



Configuring PNNI Communications

This chapter explains how to configure the RPM-PR to operate as an edge router in a PNNI network. When it is operating as a PNNI edge router, you can configure soft permanent virtual circuits (SPVCs) between the RPM-PR and other switch cards. For example, you can configure an SPVC between two RPM-PRs, or between an RPM-PR and an AXSM card. The SPVC can be configured between cards in the same switch, or between cards on two different switches. When the connection endpoints terminate on different switches, PNNI routes and, if necessary, reroutes connections between the endpoints.

This chapter begins with configuration quickstarts that provide overviews of the tasks required to configure RPM-PR SPVC connections. The chapter contains the following sections:

- [Configuration Quickstarts](#)
- [Configuring PNNI Connections](#)
- [Connection Management](#)
- [Connection State Alarms](#)

Configuration Quickstarts

Configuration quickstarts are designed as an overview and quick reference for those who have already configured RPM-PR cards. Use these quickstarts as a guide to configuring your RPM-PR card. If you need additional information on any step, look in the “Purpose” column for a reference to detailed documentation.

Switch and RPM-PR Preparation Quickstart

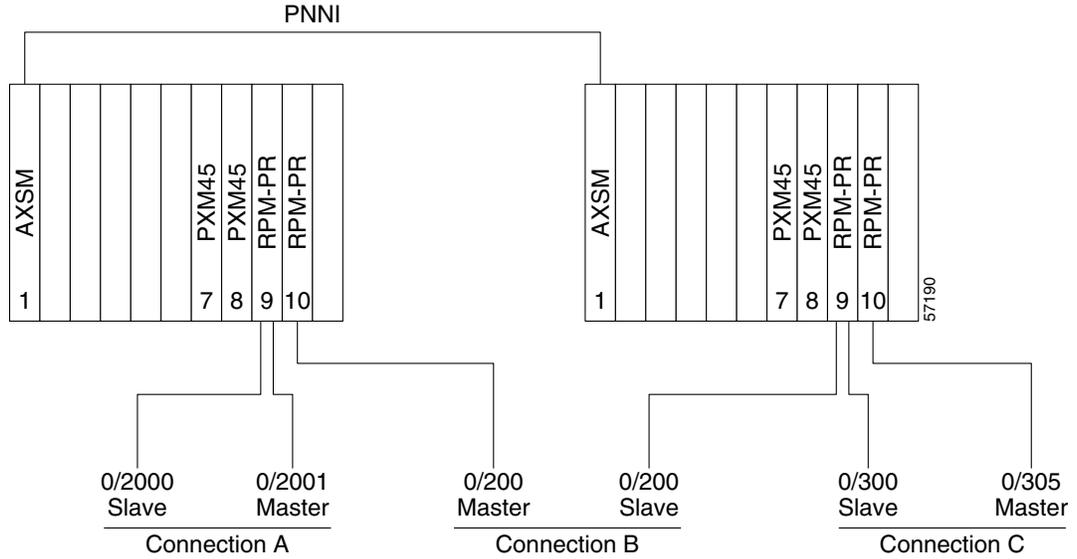
The following quickstart procedure describes tasks that prepare the switch and the RPM-PR to support multiple PNNI connections through RPM-PR. Follow this procedure whenever you configure a new RPM-PR in a switch.

	Command	Purpose
Step 1	<p>Prompt: Switch.7.PXM.a ></p> <pre>dsppcontrollers</pre> <pre>addcontroller <cntrlrId> i <cntrlrType> <slot> [<cntrlrName>]</pre>	<p>Verify that a PNNI controller is defined on the PXM-45 card and configured correctly. A PNNI controller is defined once for each switch.</p> <p>See the “Verifying the PNNI Controller Configuration” section later in this chapter.</p> <p>Adds a controller.</p>
Step 2	<p>Prompt: RPM-PR (config) #</p> <pre>interface switch1 switch partition <options> ingress-percentage-bandwidth <options> egress-percentage-bandwidth <options> vpi <options> vci <options></pre> <p>Related commands:</p> <pre>show switch partitions</pre>	<p>Assign the switch1 interface resources to the PNNI controller. This procedure must be completed once for each RPM-PR card.</p> <p>See the “Assigning Link Resources to a PNNI Controller” section later in this chapter.</p>
Step 3	<p>Prompt: Switch.7.PXM.a ></p> <pre>dnppport <port> cnfppportsig <options> upppport <port></pre> <p>Related commands:</p> <pre>dsppports dsppportsig</pre>	<p>Configure the switch1 interface signaling for PNNI. For example:</p> <pre>cnfppportsig <portID> -univer self</pre> <p>Note <i>portID</i> = slot#.partType; partType = 1 for vcc and 2 for vpc.</p> <p>See the “Configuring Switch Interface Signaling” section later in this chapter.</p>

RPM-PR to RPM-PR Connection Quickstart

The quickstart procedure in this section describes how to configure a PNNI SPVC between two RPM-PR subinterfaces. [Figure 6-1](#) illustrates three types of RPM-PR to RPM-PR connections.

Figure 6-1 RPM-PR-to-RPM-PR Connections



Connection endpoints are established on subinterfaces, which are identified by the PVC number in the format VPI/VCI. The subinterfaces can be located on the same RPM-PR card, on different RPM-PR cards within the same switch, or on RPM-PR cards in different switches. You must define the slave end of the connection first, and then the master end.

Connection B is defined between subinterfaces on two different RPM-PR cards in two different switches. Before the connection can operate, the PNNI link between the two switches must be established. Refer to the *Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide*.

Connection A is defined between two subinterfaces on the same RPM-PR; connection C is configured between two subinterfaces that are on different RPM-PR cards in the same switch. When both ends of a connection terminate on the same switch, there is no need for the PNNI trunk shown in Figure 6-1.

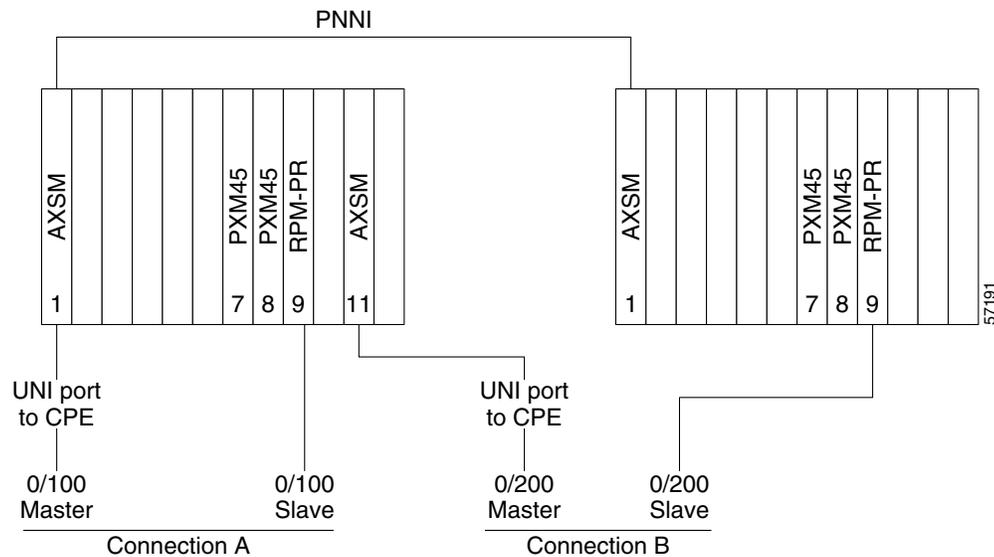
	Command	Purpose
Step 1	<pre>interface Switch 1.xx <options> ip address <options> pvc vpi/vci</pre>	At the RPM that will host the slave side of the connection, create and configure a subinterface to host the slave side connection. See the “ Creating and Configuring a Switch Subinterface ” section later in this chapter.
Step 2	<pre>switch connection <options></pre> <p>Related commands</p> <pre>show switch connection show ip int br</pre>	Add the slave end of the new connection to the subinterface PVC. See the “ Creating a Slave Connection on the RPM-PR ” section later in this chapter.
Step 3	<pre>cc <slot> dspcon <port> <vpi> <vci></pre>	Change to an active PXM-45 card and copy or write down the ATM address for the slave endpoint. See the “ Creating a Slave Connection on the RPM-PR ” section later in this chapter.

Command	Purpose
Step 4 <code>interface Switch 1.xx <options></code> <code>ip address <options></code> <code>pvc vpi/vci</code>	At the RPM that will host the master side of the connection, create and configure a subinterface to host the master side connection. See the “ Creating and Configuring a Switch Subinterface ” section later in this chapter.
Step 5 <code>switch connection <options></code> Related commands <code>show switch connection</code> <code>show ip int br</code>	Add the master end of the new connection to the subinterface PVC. See the “ Creating a Master Connection on the RPM-PR ” section later in this chapter.

RPM-PR Slave to the AXSM Master Connection Quickstart

The following quickstart procedure describes how to configure a PNNI SPVC between an RPM-PR subinterface and an AXSM port. [Figure 6-2](#) illustrates two types of RPM-PR to AXSM connections.

Figure 6-2 RPM-PR Slave to AXSM Master Connections



Connection endpoints are established on subinterfaces, which are identified by the PVC number in the format VPI/VCI. The RPM-PR and AXSM cards can be located on the same switch or on different switches. You must define the RPM-PR as the slave end of the connection first, and then you can define the master end of the connection.

Connection B is defined between the RPM-PR and AXSM cards in two different switches. Before the connection can operate, the PNNI link between the two switches must be established. Refer to the *Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide*.

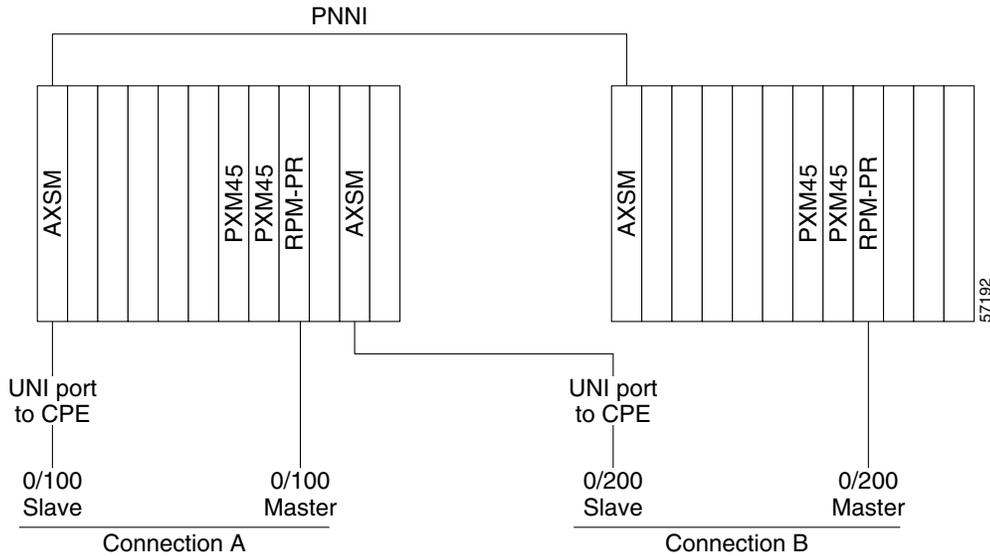
Connection A is defined between the RPM-PR and AXSM cards in the same switch. When both ends of a connection terminate on the same switch, there is no need for the PNNI trunk shown in [Figure 6-2](#).

	Command	Purpose
Step 1	<pre>interface Switch 1.xx <options> ip address <options> pvc vpi/vci</pre>	<p>At the RPM that hosts the slave side of the connection, create and configure a subinterface to host the slave side connection.</p> <p>See the “Creating and Configuring a Switch Subinterface” section later in this chapter.</p>
Step 2	<pre>switch connection <options></pre> <p>Related commands</p> <pre>show switch connection show ip int br</pre>	<p>Add the slave end of the new connection to the subinterface PVC.</p> <p>See the “Creating a Slave Connection on the RPM-PR” section later in this chapter.</p>
Step 3	<pre>cc <slot> dspcon <port> <vpi> <vci></pre>	<p>Change to active PXM-45 card and copy or write down the ATM address for the slave endpoint.</p> <p>See the “Creating a Slave Connection on the RPM-PR” section later in this chapter.</p>
Step 4	<pre>cnfcdsct upln</pre>	<p>At the AXSM card that will host the master side of the connection, configure the card and the line, if these components are not configured already.</p> <p>Refer to the <i>Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide</i>, Chapter 3, “Preparing AXSM Cards and Lines for Communication.”</p>
Step 5	<pre>dsppnni-link dsppnni-node-list dsppnni-node dsppnni-reachable-addr network</pre>	<p>If the RPM-PR card that hosts the slave side of the connection is on a different switch, verify communications between the local and remote switches.</p> <p>Refer to the <i>Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide</i>, Chapter 5, “Provisioning AXSM Communication Links,” the “Verifying PNNI Communications” section.</p> <p>Note <code>dsppnni-link</code> command provides real-time data. For the other <code>dsppnni</code> commands, designate a PTSE (PNNI topology state element) time out.</p>
Step 6	<pre>addport addpart</pre>	<p>Add an AXSM UNI port to host the master connection and create a PNNI partition for that port.</p> <p>Refer to the <i>Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide</i>, Chapter 5, “Provisioning AXSM Communication Links,” the “MPLS and PNNI UNI Port Configuration Quickstart” section.</p>
Step 7	<pre>addcon <options></pre> <p>Related commands</p> <pre>dsppcons dspcon <port> <vpi> <vci></pre>	<p>Add the master side of the connection to the UNI port.</p> <p>Refer to the <i>Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide</i>, Chapter 5, “Provisioning AXSM Communication Links,” the “Configuring the Master Side of SPVCs and SPVPs” section.</p>

AXSM Slave to RPM-PR Master Connection Quickstart

The following quickstart procedure describes how to configure a PNNI SPVC between an RPM-PR subinterface and an AXSM port. Figure 6-3 illustrates two types of RPM-PR to AXSM connections.

Figure 6-3 RPM-PR Master to AXSM Slave Connections



Connection endpoints are established on subinterfaces, which are identified by the PVC number in the format VPI/VCI. The RPM-PR and AXSM cards can be located on the same switch or on different switches. You must define the slave end of the connection first, and then define the master end.

Connection B is defined between RPM-PR and AXSM cards in two different switches. Before the connection can operate, the PNNI link between the two switches must be established. Refer to the *Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide*.

Connection A is defined between RPM-PR and AXSM cards in the same switch. When both ends of a connection terminate on the same switch, there is no need for the PNNI trunk shown in Figure 6-3.

	Command	Purpose
Step 1	<pre>dnln cnfcdsct upln</pre>	<p>At the AXSM card that will host the slave side of the connection, configure the card and the line, if these components have not been configured already.</p> <p>Refer to the <i>Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide</i>, Chapter 3, “Preparing AXSM Cards and Lines for Communication.”</p>
Step 2	<pre>dsppnni-link dsppnni-node-list dsppnni-node dsppnni-reachable-addr network</pre>	<p>If the RPM-PR card that hosts the master side of the connection is on a different switch, verify communications between the local and remote switches.</p> <p>Refer to the <i>Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide</i>, Chapter 5, “Provisioning AXSM Communication Links,” the “Verifying PNNI Communications” section.</p>

	Command	Purpose
Step 3	<code>addport</code> <code>addpart</code>	Add an AXSM UNI port to host the slave connection and create a PNNI partition for that port. Refer to the <i>Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide</i> , Chapter 5, “Provisioning AXSM Communication Links,” the “MPLS and PNNI UNI Port Configuration Quickstart” section.
Step 4	<code>addcon <options></code> Related commands <code>dspcons</code> <code>dspcon <port> <vpi> <vci></code>	Add the slave side of the connection to the UNI port. Be sure to copy or write down the ATM address for the slave endpoint. Refer to the <i>Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide</i> , Chapter 5, “Provisioning AXSM Communication Links,” the “Configuring the Slave Side of SPVCs and SPVPs” section.
Step 5	<code>interface Switch 1.xx <options></code> <code>ip address <options></code> <code>pvc vpi/vci</code>	At the RPM that will host the master side of the connection, create and configure a subinterface to host the master side connection. See the “ Creating and Configuring a Switch Subinterface ” section later in this chapter.
Step 6	<code>switch connection <options></code> Related commands <code>show switch connection</code> <code>show ip int br</code>	Add the master end of the new connection to the subinterface PVC. See the “ Creating a Master Connection on the RPM-PR ” section later in this chapter.

Configuring PNNI Connections

The following sections describe the steps listed in the configuration quickstarts.

Verifying the PNNI Controller Configuration

A PNNI controller must be added to the switch before PNNI can route communications for RPM-PR connections. The PNNI controller is added just once, usually during general switch configuration. To verify that the PNNI controller has been added and configured correctly, enter the `dspcontrollers` command on the PXM-45 as shown in the following example.

```
Switch.7.PXM.a > dspcontrollers
Switch                               System Rev: 02.01   Mar. 22, 2001 11:25:29 PST
MGX8850                               Node Alarm: CRITICAL
Number of Controllers:                 1
Controller Name:                       PNNI Controller
Controller Id:                         2
Controller Location:                   Internal
Controller Type:                       PNNI
Controller Logical Slot:                7
Controller Bay Number:                 0
Controller Line Number:                 0
Controller VPI:                        0
Controller VCI:                        0
Controller In Alarm:                   NO
Controller Error:
```

The Controller Id, Controller Location, and Controller Type must match the values shown in the example above. The controller name is defined by the person that creates the controller and can be different from what is shown above.

If the **dspscontrollers** command does not display a PNNI controller, enter the **addcontroller** command. (Refer to the *Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide*.)

Assigning Link Resources to a PNNI Controller

Link resources must be defined on the RPM-PR before you can create a connection or configure a PNNI. Link resources include the following.

- Ingress bandwidth
- Egress bandwidth
- Virtual path identifier (VPI) range
- Virtual channel identifier (VCI) range

The **switch** command defines the bandwidth and addressing resources assigned to each controller.

The **switch partition** command is used to modify the resource partitioning on the RPM-PR. Enter the **switch partition** command before you add any PNNIs or connections to the RPM-PR, because by default, all partitions are disabled.



Note

PAR is not supported.

To assign link resources to a controller, use the following switch partition routine.

Step 1 Enter the **switch partition** command.

```
(config-if)# switch partition {vcc | vpc} <partId> <ctrlrId>
```

Parameter	Description
<i>partId</i>	Range is 1 to 10; 1 is reserved for PNNI.
<i>ctrlrId</i>	Range is 2 to 255; 2 is reserved for PNNI.

Step 2 Enter the **ingress-percentage-bandwidth** command at the swpart prompt to specify the minimum and maximum ingress percentage bandwidth.

```
(config-if-swpart)# ingress-percentage-bandwidth <ingMinPctBw> <ingMaxPctBw>
```

Step 3 Enter the **egress-percentage-bandwidth** command to specify the minimum and maximum egress percentage bandwidth.

```
(config-if-swpart)# egress-percentage-bandwidth <egrMinPctBw> <egrMaxPctBw>
```

Step 4 Enter the **vpi** command to specify the minimum and maximum vpi.

```
(config-if-swpart)# vpi <min_vpi> <max_vpi>
```

Step 5 Enter the **vci** command to specify the minimum and maximum vci.

```
(config-if-swpart)# vci <min_vci> <max_vci>
```

The following is an example of the switch partition commands.

```
Router(config-if)#switch part vcc 1 2
Router(config-if-swpart)#ingress-percentage-bandwidth 1 100
Router(config-if-swpart)#egress-percentage-bandwidth 1 100
Router(config-if-swpart)#vpi 0 0
Router(config-if-swpart)#vci 2000 3000
```

partId = 1 for PNNI.

ctrlrId = 2 for PNNI.

Table 6-1 describes **switch partition** command parameters.

Table 6-1 Switch Partition Parameter Description

Parameter	Description
<i>vcc vpc</i>	The identifier type that you want to define, either Virtual Path Identifier (VPI) or Virtual Channel Identifier (VCI).
<i>ingress-percent</i>	The percentage of the ingress bandwidth on the ATM switch interface that can be allocated by the controller type. The aggregate of the ingress bandwidth across all three controllers can exceed 100 percent.
<i>egress-percent</i>	The percentage of the egress bandwidth on the ATM switch interface that can be allocated by the controller type. The aggregate of the egress bandwidth across all three controllers can exceed 100 percent.
<i>min-vpi</i>	The minimum VPI value that can be assigned on SPVCs on this controller. The VPI range on the three controllers can overlap.
<i>max-vpi</i>	The maximum VPI value that can be assigned on SPVCs on this controller. The VPI range on the three controllers can overlap.
<i>min-vci</i>	The minimum VCI value that can be assigned on SPVCs on this controller. Unlike the VPI range, the VCI range cannot overlap the VCI range of another controller.
<i>max-vci</i>	The maximum VCI value that can be assigned on SPVCs on this controller. Unlike the VPI range, the VCI range cannot overlap the VCI range of another controller.

VPIs and VCIs

There are two types of partitions.

- Virtual Channel Connection (VCC) partitions used to terminate VCCs such as SPVCs.
- Virtual Path Connection (VPC) partitions used to terminate VPCs such as Soft Permanent Virtual Paths (SPVPs).

Currently, an RPM-PR switch port supports 4096 LCNs. Out of these 4096 LCNs, 32 are reserved for management VCCs (16 for intercard communication, 13 for VSI master-to-slave communication and 3 reserved), and 255 (VPIs 1 to 255) are reserved for VPCs. Consequently, 3808 (VCIs 1 to 3808) remain for VCCs.



Note For VCC the VPI value must be set to 0.

All of these VPIs and VCIs can be partitioned among all the controllers on the switch. In this release, one PNNI controller and MPLS connection LSCs are supported.

A trade-off was made to reserve these so that they are available when a controller function is to be added at the CLI.

Table 6-2 LCN Assignments

Connection Type	VPI	VCI
VCC	0	1—3808
VPC	1—255	0—65535
Management VC	0	65520—65535
VSI Control VC	0	65507—65519

The current implementation requires that all partitions that are configured for the same controller must have the same partition ID. In this release, controller ID 2 and partition ID 1 are reserved for PNNI.

The following gives an example to show how VPI/VCI resources on the RPM-PR can be partitioned among the PNNI controller and two LSCs. In this example, the controllers and partitions are the following.

Controllers:

- PNNI Controller—Controller ID 2
- LSC1—Controller ID 3
- LSC2—Controller ID 3



Note LSC controller IDs must match those defined in the **addcontroller** command. See [Chapter 7, “Configuring ATM MPLS and VPN,”](#) the [Adding an MPLS Controller to the PXM-45](#) section.

Partitions:

- Partition 1 (Partition ID 5; Interface # 1)—VPI range: 0; VCI range: 1 to 200
- Partition 2 (Partition ID 6; Interface # 1)—VPI range: 0; VCI range: 201 to 500
- Partition 3 (Partition ID 1; Interface # 1)—VPI range: 0; VCI range: 501 to 1000
- Partition 4 (Partition ID 1; Interface # 2)—VPI range: 1 to 100; VCI range: 0 to 65535

Table 6-3 Partitioning VPI/VCI Resources on the RPM-PR

	Partition 1	Partition 2	Partition 3	Partition 4
PNNI Controller			X	X
LSC1	X			
LSC2		X		

VPI/VCI ranges cannot overlap between partitions, and a partition can only be used by one controller. The VPI/VCI range can be expanded or reduced as long as the VPI/VCIs are not in use. However, the new VPI/VCI range will not be effective until the controller is deleted and re-added. Existing connections will remain unaffected.

The VPI and VCI partitioning parameters can be configured from CWM or via the CLI command **switch partition**. Refer to the *Cisco MGX 8850 Routing Switch Command Reference* for the command syntax and usage.

Bandwidth

Bandwidth is also configured by using the **switch partition** command. The bandwidth allocated to each controller is managed by the following parameters:

- Minimum bandwidth is the guaranteed minimum bandwidth that will be reserved for use by the controller.
- Maximum bandwidth is the maximum bandwidth that can be used by the controller.

Bandwidth partitioning for the ingress direction and the egress direction are managed separately. As with VPI/VCI resources, the bandwidth partition can be expanded or reduced as long as the resource is not in use.

The bandwidth partitioning parameters can be configured through the **switch partition** CLI command as shown in this example.

```
Router(config-if-swpart)#ingress-percentage-bandwidth 1 100
Router(config-if-swpart)#egress-percentage-bandwidth 1 100
```

Use the switch partition routine. See the “[Assigning Link Resources to a PNNI Controller](#)” section earlier in this chapter to set the percentage of ingress and egress bandwidth, as shown in the following procedure.

- Step 1** Enter the following commands to configure the resource partition and set the percentage of ingress and egress bandwidth on the RPM.

```
Router(config-if)# switch partition {vcc | vpc} <partId> <ctrlrId>
Router(config-if-swpart)# ingress-percentage-bandwidth <ingMinPctBw> <ingMaxPctBw>
Router(config-if-swpart)# egress-percentage-bandwidth <egrMinPctBw> <egrMaxPctBw>
Router(config-if-swpart)# vpi <min_vpi> <max_vpi>
Router(config-if-swpart)# vci <min_vci> <max_vci>
```

partId = 1 for PNNI

ctrlrId = 2 for PNNI

- Step 2** Enter the **copy run start** command to save the configuration to the RPM’s memory.

```
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface switch1
Router(config-if)#switch part vcc 1 2
Router(config-if-swpart)#ingress-percentage-bandwidth 1 100
Router(config-if-swpart)#egress-percentage-bandwidth 1 100
Router(config-if-swpart)#vpi 0 0
Router(config-if-swpart)#vci 2000 3000
Router(config-if-swpart)#end
Router#copy run start
Building configuration...
[OK]
```

Step 3 Enter the **show switch partition** commands to verify your configuration.

```
Router#show switch partition
Part Ctrlr  Guar   Max   Guar   Max
Id   Id     Ing%Bw Ing%Bw  Egr%Bw Egr%Bw  minVpi maxVpi minVci maxVci MaxCons
1    2      1      100    1      100    0      0      2000  3000  1001

Router#show switch partition vcc 1
-----
Shelf                : 1
Pxm Slot             : 7
Slot                 : 9
IfType               : 3
IfNum                : 1
Partition ID         : 1
Controller ID        : 2
Guaranteed Ingress Pct BW: 1
Max Ingress Pct BW   : 100
Guaranteed Egress Pct BW : 1
Max Egress Pct BW    : 100
VPI Low              : 0
VPI High             : 0
VCI Low              : 2000
VCI High             : 3000
Maximum # of Connections : 1001
```

Configuring Switch Interface Signaling

The procedure in this section describes how to configure the signaling for the switch interface so it can support PNNI connections. This configuration is done on the PXM-45 card.

On the PXM-45 card, the switch interface appears as a PNNI port, as shown in the following procedure.

Step 1 Enter the **dsppnports** command to determine which PNNI ports represent RPM-PR switch interfaces.

```
Switch.7.PXM.a > dsppnports
Summary of total connections
(p2p=point to point,p2mp=point to multipoint,SpvcD=DAX spvc,SpvcR=Routed spvc)
Type  #Svcc:  #Svpc:  #SpvcD:  #SpvpD:  #SpvcR:  #SpvpR:  #Total:
p2p:  0      0      3        0        0        0        3
p2mp: 0      0      0        0        0        0        0
                                           Total=3

Summary of total configured SPVC endpoints
Type  #SpvcCfg:  #SpvpCfg:
p2p:  7      0
p2mp: 0      0

Per-port status summary

PortId      IF status      Admin status      ILMI state      #Conns
7.35        up              up                 Undefined        0
7.36        up              up                 Undefined        0
7.37        up              up                 Undefined        0
7.38        up              up                 Undefined        0
```

Type <CR> to continue, Q<CR> to stop:

9.1	up	up	Undefined	4
1:1.1:1	provisioning	up	Undefined	0
1:1.2:2	down	up	Undefined	0
2:1.1:1	up	up	Disable	1
2:2.1:1	provisioning	down	Undefined	0
2:2.2:2	provisioning	down	Undefined	0
3:2.1:5	up	up	UpAndNormal	1
3:2.2:4	building vc	up	Disable	0

In the example above, port 9.1 represents an RPM-PR switch interface. The other port numbers, which use the format *n:n.n:n*, are for AXSM card ports.



Note The port specified for RPM-PR is in the format of *slot.n*, *n=1* for vcc and *n=2* for vpc. The vsi slave is in the PXM-45 card.

Step 2 To display the port signaling type, enter the **dsppnportsig** command.

```
Switch.7.PXM.a > dsppnportsig 9.1
```

```
provisioned IF-type: uni   version:   uni3.1
sigType: private         side:     network
addrPlan: aesa
sigVpi:      0           sigVci:    5
rccVpi:      n/a         rccVci:   n/a
```

The *provisioned IF-type* field in the example above indicates this is a UNI port, and the version field indicates the signaling is configured to the default value, *uni3.1*. The correct value for a PNNI RPM-PR port is *self*. If the signaling is configured correctly, the **dsppnportsig** command displays the following information.

```
Switch.7.PXM.a > dsppnportsig 9.1
```

```
provisioned IF-type: uni   version:   self
sigType: private         side:     network
addrPlan: aesa
sigVpi:      0           sigVci:    5
rccVpi:      n/a         rccVci:   n/a
```

Step 3 If you need to change the port signaling configuration, enter the **dnppnport** command to bring down the port on which you want to configure signaling. For example,

```
Switch.7.PXM.a > dnppnport 9.1
```

Step 4 Configure the RPM-PR port UNI signaling to *self* using the **cnfpnportsig** command.

```
Switch.7.PXM.a > cnfpnportsig <portid> -univer self
```

Replace *portid* with the port number as shown in the following example:

```
Switch.7.PXM.a > cnfpnportsig 9.1 -univer self
```

Step 5 Bring up the port you just configured with the **upppnport** command. For example,

```
Switch.7.PXM.a > upnpport 9.1
```

Step 6 To verify the configuration change, re-enter the **dsppnportsig** command.

Creating and Configuring a Switch Subinterface

The switch interface on the RPM-PR does not directly support connection endpoints. Before you can create a connection endpoint, you must define a switch subinterface and define a PVC on that interface. The connection endpoint is configured using the VPI and VCI of the PVC.

Some subinterfaces support multiple PVCs (multipoint) that do the equivalent of broadcasting. Others support only one PVC (point-to-point). If a point-to-multipoint PVC exists, then that PVC can be used as the sole broadcast PVC for all multicast requests.

Each subinterface is identified using the notation **interface switch 1.<subinterface>**. The **interface switch 1** is the switch interface number, which is always 1, and the **<subinterface>** is a number that identifies the subinterface. You can choose the subinterface number when you create the subinterface. The subinterface number has to be unique on the RPM-PR card, but it does not have to match any other number.

To create a switch subinterface, configure the following:

- IP address for the subinterface
- PVC for the subinterface
- PVC configuration parameters

The following procedure describes how to complete these tasks.

Step 1 To create the subinterface, enter the **interface** command.

```
Router(config)# interface switch 1.<subinterface> <multipoint | point-to-point | mpls | tag-switching>
```

The following example adds subinterface **1** to the switch **1** interface and defines the subinterface as a point-to-point connection.

```
Router(config)#interface switch 1.1 point-to-point
```

Step 2 Enter the **ip** command to add an IP address to the subinterface.

```
Router(config-subif)# ip address <ip_addr> <subnet_mask>
```

The following example adds IP address 1.1.1.1 to subinterface 1 and defines the network mask as 255.255.255.0

```
Router(config-subif)#ip address 1.1.1.1 255.255.255.0
```



Note The IP addresses for the subinterfaces at the slave and master ends of a connection should share the same subnet.

Step 3 Enter the **pvc** command to add a PVC to the subinterface.

```
Router(config-subif)# pvc <vpi>/<vci>
```

The following example creates a PVC on the subinterface and assigns it VPI 0 and VCI 2000.

```
Router(config-subif)#pvc 0/2000
```

After you enter this command, the switch enters virtual circuit configuration mode for this PVC.



Note The VPI and VCI values you enter for the PVC must be within the ranges set for the PNNI controller when the PNNI partition was defined for the switch interface. For more information, see the “[Assigning Link Resources to a PNNI Controller](#)” section earlier in this chapter.

Step 4 Enter a question mark to list the commands that you can use to configure the PVC.

```
Router(config-if-atm-vc)#?
ATM virtual circuit configuration commands:
abr                Enter Available Bit Rate (pcr)(mcr)
atm                atm pvc commands
broadcast          Pseudo-broadcast
class-vc           Configure default vc-class name
default            Set a command to its defaults
dialer             set dialer pool this pvc belongs to
encapsulation      Select ATM Encapsulation for VC
exit-vc            Exit from ATM VC configuration mode
ilmi               Configure ILMI management
inarp              Change the inverse arp timer on the PVC
no                 Negate a command or set its defaults
oam                Configure oam parameters
oam-pvc            Send oam cells on this pvc
protocol           Map an upper layer protocol to this connection.
random-detect      Configure WRED
service-policy     Attach a policy-map to a VC
transmit-priority  set the transmit priority for this VC
tx-ring-limit      Configure PA level transmit ring limit
ubr                Enter Unspecified Peak Cell Rate (pcr) in Kbps.
vbr-nrt            Enter Variable Bit Rate (pcr)(scr)(bcs)
vc-hold-queue      Configure hold queue size
```

The following example shows some commands you might want to use to configure the PVC.

```
Router(config-if-atm-vc)#oam-pvc manage
Router(config-if-atm-vc)#encapsulation aal5snap
```

Step 5 When you have finished configuring the PVC, enter the **exit-vc** command to return to subinterface configuration mode.

```
Router(config-if-atm-vc)#exit-vc
Router(config-subif)#
```

Creating a Slave Connection on the RPM-PR

When you create a slave connection on an RPM-PR card, that connection endpoint does not route or reroute connections. Connection routing is the responsibility of the master connection endpoint.

To perform routing and rerouting, the master connection endpoint requires the ATM address of the slave endpoint, so the slave endpoint must be defined first. The following procedure describes how to create a slave connection endpoint.

**Note**

You must configure both the slave and master connection endpoints before the connection can operate.

If you have not already done so, create a subinterface and PVC to host the slave connection endpoint. See the “[Creating and Configuring a Switch Subinterface](#)” section earlier in this chapter.

Step 1 If the switch is not in subinterface configuration mode, change to that mode.

```
Router>enable
Password:
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface switch 1.1
Router(config-subif)#
```

Step 2 To create a VCC, define the slave connection endpoint with the **switch connection** command as follows:

```
Router(config-subif)# switch connection vcc <localVPI> <localVCI> master remote
```

The VPI and VCI that you enter must match the VPI and VCI you used when you configured the PVC that hosts this connection. The following example creates a slave connection for the PVC labeled VPI 0, VCI 2000.

```
Router(config-subif)#switch connection vcc 0 2000 master remote
```

Step 3 To create a VPC, define the slave connection endpoint with the **switch connection** command as follows:

```
Router(config-subif)# switch connection vpc <localVPI> master remote
```

The VPI that you enter must match the VPI you used when you configured the PVC that hosts this connection.

After you can create the slave connection endpoint, the RPM-PR enters switch connection configuration mode and displays the following prompt:

```
Router(config-if-swconn)#
```

**Note**

This is the only time that you can configure the switch connection. If you need to change the configuration later, you must delete the subinterface and recreate the connection.

Step 4 To display a list of configuration commands, enter a question mark at the switch connection prompt. For example.

```
Router(config-if-swconn)#?
Switch connection configuration commands:
 autoSynch      enable auto synch
 cost           Maximum connection cost
 default        Set a command to its defaults
 exit-swconn    Exit from switch connection configuration mode
 no            Negate a command or set its defaults
 reroute        reroute the connection
 rmbs          remote MBS value
 rmcr          remote MCR value
 rpcr          remote PCR value
 rscr          remote SCR value
 rutil         Connection remote percent utilization
 shutdown      down the connection
 util          Connection remote percent utilization
```

NOTE: raddr is optional if mastership is remote

- Step 5** Configure the switch connection using the switch connection configuration commands.



Note Local traffic parameters of an RPM endpoint are in kilobits per second (kbps) while remote traffic parameters are in cells per second (cps). 353208 cells per second equal 149760 kilobits per second.

- Step 6** Press **Ctrl-Z** to exit configuration mode, then save your configuration change.

```
Router(config-subif)#^Z
Router#copy run start
Building configuration...
[OK]
```

- Step 7** Enter the **show switch connection** command to view the slave endpoint connection. For example,

```
Router#show switch connection
```

```

                                Synchron
lVpi lVci  NSAP Address                rVpi rVci Status
0      2000 default                    0    0    inSynch:
```

Parameter	Description
lVpi	Represents the local VPI you specified when creating the connection.
lVci	Represents the local VCI you specified when creating the connection.
NSAP Address	Displays <i>default</i> as the address, identifying the connection endpoint as a slave endpoint. Master connection endpoints display an ATM address.
rVpi	Represents the remote VPI. A zero (0) value designates that a master endpoint has not been configured for this slave endpoint
rVci	Represents the remote VCI. A zero (0) value designates that a master endpoint has not been configured for this slave endpoint

- Step 8** Enter the **show ip interface brief** command to view the IP interfaces on the RPM-PR.

```
Router#show ip int br
Interface                IP-Address      OK? Method Status      Protocol
FastEthernet1/1          172.29.52.3     YES manual administratively down down
Switch1                  unassigned      YES NVRAM   up          up
Switch1.1                1.1.1.1         YES manual  up          up
```

- Step 9** To enable IP communications over the slave connection endpoint, configure the router for IP routing. The ATM connection will act as an intermediate IP network between the IP routers connected at the master and slave endpoints.

Before you can configure a master endpoint, you must locate and note the ATM address for this interface.

- Step 10** To display the ATM address assigned to the slave connection, switch to the active PXM-45 card and enter the **dspcon** command to display connection information. For example:

```
Router#cc 7

(session redirected)

Switch.7.PXM.a > dspcon 9.1 0 2000
Port                Vpi Vci                Owner                State
```

```

-----
Local  9:-1.1:-1      0.2000                SLAVE      FAIL
      Address: 47.00918100000000036b5e2bb2.000001074b01.00
Remote Routed      0.0                MASTER    --
      Address: 00.0000000000000000000000000000.000000000000.00
-----
----- Provisioning Parameters -----
Connection Type: VCC          Cast Type: Point-to-Point
Service Category: UBR        Conformance: UBR.1
Bearer Class: BCOB-X
Last Fail Cause: N/A                Attempts: 0
Continuity Check: Disabled    Frame Discard: Disabled
L-Utills: 0      R-Utills: 0      Max Cost: 0      Routing Cost: 0
OAM Segment Ep: Enabled
-----
----- Traffic Parameters -----
Tx PCR:  353208      Rx PCR:  353208
Tx CDV:  N/A        Rx CDV:  N/A
Tx CTD:  N/A        Rx CTD:  N/A

```

The slave endpoint ATM address appears below the *Local* port identification. This is the address you need to enter when you create a master connection endpoint at either an RPM-PR card or an AXSM card. The connection state is FAIL because the master endpoint has not been created.

Step 11 Copy or write down the slave endpoint ATM address for later use. (See the “[Creating a Master Connection on the RPM-PR](#)” section below.)

You are now ready to create the master endpoint on either an RPM-PR card or an AXSM card.

Creating a Master Connection on the RPM-PR

When creating a master connection on an RPM-PR card, that connection endpoint is responsible for routing and rerouting connections. Before you can create the master endpoint, you must create a slave endpoint on either an RPM-PR or AXSM card. The following procedure describes how to create a master endpoint.



Note

We recommend that the RPM-PR be configured as the slave endpoint for any connection it terminates.

If you have not done so already, create a subinterface and PVC to host the master connection endpoint. See the “[Creating and Configuring a Switch Subinterface](#)” section earlier in this chapter.



Note

The master and slave endpoints can be on the same RPM-PR card as is shown in the examples in this section. This example configuration can be used for testing and configuration practice. However, it has no practical application because you can still configure the RPM-PR to route between two Ethernet interfaces. If you do configure master and slave endpoints on the same RPM-PR card, each endpoint must use a different subinterface.

Step 1 Enter subinterface configuration mode. The following example shows how to do this from user exec mode:

```

Router>enable
Password:

```

```
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface switch 1.2 point-to-point
Router(config-subif)#
```



Note When configuring the subinterface, you must specify **point-to-point** or **p, mu, tag** or **mpls**.

Step 2 To create a VCC, enter the **switch connection** command to define the master connection endpoint.

```
Router(config-subif)# switch connection vcc <localVPI> <localVCI> master local raddr
<ATMaddr> <remoteVPI> <remoteVCI>
```

The local VPI and VCI that you enter must match the VPI and VCI you used when you configured the PVC that hosts this connection. The ATM address is the address you copied or wrote down when you created the slave endpoint, and the remote VPI and VCI must match the values set for the slave endpoint. (See the “[Creating a Slave Connection on the RPM-PR](#)” section above.)

The following example creates a master connection for the PVC labeled VPI 0, VCI 2000:

```
Router(config-subif)#switch connection vcc 0 2001 master local raddr
47.00918100000000036b5e2bb2.000001074b01.00 0 2000
```

Step 3 To create a VPC, enter the **switch connection** command to define the master connection endpoint.

```
Router(config-subif)# switch connection vpc <localVPI> master local raddr
<ATMaddr> <remoteVPI> <remoteVCI>
```

The VPI that you enter must match the VPI used to configure the PVC that hosts this connection.

After you create the master connection endpoint, the RPM-PR enters the switch connection configuration mode and displays the following prompt:

```
Router(config-if-swconn)#
```



Note This is the only time that you can configure the switch connection. If you need to change the configuration later, delete the subinterface and recreate the connection.

Step 4 To display a list of configuration commands, enter a question mark at the switch connection prompt.

```
Router(config-if-swconn)#?
Switch connection configuration commands:
 autoSynch      enable auto synch
 cost           Maximum connection cost
 default        Set a command to its defaults
 exit-swconn    Exit from switch connection configuration mode
 no             Negate a command or set its defaults
 reroute        reroute the connection
 rmbs           remote MBS value
 rmcr           remote MCR value
 rpcr           remote PCR value
 rscr           remote SCR value
 rutil          Connection remote percent utilization
 shutdown       down the connection
 util           Connection remote percent utilization
NOTE: raddr is optional if mastership is remote
```

Step 5 Configure the switch connection using the switch connection configuration commands.



Note Local traffic parameters of an RPM endpoint are in kilobits per second (kbps) while remote traffic parameters are in cells per second (cps). (353208 cps equal 149760 kbps.)

Step 6 Press **Ctrl-Z** to exit configuration mode. Save your configuration change.

```
Router(config-subif)#^Z
Router#copy run start
Building configuration...
[OK]
```

Step 7 Enter the **show switch connection** command to view the master endpoint connection.

```
Router#show switch connection

                                Synch
lVpi lVci  NSAP Address                rVpi rVci Status
-----
0    2000  default                            0    0    inSynch
0    2001  47.0091.8100.0000.0003.6b5e.2bb2.0000.0107.4b01.00 0    2000 inSynch
```

Parameter	Description
lVpi	Represents the local VPI you specified when creating the connection.
lVci	Represents the local VCI you specified when creating the connection.
NSAP Address	Displays <i>default</i> as the address, identifying the connection endpoint as a slave endpoint. Master connection endpoints display an ATM address.
rVpi	Represents the remote VPI. A zero (0) value designates that a master endpoint has not been configured for this slave endpoint
rVci	Represents the remote VCI. A zero (0) value designates that a master endpoint has not been configured for this slave endpoint

In the example above, both master and slave endpoints are on the same RPM-PR card, so both appear in the connection display. If the master and slave endpoints were on different switches, the display would show only an entry for the local endpoint. If the local endpoint is the master endpoint, the slave ATM address is shown.

Step 8 To verify that the new connection is operating properly, switch to the active PXM-45 card and enter the **dspcon** command to display connection information.

```
Switch.7.PXM.a > dspcon 9.1 0 2001
Port                Vpi Vci                Owner      State
-----
Local  9:-1.1:-1        0.2001                MASTER     OK
      Address: 47.00918100000000036b5e2bb2.000001074b01.00
Remote 9:-1.1:-1        0.2000                SLAVE      OK
      Address: 47.00918100000000036b5e2bb2.000001074b01.00

----- Provisioning Parameters -----
Connection Type: VCC          Cast Type: Point-to-Point
Service Category: UBR        Conformance: UBR.1
Bearer Class: BCOB-X
Last Fail Cause: No Fail          Attempts: 0
Continuity Check: Disabled      Frame Discard: Disabled
L-Utills: 100  R-Utills: 100    Max Cost: -1    Routing Cost: 0
OAM Segment Ep: Enabled

----- Traffic Parameters -----
Tx PCR:  353208          Rx PCR:  353208
```

```
Tx CDV: N/A          Rx CDV: N/A
Tx CTD: N/A         Rx CTD: N/A
```

Note that the ATM addresses for both ends of the connection are displayed. The connection state is OK. The connection configuration is complete.

- Step 9** To view the IP interfaces on the RPM-PR, switch back to the RPM-PR card and enter the **show ip interface brief** command.

```
Switch.7.PXM.a > cc 9
```

```
(session redirected)
```

```
Router>enable
```

```
Password:
```

```
Router#show ip int br
```

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet1/1	172.29.52.3	YES	manual	administratively down	down
Switch1	unassigned	YES	NVRAM	up	up
Switch1.1	1.1.1.1	YES	manual	up	up
Switch1.2	1.1.2.1	YES	manual	up	up

- Step 10** To validate that a local connection is operating correctly, **ping** the local IP address.

```
Router#ping 1.1.2.1
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 1.1.2.1, timeout is 2 seconds:
```

```
!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```



Note The **ping** command does not validate a connection outside the RPM-PR. It only validates that the RPM-PR subinterface IP address is working.

To enable IP communications over the master connection endpoint, configure the router for IP routing. The ATM connection will act as an intermediate IP network between the IP routers connected at the master and slave endpoints.

To validate communications to remote devices at the connection endpoints, **ping** devices on those networks. For example, ping a device connected to an RPM-PR interface, or ping an IP address on the ATM end station connected to an AXSM port.

Connection Management

This section describes connection management tasks for the RPM-PR.

Deleting a Connection

To delete a connection, you must delete both ends of the connection. The connection stops working when you delete either end, but you must delete both ends to remove the entire connection configuration.

To delete a connection endpoint on an RPM-PR card, enter the **no** form of the **switch connection** command.

```
(config-if)# no switch connection vcc <localVPI> <localVCI> master <local | remote>
[raddr <remoteNsapAddress> <remoteVPI> <remoteVCI>]
```

For example:

```
Router(config-subif)# no switch connection vcc 0 2000 master remote
```

To delete a connection endpoint on an AXSM card, refer to the *Cisco MGX 8850 and MGX 8950 Switch Software Configuration Guide*, Chapter 5, “Provisioning AXSM Communication Links,” the “Deleting SPVCs and SPVPs” section.

Modifying Traffic Parameters

The following traffic connection parameters can be modified:

- Service Type
- PCR/MCR/SCR
- Connection Cost
- Channel Utilization
- Encapsulation Type
- Virtual Template ID
- Inarp Timer
- OAM Loopback Frequency
- Enable/Disable OAM Management
- OAM Retry Up Count/Down Count Interval

There is a limitation on the changing of the service type. Although the service type can be modified using the IOS CLI on the RPM-PR, the new service type is not effective in PNNI. PNNI does not support the changing of the service type. The service type cannot be modified via CWM.

Changes to the PCR/MCR/SCR, Connection Cost, and Channel Utilization parameters result in connection reroutes, while changes to the remaining parameters result in database updates.

Enter the **switch connection** command to modify an existing connection that terminates on an RPM-PR.

Downing and Upping the Connection

A connection that terminates on an RPM-PR can be manually downed/upped. When a connection is down, its respective PNNI will be derouted and will remain derouted until the connection is upped again by the user. The master endpoint will attempt to re-establish the PNNI when the connection is upped.

Enter the **shutdown** command at the subinterface configuration level to down a connection.

```
Router(config-subif-swconn)#shutdown
```

Enter the **no shutdown** command at the subinterface configuration level to up a connection.

```
Router(config-subif-swconn)#no shutdown
```

Rerouting the Connection

A connection that terminates on an RPM-PR can be manually released and rerouted. Enter the **reroute** command and the respective SPVC will be released and automatically rerouted to the best available path.

Enter the **reroute** command at the subinterface configuration level.

```
Router(config-subif-swconn)#reroute
```

Connection Synchronization

Because connections are added separately to the RPM-PR and to AXSM or other RPM-PR cards, connections may exist on the RPM-PR but not on the AXSM or the other RPM-PR cards. Therefore, connection synchronization, which is also referred to as service module resynchronization, between the RPM-PR and the other service modules is necessary.

**Note**

Connection synchronization refers to synchronization between the modules' databases, not between endpoints.

The following conditions necessitate connection synchronization.

- If connection parameters are mismatched between the two databases, the connection status is set to "MISMATCH." To correct the problem the user is required to delete and re-add the connection.
- Administrative status is not considered as a connection parameter. Therefore, any mismatch in administrative status will not be detected by the connection synchronization feature. The mismatch, however, can be made known by using the OAM loopback test.
- If a connection exists on the RPM-PR but not on an AXSM or another RPM-PR, the connection status will be set to "ONLY_ON_RPM." To correct the problem the user is required to delete and re-add the connection.
- If connection exists on an AXSM or another RPM-PR, but not on the local RPM-PR, the connection status will be set to "NOT_ON_RPM." To correct the problem the user is required to delete and re-add the connection. The connection on the other service module can be deleted by entering the **no switch connection** command on the RPM-PR as if the connection exists on the RPM-PR.

Manually Resynchronizing Connections

You can manually resynchronize connections. However, out of synchronization conditions may be triggered by

- Periodic kickoffs
- Connection provisioning time-out on the RPM-PR
- PXM switchover
- RPM reset

You can force resynchronization by entering the **startResynch** command at the configure interface level

```
Router# config terminal  
Router(config)# interface sw1  
Router(config-if)#switch startResynch
```

Automatically Resynchronizing Connections

autoSynch corrects mismatches between the PXM and RPM databases. If your network is highly unstable, do not turn on **autoSynch**.

The commands that are used to enable/disable the **autoSynch** feature are moved under the new **switch** command. Here is an example of how you use this command on the config level.

```
Router# conf t
Router(config)# int sw1
Router(config-if)#switch autoSynch on <off|manual> "default is off"
```

Connection State Alarms

This section describes the alarm state of each PNNI, how alarms occur, and what they mean.

Endpoint status indicators reported by RPM-PR and their meanings include:

- **egrAisRdi**—The endpoint is receiving AIS or RDI cells in the egress direction (from the network).
- **ccFail**—An OAM loopback failure has occurred.
- **mismatch**—There is a mismatch between the RPM and Connection Manager databases.
- **conditioned**—There is a routing failure.

These alarms are triggered when

- There is a change in the endpoint status.
- A failure is detected by the Connection Manager during a routine routing status check.

Connection State Resynchronization

Connection state resynchronization is triggered by a PXM-45 switchover or an RPM-PR reset. This happens when an alarm state is not persistent nor contains redundant data, and needs to be rebuilt after a switchover or reset.

Each RPM gives its view of the endpoint status of the PNNI it owns and the Connection Manager gives its view of the routing status of all SPVCs that terminate on RPMs.