Control Plane and User Plane Association

Feature Summary and Revision History

Summary Data

Table 1: Summary Data

Applicable Product(s) or Functional Area	cnBNG
Applicable Platform(s)	SMI
Feature Default Setting	Disabled - Configuration Required
Related Changes in this Release	Not Applicable
Related Documentation	Not Applicable

Revision History

Table 2: Revision History

Revision Details	Release
Introduced support for multiple CP associations to an UP.	2026.02.0
Introduced support for IPv6 transport between the Control Plane and a peer User Plane.	2024.02.0

Revision Details	Release
UP Rollback Failure Handling Notification support added.	2022.01.0
UP Session Disconnect Notification support added.	2021.03.0
First introduced.	2021.01.0

Feature Description

The Control Plane (CP) associates with a peer User Plane to synchronize with the number of subscriber sessions and state of each session. The CP and UP must maintain the total number of active sessions and their state on both sides.

To associate a UP to the CP, see the Associating the User Plane, on page 2.

Enabling Control Plane and User Plane Association

This section describes how to enable CP to UP association.

Associating the CP and UP involves the following procedure.

Associating the User Plane

Associating the User Plane

Use the following commands to associate the Control Plane (CP) to the peer User Plane.

```
config
  user-plane user_plane_name
  offline
  peer-address { ipv4 ipv4_address | ipv6 ipv6_address }
  port-id port_identifier subscriber-profile subscriber_profile
  subscriber-profile subscriber_profile
  exit
```

NOTES:

- **user-plane** *user_plane_name*: Specifies the User Plane (UP) name and enter UP Configuration mode.
- **offline**: Marks the UP offline for a graceful disconnect.
- **peer-address ipv4** *ipv4_address*: Specifies the peer IPv4 address of the UP.
- **peer-address ipv6** *ipv6_address*: Specifies the peer IPv6 address of the UP.
- **port-id** *port_identifier* **subscriber-profile** *subscriber_profile*: Specifies the port identifier of the UP. **subscriber-profile** *subscriber_profile* associates the subscriber profile at the port identifier level.
- **subscriber-profile** *subscriber_profile*: Associates the subscriber profile at UP level.

Multiple Control Plane associations

A multiple control plane association is a deployment capability that

- allows a single User Plane (UP) to simultaneously connect to multiple Control Plane (CP) instances
- enables Subscriber Redundancy Groups (SRG) to be mapped flexibly across different CPs, and
- improves scalability, redundancy, and migration flexibility in Broadband Network Gateway (BNG) environments.

Table 3: Feature History

Feature Name	Release Information	Description
Multiple Control Plane associations	2026.02.0	You can now improve cnBNG redundancy and flexibility by enabling a single User Plane (UP) to connect to multiple Control Plane (CP) instances at the same time. This allows Subscriber Redundancy Groups (SRG) to be mapped more flexibly across different Control Planes.

Traditionally, a User Plane could connect to only one Control Plane instance, which limited the ability to support complex SRG peering or to optimize resource utilization in large, distributed networks. With this enhancement, a User Plane (such as Cisco ASR 9000) can maintain up to 10 logical associations with different Control Plane instances or Geo-Redundancy (GR) instances. Each logical association acts as a separate User Plane context from the Control Plane perspective.

Benefits of multiple Control Plane associations

These are the key benefits:

- Enhanced network resilience through improved redundancy.
- Reduced operational complexity by simplifying migration processes.
- Support for scalable deployment across different environments.

Restrictions for multiple Control Plane associations

These restrictions apply when configuring multiple Control Plane associations with a single User Plane:

- Only IP over Ethernet (IPoE) hot standby Service Redundancy Group (SRG) sessions are supported across multiple user plane instances. PPPoE, LNS, and LAC session types are not supported in this mode.
- Warm standby is not supported when using logical User Plane instances.
- Support for non-SRG subscribers is available only on the default instance (ID 0).
- Parallel reconciliation involving subscriber, route, or SRG information, in any combination, is not supported.
- Changing a user-plane name on the Control Plane while the association is up is not supported.

Configure multiple CP associations for a UP

Set up one or more logical associations between a User Plane (UP) and multiple Control Plane (CP) instances to enable advanced redundancy and scalability.

Use this task when you want a User Plane node to support multiple CP clusters or GR instances simultaneously, such as during migration or when optimizing SRG group mapping.

Before you begin

Ensure you have the following prerequisites:

- Confirm the number and addresses of CP instances you wish to connect.
- Ensure you have administrator access to configure cnBNG components.

Follow these steps to configure multiple CP associations for a UP.

Procedure

Step 1 On the User Plane, configure the default (global) association parameters (instance-id 0).

Example:

```
Router# configure
Router(config)# cnbng-nal location 0/RSP0/CPU0
Router(config-cnbng-nal-local)# hostidentifier asr9k-1-cp-1-inst-0
Router(config-cnbng-nal-local)# up-server ipv4 10.1.1.51 vrf default gtp-port 15002 pfcp-port 15003
Router(config-cnbng-nal-local)# cp-server primary ipv4 192.0.2.1
Router(config-cnbng-nal-local)# cp-association retry-count 6
```

By default, the device uses instance ID 0 if no **up-instance-id** is specified.

Step 2 Configure additional logical UP instances to support multiple CP-UP association.

Example:

```
Router# configure
Router(config)# cnbng-nal location 0/RSP0/CPU0
Router(config-cnbng-nal-local)# up-instance-id 1
Router(config-cnbng-nal-local)# hostidentifier asr9k-1-cp-1-inst-1
Router(config-cnbng-nal-local)# up-server ipv4 10.1.1.52 vrf default gtp-port 15002 pfcp-port 15003
Router(config-cnbng-nal-local)# cp-server primary ipv4 192.0.2.2
Router(config-cnbng-nal-local)# cp-association retry-count 6
```

Example:

```
Router# configure
Router(config)# cnbng-nal location 0/RSP0/CPU0
Router(config-cnbng-nal-local)# up-instance-id 2
Router(config-cnbng-nal-local)# hostidentifier asr9k-1-cp-1-inst-2
Router(config-cnbng-nal-local)# up-server ipv4 10.1.1.53 vrf default gtp-port 15002 pfcp-port 15003
Router(config-cnbng-nal-local)# cp-server primary ipv4 192.0.2.3
Router(config-cnbng-nal-local)# cp-association retry-count 6
```

Repeat this step for each additional logical UP instance. Assign a unique **up-instance-id** (1–15) and **hostidentifier** per instance.

Step 3 On the User Plane, configure SRG groups to be mapped to UP instances.

Example:

Associating a group to default UP instance:

```
Router# configure
Router(config)# cnbng-nal location 0/RSP0/CPU0
Router(config-cnbng-nal-local)# subscriber-redundancy
Router(config-cnbng-nal-sub-red)# group group2001
Router(config-cnbng-nal-srg-grp)# virtual-mac 0000.1111.03e9
Router(config-cnbng-nal-srg-grp)# access-tracking track_group2001
Router(config-cnbng-nal-srg-grp)# access-interface-list
Router(config-cnbng-nal-srg-grp-intf)# interface Bundle-Ether40.2001
```

Example:

Associating a group to UP instance 1:

```
Router# configure
Router(config)# cnbng-nal location 0/RSP0/CPU0
Router(config-cnbng-nal-local)# up-instance-id 1
Router(config-cnbng-nal-local)# subscriber-redundancy
Router(config-cnbng-nal-sub-red)# group group2002
Router(config-cnbng-nal-srg-grp)# virtual-mac 0000.1111.03ea
Router(config-cnbng-nal-srg-grp)# access-tracking track_group2002
Router(config-cnbng-nal-srg-grp)# access-interface-list
Router(config-cnbng-nal-srg-grp-intf)# interface Bundle-Ether40.2002
```

Step 4 On the Control Plane, configure Each UP instance as a separate User Plane.

Important
The `user-plane` hostname configured on the CP must exactly match the `hostidentifier` configured for the corresponding UP instance on the User Plane.

Example:

```
user-plane
  instance 0
    user-plane asr9k-1-cp-1-inst-0
      peer-address ipv4 10.1.1.51
      subscriber-profile SUBS_PROF_1
      exit
      subscriber-redundancy
        group group2001
          preferred-role-active
          peer-identifier peer2001-x
          port-id-map port-name Bundle-Ether40.2001 1
        exit
      exit

  instance 1
    user-plane asr9k-1-cp-1-inst-1
      peer-address ipv4 10.1.1.52
      subscriber-profile SUBS_PROF_1
      exit
      subscriber-redundancy
        group group2002
          peer-identifier peer2002-x
          port-id-map port-name Bundle-Ether40.2002
        exit
      exit
```

Step 5 (Optional) On the User Plane, configure per-instance flow control thresholds.

Example:

```
Router(config-cnbng-nal-instance-id)# up-cp-notification flow-control 100
Router(config-cnbng-nal-instance-id)# up-cp-stats flow-control 150
```

Adjust per-instance flow and statistics thresholds as needed for scale and performance requirements.

Step 6 (Optional) On the User Plane, configure global flow control thresholds if required.

Example:

```
Router(config-cnbng-nal-local)# up-cp-notification global-flow-control 500
Router(config-cnbng-nal-local)# up-cp-stats global-flow-control 250
```

Use only if you require system-wide aggregate limits.

Step 7 On the User Plane, execute the **cnbng-nal cp-association start [up-instance-id 1] location 0/RSP0/CPU0** command to bring up the association.

Verify multiple CP associations to a UP

Ensure each logical user plane instance is correctly associated and operating with its geo-redundant CP peer. Diagnose and resolve issues related to SRG mapping, session and route allocation, and association failures.

Procedure

Step 1 Verify CP-UP association status for a specific or all UP instances.

Example:

```
show cnbng-nal cp connection status up-instance-id 1

show cnbng-nal cp connection status up-instance-id all
```

Expected result: Each UP instance reports an ESTABLISHED state with its assigned control plane group. If state is FAILED or ATTEMPTING, proceed to troubleshooting.

Step 2 Verify SRG group assignments and operational roles.

Example:

```
show cnbng-nal srg-group detail up-instance-id 1

show cnbng-nal srg-group detail up-instance-id all
```

Check for correct mapping to UP instances and proper Active/Standby roles.

Step 3 Verify dynamic route distribution across UP instances.

Example:

```
show cnbng-nal dynamic-routes summary up-instance-id all
show cnbng-nal dynamic-routes afi ipv4 up-instance-id 1_
show cnbng-nal dynamic-routes afi ipv6 up-instance-id 1
```

Routes must be correctly distributed per instance. Look for overlaps or missing entries.

Step 4 Verify subscriber session distribution and status.

Example:

```
show cnbng-nal subscriber all summary up-instance-id all
show cnbng-nal subscriber all detail up-instance-id 1
```

Sessions should align with expected UP instance and SRG group associations.

Step 5 Review PFCP message, reconciliation, and notification history.

Example:

```
show cnbng-nal spa pfcp-api up-instance-id 1
show cnbng-nal spa recon-stats up-instance-id all
show cnbng-nal spa notif-history up-instance-id 1
```

Identify unusual message logs or recon reports that could indicate communication or failover issues.

Step 6 Check UP instance process information and flow control status.

Example:

```
show cnbng-nal process-info detail
```

Investigate abnormal states or threshold limits that could signal resource or configuration issues.

Step 7 If any UP association is not ESTABLISHED, validate critical configuration parameters:

- Confirm `hostidentifier` values match on both user plane and control plane for each instance.
- Validate that `cp-server primary` address, `up-server IP`, and SRG mapping are unique and correct for each instance.
- Check for port or IP conflicts, missing exit commands, or duplicate values.

Expected result: The instance re-associates after correcting discrepancies.

Step 8 If association or SRG mapping fails repeatedly, verify control plane connectivity and logs.

- Ping `cp-server` and `up-server` addresses to confirm reachability.
- Check system and debug logs for errors (for example, PFCP handshake failures).
- Ensure CP node process health and end-to-end connectivity.

Expected result: Connectivity and process issues are identified and resolved, restoring association.

Adding a new CP-UP association without disrupting existing connections

When you need to establish a new CP-UP association while an existing association is already active, this feature allows each CP GR instance to form its own connection to the User Plane.

If an association from CP GR instance 1 is already running, simply configure and bring up the new association for another CP GR instance. There is no need to change or interrupt the existing connection.

The new association can onboard additional SRG groups to provide greater redundancy or scalability. You can introduce the second association at any time so the active association remains unaffected.

UP Session Disconnect Notification

Feature Description

The User Plane (UP) Session Disconnect Notification feature enables the UP to send a session disconnect notification to the Control Plane (CP) in the following scenario:

When the UP deletes a session locally following any local event (for example, mark and sweep).

For a list of scenarios that trigger a session disconnect notification, see the *Broadband Network Gateway Configuration Guide for Cisco ASR 9000 Series Routers* here: https://www.cisco.com/c/en/us/support/routers/asr-9000-series-aggregation-services-routers/products-installation-and-configuration-guides-list.html.

This notification carries the final statistics for the session and for all services, if accounting is enabled.

The CP initiates the session disconnect for this session only in the CP. The CP then deletes this session. If the session accounting is enabled for this session, the CP sends an accounting "stop record" message to RADIUS.

The UP deletes the session after initiating the session disconnect request to the CP. Therefore, the CP doesn’t send a session release Packet Forwarding Control Protocol (PFCP) message to the UP.

UP Rollback Failure Handling Notification

Feature Description

The User Plane (UP) Rollback Failure Handling Notification feature sends a failure notification to the Control Plane (CP) as follows:

- The CP sends the subscriber configuration in a session modification request to the UP. The UP rolls back the configuration if the application of the configuration fails. The UP deletes the session if the rollback configuration also fails and returns the rollback failure error in the session modification response to the CP.
- The UP sends the final statistics, if applicable, for the session and for each service activated for the failed session, in the session modification response.
- The CP deletes the session in the CP only after receiving a rollback failure in the session modification response from the UP.