

PNNIs with Different Peer Groups

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Introduction

This document provides a sample configuration to set up a Private Network–Network Interface (PNNI) across different peer groups.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

The information in this document is based on Cisco IOS® Software Release 12.0(10)W5(18c).

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

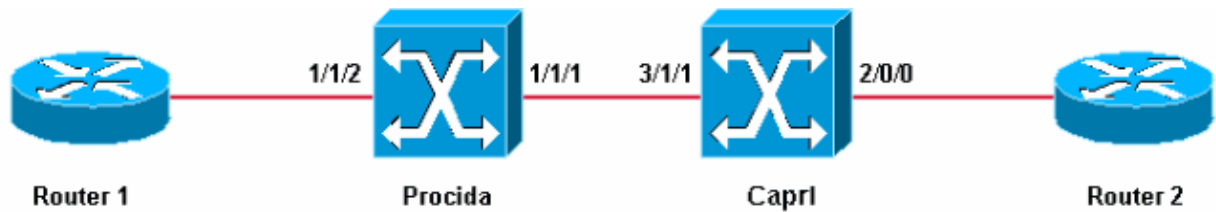
Configure

In this section, you are presented with the information to configure the features described in this document.

Note: Use the Command Lookup Tool (registered customers only) to find more information on the commands used in this document.

Network Diagram

This document uses this network setup:



In this configuration:

- Router 1 advertises this NSAP address:

```
47.0091.8100.1100.0090.2156.1401.00c0.0000.0002.00
```

- Router 2 advertises this NSAP address:

```
47.0091.8100.0000.0090.215d.b801.00c0.0000.0001.00
```

Configurations

This document uses these configurations:

- Procida
- Capri

```
Procida
atm address 47.0091.8100.1100.0090.2156.1401.0090.2156.1401.00
atm router pnni
no aesa embedded-number left-justified
node 1 level 44 lowest
parent 2
redistribute atm-static
election leadership-priority 205
node 2 level 36
!
interface ATM1/1/1
no ip address
no ip directed-broadcast
no atm ilmi-keepalive
!
interface ATM1/1/2
no ip address
no ip directed-broadcast
no atm ilmi-keepalive
```

```
Capri
atm address 47.0091.8100.0000.0090.215d.b801.0090.215d.b801.00
atm router pnni
no aesa embedded-number left-justified
node 1 level 44 lowest
parent 2
redistribute atm-static
election leadership-priority 205
node 2 level 36
```

```

parent 3
 election leadership-priority 205
node 3 level 30
!interface ATM2/0/0
no ip address
no ip directed-broadcast
no atm ilmi-keepalive
!
interface ATM3/1/1
no ip address
no ip directed-broadcast
no ip mroute-cache
no atm ilmi-keepalive

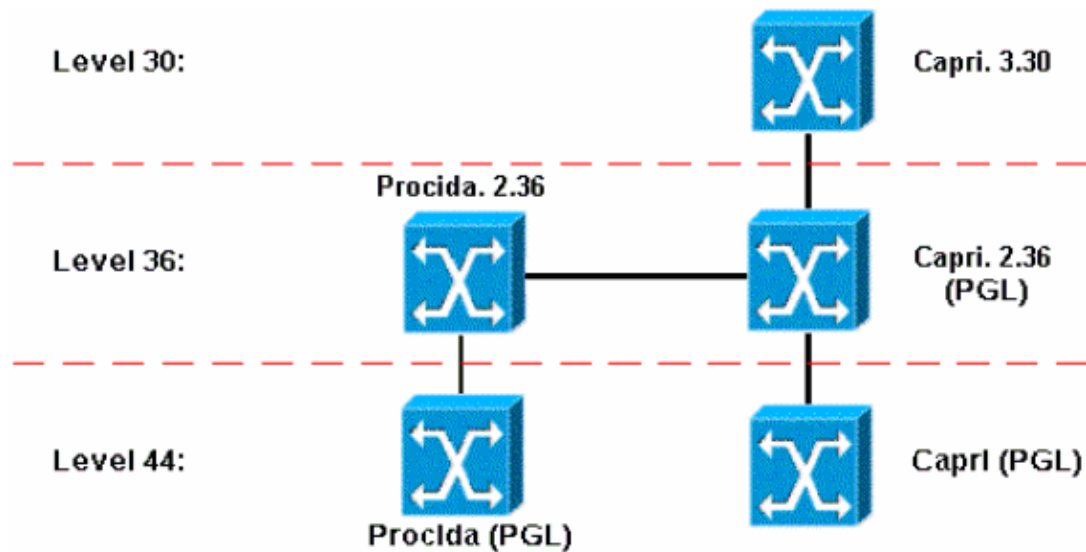
```

These are definitions of some of the terms that appear under **atm router pnni** in these configurations:

- **parent** In order to make a node eligible to become a peer group leader (PGL) within its own peer group, you must configure a parent node and a non-zero election leadership level. If a node is elected to be the PGL, the node specified by the parent command becomes the parent node. This represents the peer group at the next hierarchical level.
- **election leadership-priority** Normally the node with the highest election leadership priority is elected to be the PGL. If two nodes share the same election priority, the node with the highest node identifier becomes the PGL. In order to be eligible for election, the configured priority must be greater than zero. You can configure multiple nodes in a peer group with non-zero leadership priority so that, if one PGL becomes unreachable, the node configured with the next highest election leadership priority becomes the new PGL.

Logical Hierarchy

This is the logical (hierarchical) setup:



In this diagram you can see that:

- At level 44, Capri and Procida belong to different peer groups so they are not neighbors.
- Procida and Capri are PGLs in their own peer groups. Node 2 represents them at the next hierarchical level.
- Procida.2.36 and Capri.2.36 are part of the same peer group and are therefore neighbors. In this peer group, Capri.2.36 is the PGL and is represented by Capri.3.30 at the next hierarchical level.

Levels

This section defines what the levels 36, 44 and so on mean. These levels indicate the number of bits taken into account in the ATM address. That is, two switches are part of the same peer group at level n when the first n bits of their ATM address are the same.

For example, at level 44, Capri and Procida are not part of the same peer group because the first 44 bits of their NSAP addresses are not the same. You can compare their addresses:

- Procida 7.009181001...
- Capri 7.009181000...

However, at level 36, Capri.2.36 (the parent that represents the PGL at the next hierarchical level) and Procida.2.36 are part of the same peer group because the first 36 bits of their NSAP addresses are the same:

- Procida 7.0091810...
- Capri 7.0091810...

Issue the **show atm route** command to see the ATM routing table more clearly:

```
Procida#show atm route
```

```
Codes: P - installing Protocol (S - Static, P - PNNI, R - Routing control),  
T - Type (I - Internal prefix, E - Exterior prefix, SE -  
Summary Exterior prefix, SI - Summary Internal prefix,  
ZE - Suppress Summary Exterior, ZI - Suppress Summary Internal)
```

```
P  T Node/Port      St Lev Prefix  
~  ~ ~~~~~  
P  I 10 0          UP 0  47.0091.810/36  
P  I 9  0          UP 0  47.0091.8100.0/44  
P  SI 2  0         UP 0  47.0091.8100.1/44  
P  SI 1  0         UP 0  47.0091.8100.1100.0090.2156.1401/104
```

The various levels are represented here as /36 and /44 and /104. From this output, you can see that calls that are destined for an NSAP address whose first 104 bits match 47.0091.8100.1100.0090.2156.1401 are sent to Node 1.

Peer Group Leader Election

The PGL is the logical entity that represents the peer group at the next hierarchical level. Each PGL summarizes the status of its peer group and passes it to the other PGLs at the same level. Within each peer group, all reachability and Quality of Service (QoS) information such as hello packets and database synchronization are flooded. However, between the groups this information is summarized.

How is the PGL Elected in a Peer Group?

The peers inside a peer group exchange hello packets in order to select the PGL. The node with the highest leadership priority becomes the leader of that group. If several nodes have identical leadership priority, then the node with the highest node ID becomes the PGL.

Refer to ATM Forum Private Network–Network Interface Specifications for more information about how PNNI works.

Verify

Use the **show** commands listed in this section to confirm that your configuration works properly.

The Output Interpreter Tool (registered customers only) (OIT) supports certain **show** commands. Use the OIT to view an analysis of **show** command output.

- **show atm pnni neighbor**
- **show atm pnni identifiers**
- **show atm pnni election local-node** *<node number>*
- **show atm route**

Capri

This output is a result of these **show** commands issued on the devices used in the sample configuration:

```
Capri#show atm pnni neighbor

Neighbors For Node (Index 1, Level 44)

Neighbors For Node (Index 2, Level 36)

  Neighbor Name: Procida.2.36, Node number: 9
  Neighbor Node Id: 36:44:47.009181001000000000000000.009021561401.00
  Neighboring Peer State: Full
  Link Selection For CBR      : minimize blocking of future calls
  Link Selection For VBR-RT  : minimize blocking of future calls
  Link Selection For VBR-NRT : minimize blocking of future calls
  Link Selection For ABR      : balance load
  Link Selection For UBR      : balance load
  Port                        Remote Port Id      HrзLn state
  2E77000                    2946000          2way
  Note: Flooding to this LGN is done through the common SVCC RCC.

Neighbors For Node (Index 3, Level 30)

Capri#show atm pnni election local-node 1

PGL Status.....: PGL
Preferred PGL.....: (1) Capri
Preferred PGL Priority.: 255
Active PGL.....: (1) Capri
Active PGL Priority....: 255
Active PGL For.....: 00:11:37
Current FSM State.....: PGLE Operating: PGL
Last FSM State.....: PGLE Awaiting Unanimity
Last FSM Event.....: Unanimous Vote

Configured Priority....: 205
Advertised Priority....: 255
Conf. Parent Node Index: 2
PGL Init Interval.....: 15 secs
Search Peer Interval...: 75 secs
Re-election Interval...: 15 secs
Override Delay.....: 30 secs

Capri#show atm pnni election local-node 2

PGL Status.....: PGL
Preferred PGL.....: (2) Capri.2.36
Preferred PGL Priority.: 255
Active PGL.....: (2) Capri.2.36
```

```

Active PGL Priority....: 255
Active PGL For.....: 00:11:05
Current FSM State.....: PGLE Operating: PGL
Last FSM State.....: PGLE Awaiting Unanimity
Last FSM Event.....: Unanimous Vote

```

```

Configured Priority....: 205
Advertised Priority....: 255
Conf. Parent Node Index: 3
PGL Init Interval.....: 15 secs
Search Peer Interval...: 75 secs
Re-election Interval...: 15 secs
Override Delay.....: 30 secs

```

Capri#**show atm route**

```

Codes: P - installing Protocol (S - Static, P - PNNI, R - Routing control),
       T - Type (I - Internal prefix, E - Exterior prefix, SE -
              Summary Exterior prefix, SI - Summary Internal prefix,
              ZE - Suppress Summary Exterior, ZI - Suppress Summary Internal)

```

```

P  T Node/Port      St Lev Prefix
~  ~ ~~~~~
P SI 3 0           UP 0 47.0091.810/36
P SI 2 0           UP 0 47.0091.8100.0/44
P SI 1 0           UP 0 47.0091.8100.0000.0090.215d.b801/104
R I 1 ATM0        UP 0 47.0091.8100.0000.0090.215d.b801.0090.215d.b801/152
R I 1 ATM2/0/0    UP 0 47.0091.8100.0000.0090.215d.b801.00c0.0000.0001/152
R I 1 ATM0        UP 0 47.0091.8100.0000.0090.215d.b801.4000.0c/128
P I 9 0           UP 0 47.0091.8100.1/44

```

Capri#**show atm pnni identifiers**

Node	Node Id	Name
1	44:160:47.00918100000000090215DB801.0090215DB801.00	Capri
2	36:44:47.00918100000000000000000000.0090215DB801.00	Capri.2.36
3	30:36:47.00918100000000000000000000.0090215DB801.00	Capri.3.30
9	36:44:47.00918100100000000000000000.009021561401.00	Procida.2.36

Procida

This output is a result of these **show** commands issued on the devices used in the sample configuration:

Procida#**show atm pnni neighbor**

Neighbors For Node (Index 1, Level 44)

Neighbors For Node (Index 2, Level 36)

```

Neighbor Name: Capri.2.36, Node number: 9
Neighbor Node Id: 36:44:47.009181000000000000000000.0090215DB801.00
Neighboring Peer State: Full
Link Selection For CBR      : minimize blocking of future calls
Link Selection For VBR-RT  : minimize blocking of future calls
Link Selection For VBR-NRT : minimize blocking of future calls
Link Selection For ABR     : balance load
Link Selection For UBR     : balance load

```

Port	Remote Port Id	HzLn state
2946000	2E77000	2way

Note: Flooding to this LGN is done through the common SVCC RCC.

Procida#**show atm pnni election local-node 1**

```

PGL Status.....: PGL
Preferred PGL.....: (1) Procida
Preferred PGL Priority.: 255
Active PGL.....: (1) Procida
Active PGL Priority....: 255

```

```

Active PGL For.....: 00:32:10
Current FSM State.....: PGLE Operating: PGL
Last FSM State.....: PGLE Awaiting Unanimity
Last FSM Event.....: Unanimous Vote

```

```

Configured Priority....: 205
Advertised Priority....: 255
Conf. Parent Node Index: 2
PGL Init Interval.....: 15 secs
Search Peer Interval...: 75 secs
Re-election Interval...: 15 secs
Override Delay.....: 30 secs

```

```

Procida#sh atm pnni election local-node 2

```

```

PGL Status.....: Not PGL
Preferred PGL.....: (9) Capri.2.36
Preferred PGL Priority.: 255
Active PGL.....: (9) Capri.2.36
Active PGL Priority....: 255
Active PGL For.....: 00:04:34
Current FSM State.....: PGLE Operating: Not PGL
Last FSM State.....: PGLE Calculating
Last FSM Event.....: Preferred PGL Is Not Self

```

```

Configured Priority....: 0
Advertised Priority....: 0
Conf. Parent Node Index: NONE
PGL Init Interval.....: 15 secs
Search Peer Interval...: 75 secs
Re-election Interval...: 15 secs
Override Delay.....: 30 secs

```

Issue the **show atm route** command in order to see the ATM routing table:

```

Procida#show atm route

```

```

Codes: P - installing Protocol (S - Static, P - PNNI, R - Routing control),
       T - Type (I - Internal prefix, E - Exterior prefix, SE - Summary Exterior prefix,
       SI - Summary Internal prefix, ZE - Suppress Summary Exterior,
       ZI - Suppress Summary Internal)

```

```

P  T Node/Port      St Lev Prefix
~  ~ ~~~~~~
P  I 10 0          UP 0 47.0091.810/36
P  I 9 0           UP 0 47.0091.8100.0/44
P  SI 2 0          UP 0 47.0091.8100.1/44
P  SI 1 0          UP 0 47.0091.8100.1100.0090.2156.1401/104
R  I 1 ATM0        UP 0 47.0091.8100.1100.0090.2156.1401.0090.2156.1401/152
R  I 1 ATM1/1/2    UP 0 47.0091.8100.1100.0090.2156.1401.00c0.0000.0002/152
R  I 1 ATM0        UP 0 47.0091.8100.1100.0090.2156.1401.4000.0c/128

```

```

Procida#show atm pnni identifiers

```

Node	Node Id	Name
1	44:160:47.009181001100009021561401.009021561401.00	Procida
2	36:44:47.009181001000000000000000.009021561401.00	Procida.2.36
9	36:44:47.009181000000000000000000.0090215DB801.00	Capri.2.36
10	30:36:47.009181000000000000000000.0090215DB801.00	Capri.3.30

Troubleshoot

There is currently no specific troubleshooting information available for this configuration.

Related Information

- [ATM Technology Support Pages](#)
 - [Introduction to PNNI](#)
 - [Configuring ATM Routing and PNNI](#)
 - [ATM Forum Private Network–Network Interface Specifications](#)
 - [Technical Support & Documentation – Cisco Systems](#)
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