        ====
Session Counts by State:
      initializing    0            0
      
```

**Verify Subscriber Information**

connecting	0	0
connected	226	0
activated	31774	0
idle	0	0
disconnecting	0	0
Total:	32000	0

## Session Counts by Address-Family:

none	226	0
ipv4	7774	0
ipv6	0	0
dual	24000	0
Total:	32000	0

- ```
Router#show cnbng-nal subscriber all detail
Mon Aug  3 00:00:14.624 UTC
Location: 0/2/CPU0
=====
Location: 0/RSP1/CPU0
=====
Interface:           Bundle-Ether1.1.ip2148413040
UPID:               0x800e2e70
CPID:               0x0100918f
PPPOE Session Id:  0x0000
Type:                IPOE
IPv4 Address:       0.0.0.0
IPv4 Framed Route:
  Prefix:            0.0.0.0/0
  Next Hop:          0.0.0.0
  Tag:               0
IPv6 IANA Address:  1:5::345c
IPv6 IAPD Prefix:   2004:cd0:0:188d::/64
CPE link local Address: ::

IPv6 Framed Route:
  Prefix:            ::/0
  Next Hop:          ::
  Tag:               0
IPv6 State:          UP, Sat Jul 25 02:09:55 2020
Mac Address:         5065.aaab.d864
Inner VLAN ID:      Not Set
Outer VLAN ID:      100
Outer VLAN Cos:     0
Outer VLAN DEI:     1
Created:             Sat Jul 25 02:09:54 2020
State:               Activated
Ifhandle:            0x000b75a0
VRF:                 default
Access-interface:    Bundle-Ether1.1
Attribute List:      0x5556aed3f878
```

```

1: ipv6-enable      len= 4 value= 1(1)
2: ipv4-unnumbered len= 9 value= Loopback1
3: strict-rpf      len= 4 value= 1(1)
4: ipv6-strict-rpf len= 4 value= 1(1)
5: ipv4-icmp-unreachable len= 4 value= 1(1)
6: ipv6-unreachable len= 4 value= 1(1)
7: ipv4-mtu         len= 4 value= 1500(5dc)
8: ipv6-mtu         len= 4 value= 1500(5dc)
Session Accounting:          enabled
Interim Interval:           1800 secs
Last interim timestamp:     Sun Aug  2 23:39:46 2020
Interim fail count: None
Last interim failed reason: NA
Last stats:
  BytesIn: 0
  BytesOut: 384570
  BytesInGiga: 0
  BytesOutGiga: 0
Feature IDs activated :
  0x800e2e71
  0x800e2e72

```

- Router#**show cnbng-nal subscriber type ipoe summary**  
Mon Aug 3 00:06:15.032 UTC  
=====  
Location: 0/RSP0/CPU0  
=====

| Type                              | PPPoE | IPoE |
|-----------------------------------|-------|------|
| ====                              | ===== | ==== |
| Session Counts by State:          |       |      |
| initializing                      | 0     | 0    |
| connecting                        | 0     | 0    |
| connected                         | 0     | 0    |
| activated                         | 0     | 8000 |
| idle                              | 0     | 0    |
| disconnecting                     | 0     | 0    |
| Total:                            | 0     | 8000 |
| Session Counts by Address-Family: |       |      |
| none                              | 0     | 0    |
| ipv4                              | 0     | 0    |
| ipv6                              | 0     | 8000 |
| dual                              | 0     | 0    |
| Total:                            | 0     | 8000 |
| =====                             |       |      |
| Location: 0/RSP1/CPU0             |       |      |
| =====                             |       |      |
| Type                              | PPPoE | IPoE |
| ====                              | ===== | ==== |
| Session Counts by State:          |       |      |
| initializing                      | 0     | 0    |
| connecting                        | 0     | 0    |
| connected                         | 0     | 0    |
| activated                         | 0     | 8000 |
| idle                              | 0     | 0    |
| disconnecting                     | 0     | 0    |
| Total:                            | 0     | 8000 |

## Verify Subscriber Information

```

Session Counts by Address-Family:
      none          0          0
      ipv4          0          0
      ipv6          0        8000
      dual          0          0
Total:          0        8000

```

Router#

```
Router#show cnbng-nal subscriber type pppoe summary
Mon Aug 3 00:06:15.032 UTC
=====
Location: 0/RSPO/CPU0
=====
```

| Type | PPPoE | IPoE |
|------|-------|------|
| ==== | ===== | ==== |

### Session Counts by State:

|               |       |   |
|---------------|-------|---|
| initializing  | 0     | 0 |
| connecting    | 0     | 0 |
| connected     | 0     | 0 |
| activated     | 31031 | 0 |
| idle          | 0     | 0 |
| disconnecting | 0     | 0 |
| Total:        | 31031 | 0 |

### Session Counts by Address-Family:

|        |       |   |
|--------|-------|---|
| none   | 0     | 0 |
| ipv4   | 31031 | 0 |
| ipv6   | 0     | 0 |
| dual   | 0     | 0 |
| Total: | 31031 | 0 |

Router#

```
Router#show cnbng-nal subscriber disconnect-history unique  
Mon Aug 3 00:07:22.716 UTC
```

Non-Hag 3 33.3% 22.7% 31.3%

EDUCATION: B/RSP/CFB

| Count | Last Interface               | Disconnected Reason              | Last Time                   |
|-------|------------------------------|----------------------------------|-----------------------------|
|       |                              |                                  | Disconnected                |
|       | Location: 0/1/CPU0           |                                  |                             |
|       | Location: 0/RSP0/CPU0        |                                  |                             |
| Count | Last Interface               | Disconnected Reason              | Last Time                   |
|       |                              |                                  | Disconnected                |
| 35494 | Bundle-Ether1.1.ip2148328848 | Disconnect by CP                 | Sat Jul 25<br>02:04:55 2020 |
| 14154 | Bundle-Ether1.1.ip2148324096 | Disconnect by clear CLI          | Sat Jul 25<br>02:05:48 2020 |
| 2777  | Bundle-Ether1.1.ip2148194512 | Disconnect due to create failure | Sat Jul 25<br>01:38:29 2020 |

```
Router#show cnbng-nal subscriber disconnect-history last location  
Mon Aug 3 00:08:42 655 UTC
```

```

Disconnect-reason: Disconnect by clear CLI
Disconnect-timestamp: Sat Jul 25 02:05:48 2020
    Message Txn ID: 55663
    Session Txn ID: 1
    Failed at: Sat Jul 25 01:57:03 2020
    Feature Mask: 0x0
    SVM State: 0
    IPSUB flags: 0x600a200
    Pending callback: 0x2
    Data:

Interface: Bundle-Ether1.1.ip2148324096
UPID: 0x800cd300
CPID: 0x01007bd8
PPPOE Session Id: 0x0000
Type: IPoE
IPv4 Address: 0.0.0.0
IPv4 Framed Route:
    Prefix: 0.0.0.0/0
    Next Hop: 0.0.0.0
    Tag: 0
IPv6 IANA Address: 1:5::3de5
IPv6 IAPD Prefix: 2004:cd0:0:616::/64
CPE link local Address: ::
IPv6 Framed Route:
    Prefix: ::/0
    Next Hop: ::
    Tag: 0
IPv6 State: UP, Sat Jul 25 01:57:03 2020
Mac Address: 5065.aaab.cfbb
Inner VLAN ID: Not Set
Outer VLAN ID: 100
Outer VLAN Cos: 0
Outer VLAN DEI: 1
Created: Sat Jul 25 02:05:48 2020
State: Init
Ifhandle: 0x000323a0
VRF: default
Access-interface: Bundle-Ether1.1
Attribute List: 0x559125764408
1: ipv6-enable len= 4 value= 1(1)
2: ipv4-unnumbered len= 9 value= Loopback1
3: strict-rpf len= 4 value= 1(1)
4: ipv6-strict-rpf len= 4 value= 1(1)
5: ipv4-icmp-unreachable len= 4 value= 1(1)
6: ipv6-unreachable len= 4 value= 1(1)
7: ipv4-mtu len= 4 value= 1500(5dc)
8: ipv6-mtu len= 4 value= 1500(5dc)
Session Accounting: enabled
Interim Interval: 1800 secs
Last interim timestamp: Sat Jul 25 02:05:47 2020
Interim fail count: None
Last interim failed reason: NA
Last stats:
    BytesIn: 0
    BytesOut: 540
    BytesInGiga: 0
    BytesOutGiga: 0
Feature IDs activated :
    0x800cd301
    0x800cd302

[Event History]
UPID: 0x800cd300

```

**Verify Subscriber Information**

| Event Name          | Time Stamp             | S, M |
|---------------------|------------------------|------|
| Create              | Jul 25 01:57:02.999679 | 0, 0 |
| New Session Request | Jul 25 01:57:02.999686 | 0, 0 |
| Interface create    | Jul 25 01:57:02.999823 | 0, 0 |
| SVM create          | Jul 25 01:57:03.018268 | 0, 0 |
| UP Install(req)     | Jul 25 01:57:03.018321 | 0, 0 |
| UP Install(CB)      | Jul 25 01:57:03.019220 | 0, 0 |
| Last Assoc(req)     | Jul 25 01:57:03.019232 | 0, 0 |
| Last Assoc(CB)      | Jul 25 01:57:03.020160 | 0, 1 |
| Produce done(req)   | Jul 25 01:57:03.020233 | 0, 0 |
| IPv4 Caps Up        | Jul 25 01:57:03.188034 | 0, 0 |
| IPv6 Caps Up        | Jul 25 01:57:03.233210 | 0, 0 |
| Init data req       | Jul 25 01:57:03.254482 | 0, 1 |
| Init data cb        | Jul 25 01:57:03.369027 | 0, 1 |
| Client Session up   | Jul 25 01:57:03.379152 | 0, 0 |
| Produce done        | Jul 25 01:57:03.977629 | 0, 0 |
| IPv6 Up             | Jul 25 01:57:03.977643 | 0, 0 |
| Session up notified | Jul 25 01:57:03.977650 | 0, 0 |
| Stats start         | Jul 25 01:57:03.977841 | 0, 0 |
| Disconnect notified | Jul 25 02:05:47.548202 | 0, 0 |
| Disconnect ack      | Jul 25 02:05:47.550293 | 0, 0 |
| IPv4 Caps Down      | Jul 25 02:05:47.652232 | 0, 0 |
| IPv6 Caps Down      | Jul 25 02:05:47.652333 | 0, 0 |
| Final stats         | Jul 25 02:05:47.753805 | 0, 0 |
| SVM delete          | Jul 25 02:05:47.780713 | 0, 0 |
| SVM cleanup         | Jul 25 02:05:48.283050 | 0, 0 |

Help: S - Sticky Event, M - Multiple Occurrence

- Router#show cnbng-nal subscriber fadb
 

```
Mon Aug 3 00:03:12.858 UTC
      Location: 0/RSP1/CPU0
      =====
      UPID: 0x800ec810
      Service-ID: 0x04000003 Service-Name: JHV_VOICE
      Feature-ID: 0x800ec812
      Attribute List: 0x559cba6d0008
      1: feature-acct-bitmask len= 4 value= 805306413(3000002d)
      Accounting: enabled
      Interim fail count: None
      Last interim failed reason: None
      Last stats:
      BytesIn: 0
      BytesOut: 0
      BytesInGiga: 0
      BytesOutGiga: 0

      UPID: 0x800e9470
      Service-ID: 0x04000003 Service-Name: JHV_VOICE
      Feature-ID: 0x800e9472
      Attribute List: 0x559cba6d0008
      1: feature-acct-bitmask len= 4 value= 805306413(3000002d)
      Accounting: enabled
      Interim fail count: None
      Last interim failed reason: None
      Last stats:
      BytesIn: 0
      BytesOut: 0
      BytesInGiga: 0
      BytesOutGiga: 0
```

```

UPID:      0x800e7ee0
Service-ID: 0x04000003 Service-Name: JHV_VOICE
Feature-ID: 0x800e7ee2
    Attribute List: 0x559cba6d0008
1: feature-acct-bitmask len= 4 value= 805306413(3000002d)
Accounting:           enabled
Interim fail count: None
Last interim failed reason: None
Last stats:
    BytesIn: 0
    BytesOut: 0
    BytesInGiga: 0
    BytesOutGiga: 0

UPID:      0x800e16e0
Service-ID: 0x04000004 Service-Name: LIVE_TV
Feature-ID: 0x800e16e1
    Attribute List: 0x559cba6d0008
1: feature-acct-bitmask len= 4 value= 0(0)
Accounting:           disabled
Interim fail count: None
Last interim failed reason: None
Last stats:
    BytesIn: 0
    BytesOut: 0
    BytesInGiga: 0
    BytesOutGiga: 0

UPID:      0x800dda90
Service-ID: 0x04000003 Service-Name: JHV_VOICE
Feature-ID: 0x800dda91
    Attribute List: 0x559cba6d0008
1: feature-acct-bitmask len= 4 value= 805306413(3000002d)
Accounting:           enabled
Interim fail count: None
Last interim failed reason: None
Last stats:
    BytesIn: 0
    BytesOut: 0
    BytesInGiga: 0
    BytesOutGiga: 0

UPID:      0x800dd4e0
Service-ID: 0x04000004 Service-Name: LIVE_TV
Feature-ID: 0x800dd4e1
    Attribute List: 0x559cba6d0008
1: feature-acct-bitmask len= 4 value= 0(0)
Accounting:           disabled
Interim fail count: None
Last interim failed reason: None
Last stats:
    BytesIn: 0
    BytesOut: 0
    BytesInGiga: 0
    BytesOutGiga: 0

```

## Verify cnBNG NAL Counters

You can use the following commands to verify various NAL counters on the cnBNG user plane:

**Verify cnBNG NAL Counters**

- ```

Router#show cnbng-nal counters type all
Sun Aug  2 20:42:49.548 UTC

Location: 0/RSP0/CPU0

Subscriber Counters
-----
Counter name          Value
=====
INTF Delete           500
IPv4 caps down       500
IPv6 caps down       500
IPv4 Rou del          500
IPv6 Rou del          500
Blkdis q empty        1
DB cache hit          17113

Error Counters
-----
Counter name          Value
=====

Accounting Counters
-----
Counter name          Value
=====
Sess Stop req         500
Feat Stop req         500
Stop req              3000
Stop cb                3000
Final cb               3000
Feat Final cb          500
Sess Final cb          2500

SVM Counters
-----
Counter name          Value
=====
Sess deleted           500
Delete CB              500
Feat deleted            1000
Cleanup                 500
Sess stats, before svm 500
Feat stats, before svm 500

SPA Counters
-----
Counter name          Value
=====
SPA Delete Req         500
SPA Update Req         500
Sub Delete Res          500
Sub Update Res          500
Blkdic adm more          39
GTPu pkt sent           1000
PFCP pkt sent            1463
GTPu pkt punt             500
PFCP pkt punt            1463

```

DHCPv4 pkt punt	500								
DHCPv6 pkt punt	500								
DHCPv6 pkt inj	500								
Alloc count	3463								
Free count	3463								
Mutex lock	6741								
Mutex unlock	6741								
Timer start	463								
Timer expiry	463								
Sub Update IPOE OK	500								
Sub Delete IPOE OK	500								
 CP Recon Counters									
-----									
Counter name	Value								
=====									
 Histogram/API Performance Stats									
-----									
API name	1ms	10ms	100ms	1s	5s	10s	20s	50s	100s
=====	====	=====	=====	==	==	====	====	====	====
Per trans	410	90	0	500	0	0	0	0	0
Sub Create	0	0	0	0	0	0	0	0	0
Sub Update	445	55	0	0	0	0	0	0	0
Sub Delete	0	0	0	500	0	0	0	0	0
IPOE Int Crt	0	0	0	0	0	0	0	0	0
IPOE Int Upd	0	0	0	0	0	0	0	0	0
IPOE Int Del	0	0	0	500	0	0	0	0	0
PPPOE Int Crt	0	0	0	0	0	0	0	0	0
PPPOE Int Upd	0	0	0	0	0	0	0	0	0
PPPOE Int Del	0	0	0	0	0	0	0	0	0
Sess Create	0	0	0	0	0	0	0	0	0
Sess Update	0	0	0	0	0	0	0	0	0
Sess Delete	0	0	10	490	0	0	0	0	0
V4 RT Inst	0	0	0	0	0	0	0	0	0
V4 RT Del	0	6	320	174	0	0	0	0	0
V4 FR Inst	0	0	0	0	0	0	0	0	0
V4 FR Del	0	0	0	0	0	0	0	0	0
V6 RT Inst	0	0	0	0	0	0	0	0	0
V6 RT Del	0	6	310	184	0	0	0	0	0
V6 PD RT Inst	0	0	0	0	0	0	0	0	0
V6 PD RT Del	0	0	0	0	0	0	0	0	0
V6 FR Inst	0	0	0	0	0	0	0	0	0
V6 FR Del	0	0	0	0	0	0	0	0	0
CDM Lookup	0	0	0	0	0	0	0	0	0
CDM Insert	0	0	0	0	0	0	0	0	0
CDM Update	1469	31	0	0	0	0	0	0	0
Eval Lookup	0	0	0	0	0	0	0	0	0

.

```
Router#show cnbng-nal counters type all | beg SPA LIB
Sun Aug  2 20:44:07.902 UTC
SPA LIB Counters
-----
Counter name          Value
=====                =====
pfcp_rx_counter      6899
pfcp_tx_counter      6900
gtpu_tx_counter      9048
gtpu_rx_counter      7510
```

## Verify cnBNG NAL Counters

```

pfcp_keepalive_tx_counter          891
pfcp_keepalive_rx_counter          890

SPA API counters
-----
•
Router#show cnbng-nal counters type spa
Sun Aug  2 20:42:13.703 UTC

Location: 0/RSP0/CPU0

SPA Counters
-----
Counter name           Value
=====
SPA Delete Req         500
SPA Update Req         500
Sub Delete Res         500
Sub Update Res         500
Blkdic adm more        39
GTPu pkt sent          1000
PFCP pkt sent          1461
GTPu pkt punt          500
PFCP pkt punt          1461
DHCPv4 pkt punt        500
DHCPv6 pkt punt        500
DHCPv6 pkt inj          500
Alloc count             3461
Free count              3461
Mutex lock               6727
Mutex unlock              6727
Timer start              461
Timer expiry              461
Sub Update IPOE OK       500
Sub Delete IPOE OK       500

```