

# Configuring VP Tunnels and VP Switching

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## **Introduction**

### **Prerequisites**

- Requirements
- Components Used
- Conventions

### **Configure VP Switching**

- Network Diagram
- Configurations
- Verify

### **Configure Regular or Unshaped VP Tunnels**

- Network Diagram
- Configurations
- Verify

### **Configure VP Tunnels for a Single Service Category**

- Network Diagram
- Configurations
- Verify

### **Configure Shaped VP Tunnels**

- Network Diagram
- Configurations
- Verify
- Restrictions for Shaped VP Tunnels

### **Configure Hierarchical VP Tunnels for Multiple Service Categories**

- Network Diagram
- Configurations
- Verify
- Restriction for Hierarchical VP Tunnels

## **Troubleshoot**

## **Related Information**

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## **Introduction**

This document provides sample configurations for virtual path (VP) tunnels and VP switching.

With VP switching, the switching decision is solely based on the virtual path identifier (VPI) number. This is unlike VPI and virtual channel identifier (VCI) for virtual channel (VC) switching, which reduces administration as well as allows for faster switching of cells.

With VP tunnels, the VP interface is a multiplexing/demultiplexing point on an ATM switch at which VCs from various ATM interfaces are aggregated to a VP on an interface. VPs are ATM connections that are an aggregate of multiple VCs that all have the same VPI number. VPs are most often used across WANs.

### **ATM Connections**

The two major types of ATM connections are VCs and VPs.

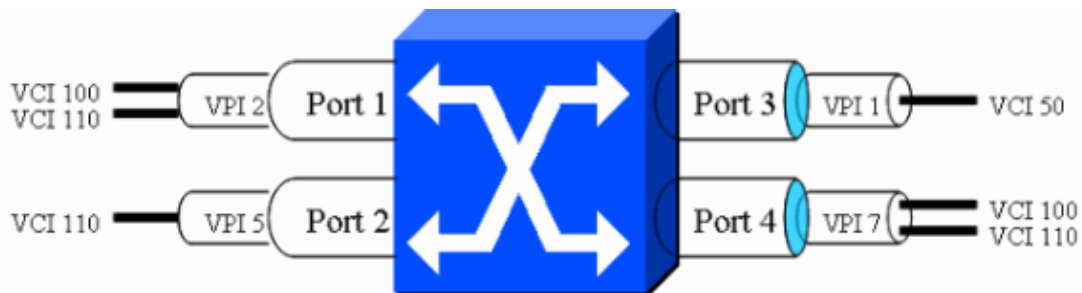
VCs are uniquely identified on the port of an ATM switch by the VPI and VCI numbers.

VPIs are uniquely identified on the ATM port by the VPI number on the ATM port.



In the diagram above, ATM cells that arrive on the VC are switched based on both the VPI and VCI number in the cell header. On the other hand, ATM cells that arrive on the VP are switched based on the VPI number only. Configuration of the ATM switch determines if the switch is supposed to be a VC or VP switch for a specific VPI/VCI pair or VPI respectively.

In this diagram, a cell is switched at the VC or VP level. With VC switching, the switch receives a cell with a configured VPI and VCI. It then looks up its connection table to determine the outgoing port (or ports) with a new VPI/VCI value. VCI/VPI 100/2 and 110/2 are attached to port 1 and the VCI/VPI associated with port 2 is 110/5. Notice that the VCI has only local significance and does not need to be unique. For port 3, the VPI/VCI associated with it is 1/50. VPI/VCI 7/100 and 7/110 are associated to port 4.



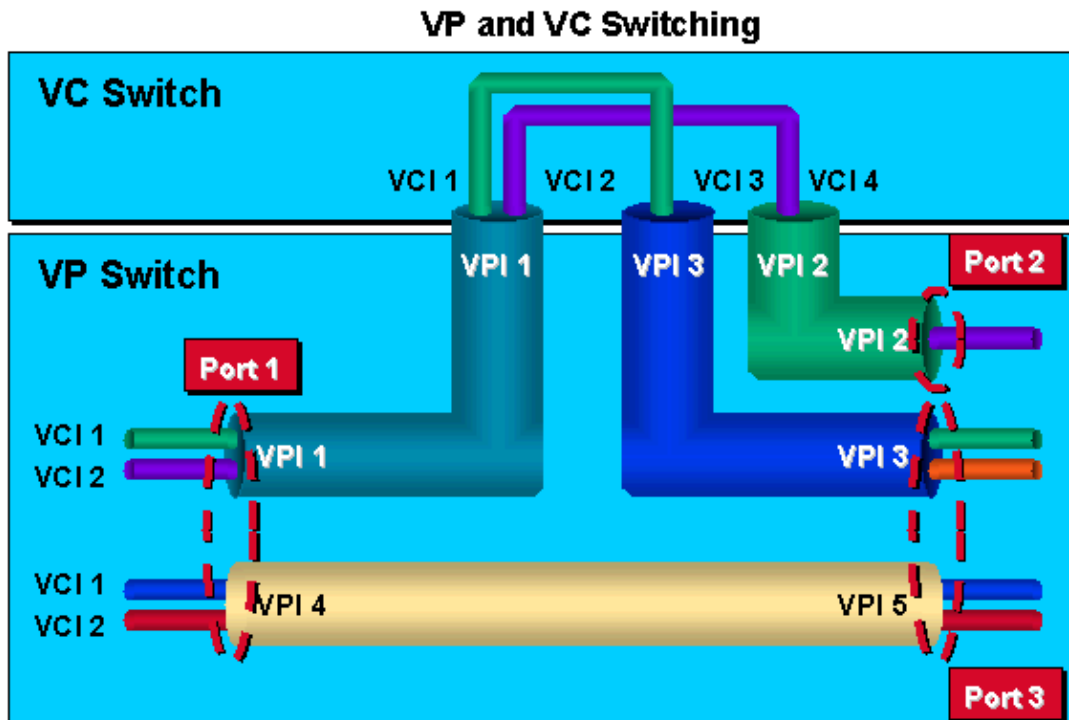
You can switch traffic from an upcoming port on the switch to an outgoing port. For example, you can determine that all traffic coming on port 1 VPI/VCI 2/100 is switched to port 4 VPI/VCI 7/110. In the same manner, you can configure the ATM switch to transfer traffic from port 2 VPI/VCI 5/110 to port 4 VCI/VPI 7/100. This table shows how the packets can be switched from one VPI/VCI to another. This is VC switching since it uses the VPI and VCI information to switch the traffic.

Port	VPI/VCI	Port	VPI/VCI
1	2/100	4	7/110
1	2/110	3	1/50
2	5/110	4	7/100

Another way to switch ATM traffic is to use only the VPI information. In this table you can see that port 1 VPI 2 is switched to port 4 VPI 7 and port 2 VPI 5 is switched to port 3 VPI 1.

Port	VPI	Port	VPI
1	2	4	7
2	5	3	1

Both VP and VC switching can be seen in this diagram:



There are three different types of VP tunnels on Cisco Enterprise ATM Switches:

- Regular or unshaped VP tunnels
- Shaped VP tunnels
- Hierarchical VP tunnels

Regular or unshaped VP tunnels are VP tunnels on which there is no traffic shaping for any ATM service category. VP tunnels can be of any service category but cannot be shaped. VCs in a tunnel have to be of the same service category as the VP tunnel.

Shaped VP tunnels are VP tunnels that are traffic shaped. They are defined only for the Constant Bit Rate (CBR) service category on Cisco Enterprise ATM switches. All VCs within a single VP tunnel must be the same service category. The overall output of this VP tunnel is rate-limited by hardware to the PCR of the tunnel.

Hierarchical VP tunnels are VP tunnels that are traffic shaped and support VCs of multiple service categories to co-exist in the tunnel at the same time. They are used, for example, if you have more than one service category but only one VP tunnel.

## Prerequisites

## Requirements

There are no specific requirements for this document.

## Components Used

The information in this document is based on these software and hardware versions.

- An unshaped VP tunnel of any service category is supported on LS1010 (with either feature card per-class queuing (FC-PCQ) and feature card per-flow queuing (FC-PFQ)), a Catalyst 8540-MSR, a Catalyst 8510-MSR, a Cisco 7500 series router with PA-A3, and a Cisco 7200 series router with PA-A2 or PA-A3, Cisco 7500 series router with PA-A6, and a Cisco 7200 series router with PA-A6. Cisco IOS® Software Releases 11.2, 11.3 or 12.0 support this feature. VCs within an unshaped tunnel have to be of the same service category of an unshaped VP tunnel.
- A shaped VP tunnel of a CBR service category is supported on LS1010 with FC-PFQ, Catalyst 8510-MSR, Catalyst 8540-MSR, Cisco 7500 series routers with PA-A3, and Cisco 7200 series routers with PA-A2 or PA-A3, Cisco 7500 series router with PA-A6, and a Cisco 7200 series router with PA-A6. All VCs within a CBR VP tunnel have to be of the same service category.
  - ◆ Shaped VP tunnels are first supported in Cisco IOS Software Release 11.2(8.0.1)FWA4. Cisco IOS Software Release 11.1 and WA3 release trains do not support shaped VP tunnels.
  - ◆ For software versions after Cisco IOS Software Release 11.3(0.8)TWA4, it is supported for a service category of VCs within a shaped VP tunnel to be on CBR.
  - ◆ Earlier software versions that support shaped VP tunnel VCs within a shaped CBR tunnel have to be of the CBR service category.
- Hierarchical VP tunnels of the CBR service category are supported on LS1010 with FC-PFQ, Catalyst 8510-MSR, and Catalyst 8540-MSR. The minimum software requirement is the W5 train of Cisco IOS.

The information presented in this document was created from devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If you are working in a live network, ensure that you understand the potential impact of any command before using it.

## Conventions

For more information on document conventions, refer to Cisco Technical Tips Conventions.

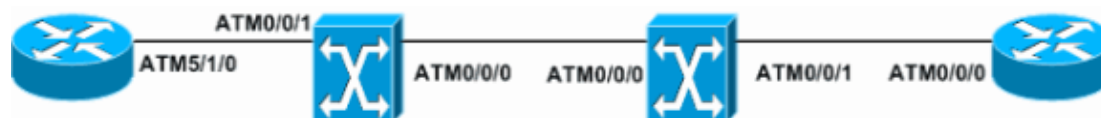
## Configure VP Switching

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

**Note:** To find additional information on the commands used in this document, use the Command Lookup Tool (registered customers only).

## Network Diagram

This section uses the network setup shown in the diagram below.



## Configurations

This section uses these configurations.

- ATM5/1/0-R1
- ATM0/0/1-S1
- ATM0/0/1-S2
- ATM0/0/0-R2

### ATM5/1/0-R1

```
interface ATM5/1/0
no ip address
no atm ilmi-keepalive
!
interface ATM5/1/0.1 point-to-point
ip address 1.1.1.1 255.255.255.0
pvc 10/20
encapsulation aal5snap
!
interface ATM5/1/0.2 point-to-point
ip address 2.1.1.1 255.255.255.0
pvc 10/30
encapsulation aal5snap
!
interface ATM5/1/0.3 point-to-point
ip address 3.1.1.1 255.255.255.0
pvc 11/40
```

### ATM0/0/1-S1

```
interface ATM0/0/1
no ip address
atm pvp 10 interface ATM0/0/0 10
atm pvp 11 interface ATM0/0/0 11
```

### ATM0/0/1-S2

```
interface ATM0/0/1
no ip address
atm pvp 10 interface ATM0/0/0 10
atm pvp 12 interface ATM0/0/0 11
```

### ATM0/0/0-R2

```
interface ATM0/0/0
no ip address
no atm ilmi-keepalive
!
interface ATM0/0/0.1 point-to-point
ip address 1.1.1.2 255.255.255.0
pvc 10/20
encapsulation aal5snap
!
interface ATM0/0/0.2 point-to-point
ip address 2.1.1.2 255.255.255.0
pvc 10/30
encapsulation aal5snap
!
interface ATM0/0/0.3 point-to-point
ip address 3.1.1.2 255.255.255.0
pvc 12/40
encapsulation aal5snap
```

## Verify

This section provides information you can use to confirm your configuration is working properly.

Certain **show** commands are supported by the Output Interpreter Tool ( registered customers only) , which allows you to view an analysis of **show** command output.

- **show atm vp** – Verifies that the VP tunnel is up.
- **show atm vp traffic interface atm0/0/0** – Verifies the ATM layer connection information about the virtual path.
- **show atm vp interface atm0/0/0 10** – Verifies all the VPs that go through the VP tunnel with VPIs.

This is sample command output for the **show atm vp** command.

```
Switch#show atm vp
Interface          VPI  Type  X-Interface          X-VPI  Status
ATM0/0/0           10   PVP   ATM0/0/1             10      UP
ATM0/0/0           11   PVP   ATM0/0/1             12      UP
ATM0/0/1           10   PVP   ATM0/0/0             10      UP
ATM0/0/1           12   PVP   ATM0/0/0             11      UP
```

This is sample command output for the **show atm vp traffic interface atm0/0/0** command.

```
Switch#show atm vp traffic interface atm0/0/0
Interface          VPI  Type  rx-cell-cnts  tx-cell-cnts
ATM0/0/0           10   PVP   70            60
ATM0/0/0           11   PVP   94            90
```

This is sample command output for the **show atm vp interface atm0/0/0 10** command.

```
Switch#show atm vp interface atm0/0/0 10

Interface: ATM0/0/0, Type: oc3suni
VPI = 10
Status: UP
Time-since-last-status-change: 00:58:11
Connection-type: PVP
Cast-type: point-to-point
Cross-connect-interface: ATM0/0/1, Type: oc3suni
Cross-connect-VPI = 10
Rx connection-traffic-table-index: 1
Rx service-category: UBR (Unspecified Bit Rate)
Rx pcr-clp01: 7113539
Rx scr-clp01: none
Rx mcr-clp01: none
Rx      cdvt: 1024 (from default for interface)
Rx      mbs: none
Tx connection-traffic-table-index: 1
Tx service-category: UBR (Unspecified Bit Rate)
Tx pcr-clp01: 7113539
Tx scr-clp01: none
Tx mcr-clp01: none
Tx      cdvt: none
Tx      mbs: none
```

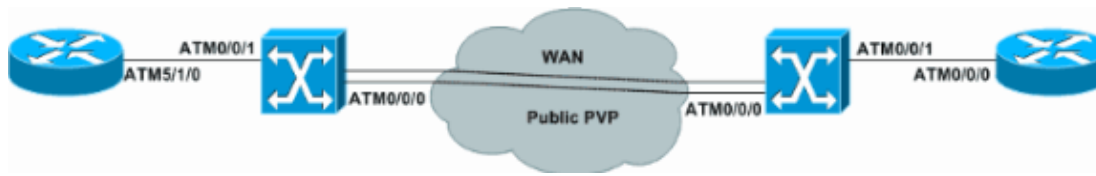
## Configure Regular or Unshaped VP Tunnels

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

**Note:** To find additional information on the commands used in this document, use the Command Lookup Tool (registered customers only).

## Network Diagram

This section uses the network setup shown in the diagram below.



## Configurations

This section describes the configurations for regular or unshaped VP tunnels. This example shows a permanent virtual path (PVP) created to go across a WAN cloud.

This section uses these configurations.

- Router 1
- Switch 1
- Switch 2
- Router 2

Router 1
<pre>interface ATM5/1/0.1 point-to-point ip address 1.1.1.1 255.255.255.0 pvc 100/32   encapsulation aal5snap ! interface ATM5/1/0.2 point-to-point ip address 2.1.1.1 255.255.255.0 <b>pvc 100/33</b>   encapsulation aal5snap</pre>

Switch 1
<pre>interface ATM0/0/0 no ip address <b>atm pvp 100</b> ! <b>interface ATM0/0/0.100 point-to-point</b> no ip directed-broadcast no atm ilmi-keepalive ! interface ATM0/0/1 no ip address no ip directed-broadcast logging event subif-link-status atm ilmi-keepalive atm svcc vci min 100 atm pvc 100 32 interface <b>ATM0/0/0.100 100 32</b> <b>atm pvc 100 33 interface ATM0/0/0.100 100 33</b></pre>

Switch 2
<pre>interface ATM0/0/0 no ip address <b>atm pvp 100</b> ! <b>interface ATM0/0/0.100 point-to-point</b> ! interface ATM0/0/1 no ip address atm pvc 100 32 interface <b>ATM0/0/0.100 100 32</b> <b>atm pvc 100 40 interface ATM0/0/0.100 100 33</b></pre>

```
!
```

### Router 2

```
interface ATM0/0/0.1 point-to-point
ip address 1.1.1.2 255.255.255.0
pvc 100/32
  encapsulation aal5snap
!
interface ATM0/0/0.2 point-to-point
ip address 2.1.1.2 255.255.255.0
pvc 100/40
  encapsulation aal5snap
!
```

## Verify

This section provides information you can use to confirm your configuration is working properly.

Certain **show** commands are supported by the Output Interpreter Tool ( registered customers only ) , which allows you to view an analysis of **show** command output.

- **show atm vp** – Verifies that the VP tunnel is up.
- **show atm vp traffic interface atm0/0/0** – Verifies the ATM layer connection information about the virtual path.
- **show atm vp interface atm0/0/0 100** – Verifies all the VPs that go through the VP tunnel with VPIs.

This is sample command output for the **show atm vp interface atm 0/0/0 100** command.

```
Switch#show atm vp interface atm 0/0/0 100

Interface: ATM0/0/0, Type: oc3suni
VPI = 100
Status: TUNNEL
Time-since-last-status-change: 17:21:32
Connection-type: PVP
Cast-type: point-to-point
Rx cells: 49968, Tx cells: 50371
Rx connection-traffic-table-index: 1
Rx service-category: UBR (Unspecified Bit Rate)
Rx pcr-clp01: 7113539
Rx scr-clp01: none
Rx mcr-clp01: none
Rx      cdvt: 1024 (from default for interface)
Rx      mbs: none
Tx connection-traffic-table-index: 1
Tx service-category: UBR (Unspecified Bit Rate)
Tx pcr-clp01: 7113539
Tx scr-clp01: none
Tx mcr-clp01: none
Tx      cdvt: none
Tx      mbs: none
```

This is sample command output for the **show atm vp** command.

```
Switch#show atm vp
Interface      VPI  Type  X-Interface      X-VPI  Status
ATM0/0/0      100   PVP   TUNNEL
```

This is sample command output for the **show atm vp traffic interface atm0/0/0** command.

```
Switch#show atm vp traffic interface atm0/0/0
Interface          VPI  Type          rx-cell-cnts  tx-cell-cnts
ATM0/0/0           100  PVP           49865         50271
```

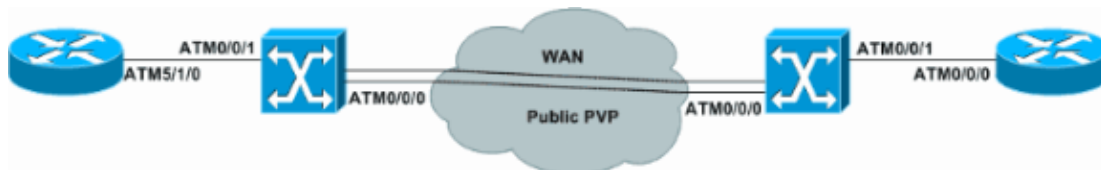
## Configure VP Tunnels for a Single Service Category

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

**Note:** To find additional information on the commands used in this document, use the Command Lookup Tool (registered customers only).

### Network Diagram

This section uses the network setup shown in this diagram.



### Configurations

This example shows how to configure a VP tunnel for a single service category. Notice that traffic shaping is enabled in the ATM interfaces of the routers using **variable bit rate non real time (vbr-nrt)**.

This section uses these configurations.

- Router 1
- Switch 1
- Switch 2
- Router 2

Router 1
<pre>interface ATM5/1/0.1 point-to-point ip address 1.1.1.1 255.255.255.0 pvc 100/32   vbr-nrt 50000 40000 100   encapsulation aal5snap ! ! interface ATM5/1/0.2 point-to-point ip address 2.1.1.1 255.255.255.0 pvc 100/33   vbr-nrt 10000 8000 100   encapsulation aal5snap !</pre>

Switch 1
<pre>interface ATM0/0/0 no ip address atm pvp 100 rx-cttr 7 tx-cttr 7 ! interface ATM0/0/0.100 point-to-point no ip directed-broadcast no atm ilmi-keepalive</pre>

```

!
interface ATM0/0/1
no ip address
atm pvc 100 32 rx-cttr 8 tx-cttr 8 interface ATM0/0/0.100 100 32
atm pvc 100 33 rx-cttr 9 tx-cttr 9 interface ATM0/0/0.100 100 33

```

### Switch 2

```

interface ATM0/0/0
no ip address
atm pvc 100 rx-cttr 7 tx-cttr 7
!
interface ATM0/0/0.100 point-to-point
!
interface ATM0/0/1
no ip address
atm pvc 100 32 rx-cttr 8 tx-cttr 8 interface ATM0/0/0.100 100 32
atm pvc 100 40 rx-cttr 9 tx-cttr 9 interface ATM0/0/0.100 100 33

```

### Router 2

```

interface ATM0/0/0.1 point-to-point
ip address 1.1.1.2 255.255.255.0
pvc 100/32
vbr-nrt 50000 40000 100
encapsulation aal5snap
!
interface ATM0/0/0.2 point-to-point
ip address 2.1.1.2 255.255.255.0
pvc 100/40
vbr-nrt 10000 8000 100
encapsulation aal5snap

```

## Verify

This section provides information you can use to confirm your configuration is working properly.

Certain **show** commands are supported by the Output Interpreter Tool ( registered customers only) , which allows you to view an analysis of **show** command output.

- **show atm vp interface atm0/0/0 100** – Verifies all the VPs that go through the VP tunnel with VPIs.

```
c8510m-r2#show atm vp int atm 0/0/0 100
```

```

Interface: ATM0/0/0, Type: oc3suni
VPI = 100
Status: TUNNEL
Time-since-last-status-change: 00:43:49
Connection-type: PVP
Cast-type: point-to-point
Rx connection-traffic-table-index: 7
Rx service-category: VBR-NRT (Non-Realtime Variable Bit Rate)
Rx pcr-clp01: 100000
Rx scr-clp0 : 80000
Rx mcr-clp01: none
Rx      cdvt: 1024 (from default for interface)
Rx      mbs: 100
Tx connection-traffic-table-index: 7
Tx service-category: VBR-NRT (Non-Realtime Variable Bit Rate)
Tx pcr-clp01: 100000
Tx scr-clp0 : 80000
Tx mcr-clp01: none

```

Tx cdvt: none  
Tx mbs: 100

## Configure Shaped VP Tunnels

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

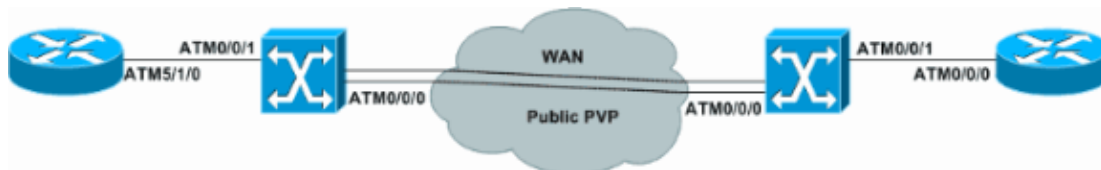
**Note:** To find additional information on the commands used in this document, use the Command Lookup Tool (registered customers only) .

If the VP Service Provider polices, the connection most likely experiences cell drops in the Service Provider network. The best way to overcome this is to configure shaped VP tunnels.

Shaped VP tunnels are VP tunnels that are traffic shaped. They are defined only for the CBR service category on Cisco Enterprise ATM Switches. All VCs within a single VP tunnel must be the same service category. The overall output of this VP tunnel is rate-limited by hardware to the PCR of the tunnel.

## Network Diagram

This section uses the network setup shown in this diagram.



## Configurations

This section describes the configurations for shaped VP tunnels and uses these configurations.

- Switch 1
- Switch 2
- Router 1
- Router 2

Switch 1
<pre>atm connection-traffic-table-row index 10 cbr pcr 8000 atm connection-traffic-table-row index 20 vbr-nrt pcr 7000 scr0 4000 mbs 100 atm connection-traffic-table-row index 30 ubr pcr 8000 atm connection-traffic-table-row index 40 abr pcr 8000 mcr 0 ! interface ATM0/0/0 no ip address atm pvp 100 shaped rx-cttr 10 tx-cttr 10 atm pvp 110 shaped rx-cttr 10 tx-cttr 10 atm pvp 120 shaped rx-cttr 10 tx-cttr 10 ! interface ATM0/0/0.100 point-to-point atm cac service-category cbr deny atm cac service-category vbr-nrt permit ! interface ATM0/0/0.110 point-to-point atm cac service-category cbr deny atm cac service-category ubr permit ! interface ATM0/0/0.120 point-to-point</pre>

```

atm cac service-category cbr deny
atm cac service-category abr permit
!
interface ATM0/0/1
no ip address
atm pvc 100 32 rx-cttr 20 tx-cttr 20 interface ATM0/0/0.100 100 32
atm pvc 110 40 rx-cttr 30 tx-cttr 30 interface ATM0/0/0.110 110 40
atm pvc 120 50 rx-cttr 40 tx-cttr 40 interface ATM0/0/0.120 120 50

```

### Switch 2

```

atm connection-traffic-table-row index 10 cbr pcr 8000
atm connection-traffic-table-row index 20 vbr-nrt pcr 7000 scr0 4000 mbs 100
atm connection-traffic-table-row index 30 ubr pcr 8000
atm connection-traffic-table-row index 40 abr pcr 8000 mcr 0
!
interface ATM0/0/0
no ip address
atm pvp 100 shaped rx-cttr 10 tx-cttr 10
atm pvp 110 shaped rx-cttr 10 tx-cttr 10
atm pvp 120 shaped rx-cttr 10 tx-cttr 10
!
interface ATM0/0/0.100 point-to-point
atm cac service-category cbr deny
atm cac service-category vbr-nrt permit
!
interface ATM0/0/0.110 point-to-point
atm cac service-category cbr deny
atm cac service-category ubr permit
!
interface ATM0/0/0.120 point-to-point
no atm ilmi-keepalive
atm cac service-category cbr deny
atm cac service-category abr permit
!
interface ATM0/0/1
no ip address
atm pvc 100 32 rx-cttr 20 tx-cttr 20 interface ATM0/0/0.100 100 32
atm pvc 110 40 rx-cttr 30 tx-cttr 30 interface ATM0/0/0.110 110 40
atm pvc 120 50 rx-cttr 40 tx-cttr 40 interface ATM0/0/0.120 120 50

```

### Router 1

```

interface ATM5/1/0.1 point-to-point
ip address 1.1.1.1 255.255.255.0
pvc 100/32
vbr-nrt 7000 4000 100
encapsulation aal5snap
!
interface ATM5/1/0.2 point-to-point
ip address 2.1.1.1 255.255.255.0
pvc 110/40
ubr 8000
!
interface ATM5/1/0.3 point-to-point
ip address 3.1.1.1 255.255.255.0
pvc 120/50
abr 8000 5000

```

### Router 2

```

interface ATM0/0/0.1 point-to-point
ip address 1.1.1.2 255.255.255.0
pvc 100/32

```

```

vbr-nrt 7000 4000 100
encapsulation aal5snap
!
interface ATM0/0/0.2 point-to-point
ip address 2.1.1.2 255.255.255.0
pvc 110/40
ubr 8000
!
interface ATM0/0/0.3 point-to-point
ip address 3.1.1.2 255.255.255.0
pvc 120/50
abr 8000 5000

```

## Verify

This section provides information you can use to confirm your configuration is working properly.

Certain **show** commands are supported by the Output Interpreter Tool ( registered customers only) , which allows you to view an analysis of **show** command output.

- **show atm vp interface atm0/0/0** – Verifies all the VPs that go through the VP tunnel with VPIs.
- **show atm vp traffic interface atm0/0/0** – Verifies the ATM layer connection information about the virtual path.
- **show atm interface atm0/0/0.110** – Displays information about the ATM interface.

This is sample command output for the **show atm vp interface atm 0/0/0** command.

```

Switch#show atm vp interface atm0/0/0
Interface          VPI  Type  X-Interface          X-VPI  Status
ATM0/0/0           100  PVP   SHAPED TUNNEL
ATM0/0/0           110  PVP   SHAPED TUNNEL
ATM0/0/0           120  PVP   SHAPED TUNNEL

```

This is sample command output for the **show atm vp traffic interface atm0/0/0** command.

```

Switch#show atm vp traffic interface atm0/0/0
Interface          VPI  Type  rx-cell-cnts  tx-cell-cnts
ATM0/0/0           100  PVP   1438          1446
ATM0/0/0           110  PVP   1374          1384
ATM0/0/0           120  PVP   755           772

```

This is sample command output for the **show atm interface atm0/0/0.110** command.

```

Switch#show atm interface atm0/0/0.110

Interface:          ATM0/0/0.110      Port-type:          vp tunnel
IF Status:          UP                Admin Status:       up

```

## Restrictions for Shaped VP Tunnels

This list describes restrictions related to shaped VP tunnels.

- LS1010 with FC-PFQ and Catalyst 8510-MSR support a maximum of 2x64=128 shaped VP tunnels. 64 shaped VP tunnels are supported on x/0/y numbered ports and 64 on x/1/y numbered ports.
- Catalyst 8540-MSR supports a maximum of 8x64=512 shaped VP tunnels. A maximum of 64 shaped VP tunnels can be defined on each of these interface groups:

◆ (0/0/x, 1/0/x)

- ◆ (0/1/x, 1/1/x)
  - ◆ (2/0/x, 3/0/x)
  - ◆ (2/1/x, 3/1/x)
  - ◆ (9/0/x, 10/0/x)
  - ◆ (9/1/x, 10/1/x)
  - ◆ (11/0/x, 12/0/x)
  - ◆ (11/1/x, 12/1/x)
- The bandwidth of the shaped VP tunnel is shared by the active VCs inside the tunnel in strict round-robin (RR) fashion.
  - Shaped VP tunnels do not support merged VCs for tag switching.
  - Unspecified bit rate (UBR)+ and available bit rate (ABR) VCs with non-zero minimum cell rate (MCR) are not allowed on a shaped VP tunnel interface.
  - A maximum of 128 VCs can transit an s-shaped VP tunnel interface.

## Configure Hierarchical VP Tunnels for Multiple Service Categories

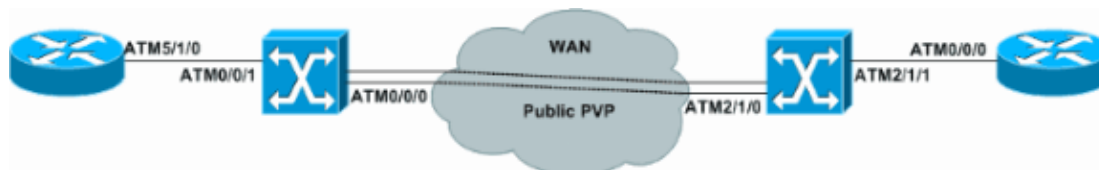
In this section, you are presented with the information to configure the features described in this document.

**Note:** To find additional information on the commands used in this document, use the Command Lookup Tool (registered customers only).

A hierarchical VP tunnel configuration is used if you have more than one service category and cannot buy more than one VP tunnel. A hierarchical VP tunnel is a VP tunnel that is traffic shaped and supports VCs of multiple service categories to co-exist in a tunnel at the same time.

### Network Diagram

This section uses the network setup shown in the diagram below.



### Configurations

This section describes the configurations for hierarchical VP tunnels for multiple services categories and uses these configurations.

- Switch 1
- Switch 2
- Router 1
- Router 2

Switch 1	
<b>atm hierarchical-tunnel</b>	
<b>atm connection-traffic-table-row</b>	<b>index 20 vbr-nrt pcr 7000 scr0 4000 mbs 100</b>
<b>atm connection-traffic-table-row</b>	<b>index 30 ubr pcr 8000</b>
<b>atm connection-traffic-table-row</b>	<b>index 40 abr pcr 8000 mcr 0</b>
<b>atm connection-traffic-table-row</b>	<b>index 50 cbr pcr 50000</b>
<b>!</b>	

```

interface ATM0/0/0
  no ip address
  no ip directed-broadcast
  logging event subif-link-status
  atm pvp 100 hierarchical rx-cttr 50 tx-cttr 50
!
interface ATM0/0/0.100 point-to-point
  no ip directed-broadcast
  no atm ilmi-keepalive
!
interface ATM0/0/1
  no ip address
  no ip directed-broadcast
  logging event subif-link-status
  atm pvc 100 32 rx-cttr 20 tx-cttr 20 interface ATM0/0/0.100 100 32
  atm pvc 100 40 rx-cttr 30 tx-cttr 30 interface ATM0/0/0.100 100 40
  atm pvc 100 50 rx-cttr 40 tx-cttr 40 interface ATM0/0/0.100 100 50

```

### Switch 2

```

atm hierarchical-tunnel
atm connection-traffic-table-row index 20 vbr-nrt pcr 7000 scr0 4000 mbs 100
atm connection-traffic-table-row index 30 ubr pcr 8000
atm connection-traffic-table-row index 40 abr pcr 8000 mcr 0
atm connection-traffic-table-row index 50 cbr pcr 50000
!
interface ATM2/1/0
  no ip address
  atm pvp 100 hierarchical rx-cttr 50 tx-cttr 50
!
interface ATM2/1/0.100 point-to-point
!
interface ATM2/1/1
  no ip address
  atm pvc 100 32 rx-cttr 20 tx-cttr 20 interface ATM2/1/0.100 100 32
  atm pvc 100 40 rx-cttr 30 tx-cttr 30 interface ATM2/1/0.100 100 40
  atm pvc 100 50 rx-cttr 40 tx-cttr 40 interface ATM2/1/0.100 100 50

```

### Router 1

```

interface ATM5/1/0.1 point-to-point
  ip address 1.1.1.1 255.255.255.0
  pvc 100/32
  vbr-nrt 7000 4000 100
  encapsulation aal5snap
!
interface ATM5/1/0.2 point-to-point
  ip address 2.1.1.1 255.255.255.0
  pvc 100/40
  ubr 8000
  encapsulation aal5snap
!
interface ATM5/1/0.3 point-to-point
  ip address 3.1.1.1 255.255.255.0
  pvc 100/50
  abr 8000 5000
  encapsulation aal5snap

```

### Router 2

```

interface ATM0/0/0.1 point-to-point
  ip address 1.1.1.2 255.255.255.0
  pvc 100/32
  vbr-nrt 7000 4000 100

```

```

encapsulation aal5snap
!
interface ATM0/0/0.2 point-to-point
ip address 2.1.1.2 255.255.255.0
pvc 100/40
 ubr 8000
encapsulation aal5snap
!
interface ATM0/0/0.3 point-to-point
ip address 3.1.1.2 255.255.255.0
pvc 100/50
abr 8000 5000
encapsulation aal5snap

```

## Verify

This section provides information you can use to confirm your configuration is working properly.

Certain **show** commands are supported by the Output Interpreter Tool ( registered customers only) , which allows you to view an analysis of **show** command output.

- **show atm vp** – Verifies that the VP tunnel is up.
- **show atm resource** – Displays global resource manager configuration and status.
- **show atm vp traffic interface atm2/1/0 100** – Verifies the ATM layer connection information about the virtual path.
- **show atm vp interface atm2/1/0 100** – Verifies all the VPs that go through the VP tunnel with VPIs.

This is sample command output for the **show atm vp** command.

```

Switch#show atm vp
Interface          VPI  Type  X-Interface          X-VPI  Status
ATM2/1/0           100   PVP   HIE. TUNNEL

```

This is sample command output for the **show atm resource** command.

```

Switch#show atm resource
Resource configuration:
  Sustained-cell-rate-margin-factor 1%
  Abr-mode:      EFCI
  Hierarchical Scheduling Mode : enabled

!--- Truncated.

```

This is sample command output for the **show atm vp traffic interface atm2/1/0 100** command.

```

Switch#show atm vp traffic interface atm 2/1/0 100
Interface          VPI  Type          rx-cell-cnts  tx-cell-cnts
ATM2/1/0           100   PVP           2451          2470

```

This is sample command output for the **show atm vp interface atm2/1/0 100** command.

```

Switch#show atm vp interface atm2/1/0 100

Interface: ATM2/1/0, Type: oc3suni
VPI = 100
Status: HIE. TUNNEL
Time-since-last-status-change: 00:49:16
Connection-type: PVP
Cast-type: point-to-point

```

```
Rx cells: 2214, Tx cells: 2234

Rx connection-traffic-table-index: 50
Rx service-category: CBR (Constant Bit Rate)
Tx connection-traffic-table-index: 50
Tx service-category: CBR (Constant Bit Rate)
Tx pcr-clp01: 50000
Tx scr-clp01: none
Tx mcr-clp01: none
Tx      cdvt: none
Tx      mbs: none
```

## Restriction for Hierarchical VP Tunnels

This list describes restrictions related to hierarchical VP tunnels.

- LS1010 with FC–PFQ, Catalyst 5500 with ATM Switch Processor (ASP) and FC–PFQ, and Catalyst 8510–MSR support a maximum of 62 hierarchical VP tunnels.
- Hierarchical VP tunnels can only be defined on ports in slots 0 and 3 on LS1010 and Catalyst 8510–MSR. Hierarchical VP tunnels can be defined in slots 9 and 11 on Catalyst 5500 with ASP and FC–PFQ.
- LS1010 equipped with FC–PFQ and ASP–B supports a maximum of 30 hierarchical VP tunnels on ports 0/0/z and 3/0/z combined, and a maximum of 32 on ports 0/1/z and 3/1/z combined. Use the **show hardware** command to find out the type of ASP and feature card.
- LS1010 equipped with FC–PFQ and ASP–C as well as Catalyst 8510–MSR support a maximum of 30 hierarchical VP tunnels on ports 0/y/z and a maximum of 32 on ports 3/y/z.
- On a Catalyst 5500 with ASP and FC–PFQ with a maximum of 30, hierarchical VP tunnels can be defined on ports 9/0/z and 11/0/7 combined. A maximum of 32 hierarchical VP tunnels can be defined on ports 9/1/z and 11/1/z combined.
- On a Catalyst 8540–MSR, hierarchical VP tunnels can be defined on slots 0,2,9, and 11.
- The maximum number of hierarchical VP tunnels varies between 120 and 240 depending on the type of port adapter modules (PAMs) used. If all the ports are super PAMs (full with modules), the maximum number of VP tunnels supported is 240. If all the ports installed are super CAMs with LS1010, the PAM's maximum number of hierarchical VP tunnels is 120.
- Hierarchical VP tunnels cannot co–exist with any other type of connection (VCs, VPs, Tag VCs, regular or shaped VP tunnels, and so forth) on the same physical interface. Therefore, the only type of connection that can co–exist with hierarchical VP tunnels on the same physical interface are additional hierarchical VP tunnels and well known VCs (signaling 0/5, PNNI, 0/18, ILMI 0/16, and so forth).
- Hierarchical VP tunnels can only support either ATM Forum VCs or Tag VCs, but not both at the same time.
- When you perform on line insertion and removal (OIR) of PAM that has hierarchical VP tunnels configured for its ports, configuration of the hierarchical tunnel is preserved. If the same PAM is inserted back in, the hierarchical VP tunnel is automatically active. However, if a different type of PAM is to be inserted, it is strongly recommended that any configured hierarchical VP tunnel (on the port about to be removed) be deleted prior to the physical removal of PAM.

## Troubleshoot

There is currently no troubleshooting information available for this document.

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## Related Information

- [Troubleshooting VP Tunnels](#)
  - [Understanding VP Tunnels and VP Switching](#)
  - [LANE, CES, and VBR PVCs in Shaped VP Tunnels](#)
  - [LANE and CES \(Using PVCs\) in Unshaped VP Tunnels](#)
  - [LANE and CES \(Using PVCs\) Through Hierarchical VP Tunnels](#)
  - [VBR, UBR and ABR Soft PVCs in Shaped Tunnels](#)
  - [ATM Technology Support Pages](#)
  - [Technical Support – Cisco Systems](#)
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