

LANE, CES, and VBR PVCs in Shaped VP Tunnels

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Introduction

This document shows a sample configuration of LAN emulation (LANE), circuit emulation service (CES), and variable bit rate (VBR) permanent virtual connections (PVCs) in shaped virtual path (VP) tunnels. In the configuration shown in this document, LANE, CES, and variable bit rate–non real–time (VBR–nrt) PVCs are transported across the WAN. These examples use shaped VP tunnels to ensure compliance with traffic contracts. When using shaped VP tunnels with traffic parameters identical to the service provider, the service provider's ATM network should not drop any cells.

The VP tunnel must be of the constant bit rate (CBR) service category in order to be shaped: it is the only shaped tunnel that Cisco currently supports. You must have three VP tunnels because LANE uses unspecified bit rate (UBR) switched virtual connections (SVCs), CES uses CBR PVCs, you have a VBR PVC, and you are using shaped VP tunnels. You have one for each service category: CBR virtual channels (VCs) and UBR VCs. You could have used one tunnel by using hierarchical VP tunnels.

Prerequisites

Requirements

Readers of this document should have knowledge of these topics:

- LANE
 - ◆ LANE Design Recommendations
 - ◆ Configuring LANE
- CES
 - ◆ An Introduction to Circuit Emulation Services
 - ◆ Configuring Circuit Emulation Services
- VBR
 - ◆ Understanding the Variable Bit Rate Real Time (VBR–rt) Service Category for ATM VCs
 - ◆ Understanding the VBR–nrt Service Category and Traffic Shaping for ATM VCs
- VP Tunnels

Components Used

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

- Cisco IOS® Software Release 11.3(0.8)TWA4 ASP or later for the LightStream 1010 (LS1010)
- Any version of the Cisco 8540-MSR

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

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

Assumptions

The example shown in this document assumes these facts:

- Shaped tunnels must be of the CBR service category, so this example has a CBR VP tunnel that can only contain CBR VCs. It is used for CES CBR PVCs (labeled **VPI1** in the network diagram). Note that the virtual path identifier (VPI) number is locally significant to the switch port, so you can have the same VPI number on the same switch, but two different switch ports.
- Because shaped VP tunnels cannot simultaneously transport VCs of multiple service categories, the first VP tunnel used for CBR VCs cannot be used for LANE UBR VCs or the VBR-nrt PVC. You must create another VP tunnel for LANE (which uses UBR service category VCs). Therefore, the second VP tunnel (labeled **VPI2** in the network diagram) is a CBR-shaped VP tunnel through which only UBR VCs are permitted.
- A third shaped VP tunnel transports the VBR-nrt PVC (labeled **VPI3** in the network diagram).
- You need to purchase three CBR VPs from the service provider.
- It is assumed that the three CBR VPs have a peak cell rate (PCR) of 10 Mbps and a cell delay variation tolerance (CDVT) of 500 cells. Note that the sum of the PCRs of all the VP tunnels defined on the same physical interface must be smaller than 95 percent of the line rate of the physical interface (assuming that only VP tunnels are configured on the physical interface).
- For the VBR PVC, the sustained cell rate (SCR) of the PVC must be smaller than 95 percent of the PCR of the CBR-shaped VP tunnel. In other words, the PVC SCR must be smaller than 9.5 Mbps for the VBR-nrt. If there are multiple VBR PVCs going through the CBR tunnel, the sum of the SCRs of all the VBR PVCs must be smaller than 95 percent of the PCR of the shaped VP tunnel. The 5 percent remaining is reserved for signaling and other mandatory protocols.
- Device 5500-asp-f is for VP switching. The service provider typically performs this function.
- LANE services are defined on 8540-MSR; LAN Emulation Clients (LECs) are defined on 8540-MSR and 5500-asp-e.

Note: In this example, LANE services are placed on the ATM switch for simplicity. That is not, however, the optimal location for LANE services. The best place for a LAN Emulation Server (LES) or broadcast and unknown server (BUS) is on the LANE module of a Catalyst 5500. The ideal place for a LEC is on a Cisco 7500 series router.

- The two private branch exchanges (PBXs) in the diagram use a CES CBR circuit. For details on how to configure circuit emulation, refer to Configuring Circuit Emulation Services.

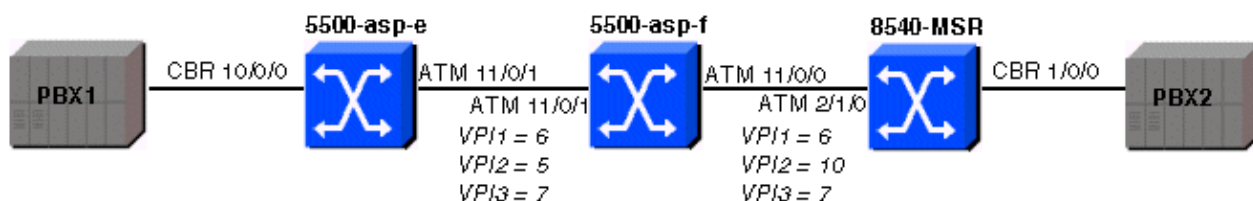
Configure

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

Click on the switches in this diagram to view the sample configurations:



Configurations

This document uses these configurations:

- 5500-asp-e
- 5500-asp-f
- 8540-MSR

5500-asp-e Sample Configuration

```
5500-asp-e
-----
5500-asp-e# show running-config
Building configuration...
Current configuration:
!
version 11.3
no service pad
service timestamps debug datetime msec
service timestamps log uptime
no service password-encryption
!
hostname 5500-asp-e
!
boot system flash slot0:LS1010-wp-mz.120-3c.W5.9.bin
!
ip host-routing
!
atm connection-traffic-table-row index 63997 vbr-nrt pcr 20480 scr10 9000 mbs 100
atm connection-traffic-table-row index 64000 cbr pcr 10240 cdvt 500
atm lecs-address-default 47.0091.8100.0000.0090.2144.8401.0090.2144.8405.00 1
atm address 47.0091.8100.0000.0050.537e.1401.0050.537e.1401.00
atm router pnni
no aesa embedded-number left-justified
node 1 level 56 lowest
redistribute atm-static
```

```
!  
!  
!  
interface CBR10/0/0  
  no ip address  
  ces circuit 0 circuit-name test  
  ces pvc 0 interface ATM11/0/1.6 vpi 6 vci 100  
!  
interface ATM11/0/1  
  no atm signaling enable  
  no ip address  
  atm pvp 5 shaped rx-cttr 64000 tx-cttr 64000  
  atm pvp 6 shaped rx-cttr 64000 tx-cttr 64000  
  atm pvp 7 shaped rx-cttr 64000 tx-cttr 64000  
!  
interface ATM11/0/1.5 point-to-point  
  atm cac service-category cbr deny  
  atm cac service-categoryubr permit  
!  
interface ATM11/0/1.6 point-to-point  
!  
interface ATM11/0/1.7 point-to-point  
  atm cac service-category cbr deny  
  atm cac service-categoryvbr-nrt permit  
  atm pvc 7 100 rx-cttr 63997 tx-cttr 63997 interface ATM10/1/0 0 100  
!  
interface ATM11/0/2  
  no ip address  
!  
interface ATM11/0/3  
  no ip address  
!  
interface ATM11/1/0  
  no ip address  
!  
interface ATM11/1/1  
  no ip address  
!  
interface ATM11/1/2  
  no ip address  
!  
interface ATM11/1/3  
  no ip address  
!  
interface ATM13/0/0  
  no ip address  
  atm maxvp-number 0  
!  
interface ATM13/0/0.1 multipoint  
  ip address 100.100.100.2 255.255.255.0  
  lane client ethernet test  
!  
interface Ethernet13/0/0  
  no ip address  
!  
no ip classless  
logging buffered 16000 debugging  
!  
line con 0  
line aux 0  
line vty 0 4  
  login  
!  
end
```

Feature Displays

You can use the **show** commands in this section to verify configuration features on the device. Certain **show** commands are supported by the Output Interpreter Tool (registered customers only), which allows you to view an analysis of **show** command output.

Note: You can use additional **show** commands to verify the configuration; not all of them are included in this document.

To ensure that all the LANE VCs go across the correct VP tunnel (in other words, to prevent signaling from being initiated through the main interface), signaling is disabled on the interface atm11/0/1 using the **no atm signaling enable** command. The same operation has been performed on the 8540-MSR.

To see which VCs are passing through the VP tunnel with a VPI of 7, issue the **show atm vc interface interface-number** command:

```
5500-asp-e# show atm vc interface atm11/0/1.7
```

Interface	VPI	VCI	Type	X-Interface	X-VPI	X-VCI	Encap	Status
ATM11/0/1.7	7	3	PVC	ATM13/0/0	0	181	SNAP	UP
ATM11/0/1.7	7	4	PVC	ATM13/0/0	0	182	SNAP	UP
ATM11/0/1.7	7	5	PVC	ATM13/0/0	0	180	QSAAL	UP
ATM11/0/1.7	7	16	PVC	ATM13/0/0	0	179	ILMI	UP
ATM11/0/1.7	7	18	PVC	ATM13/0/0	0	183	PNNI	UP
ATM11/0/1.7	7	100	PVC	ATM10/1/0	0	100		UP

```
5500-asp-e# show atm interface resource atm11/0/1.7
```

Resource Management configuration:

Service Categories supported: vbr-nrt

Link Distance: 0 kilometers

Best effort connection limit: disabled 0 max connections

Max traffic parameters by service (rate in Kbps, tolerance in cell-times):

Peak-cell-rate RX: none vbr,

Peak-cell-rate TX: none vbr,

Sustained-cell-rate: none vbr RX, none vbr TX

Minimum-cell-rate RX:

Minimum-cell-rate TX:

CDVT RX: none vbr,

CDVT TX: none vbr,

MBS: none vbr RX, none vbr TX

Resource Management state:

Available bit rates (in Kbps):

0 cbr RX, 0 cbr TX, **613 vbr RX, 613 vbr TX,**

0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX

Allocated bit rates:

0 cbr RX, 0 cbr TX, **9114 vbr RX, 9114 vbr TX,**

0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX

```
5500-asp-e# show atm interface resource atm11/0/1
```

Resource Management configuration:

Service Classes:

Service Category map: c1 cbr, c2 vbr-rt, c3 vbr-nrt, c4 abr, c5 ubr

Scheduling: RS c1 WRR c2, WRR c3, WRR c4, WRR c5

WRR Weight: 8 c2, 1 c3, 1 c4, 1 c5

Pacing: disabled 0 Kbps rate configured, 0 Kbps rate installed

Service Categories supported: cbr, vbr-rt, vbr-nrt, abr, ubr

Link Distance: 0 kilometers

Controlled Link sharing:

Max aggregate guaranteed services: none RX, none TX

Max bandwidth: none cbr RX, none cbr TX, none vbr RX, none vbr TX,

```

        none abr RX, none abr TX, none ubr RX, none ubr TX
Min bandwidth: none cbr RX, none cbr TX, none vbr RX, none vbr TX,
               none abr RX, none abr TX, none ubr RX, none ubr TX
Best effort connection limit: disabled 0 max connections
Max traffic parameters by service (rate in Kbps, tolerance in cell-times):
Peak-cell-rate RX: none cbr, none vbr, none abr, none ubr
Peak-cell-rate TX: none cbr, none vbr, none abr, none ubr
Sustained-cell-rate: none vbr RX, none vbr TX
Minimum-cell-rate RX: none abr, none ubr
Minimum-cell-rate TX: none abr, none ubr
CDVT RX: none cbr, none vbr, none abr, none ubr
CDVT TX: none cbr, none vbr, none abr, none ubr
MBS: none vbr RX, none vbr TX

```

Resource Management state:

Available bit rates (in Kbps):

```

117023 cbr RX, 117023 cbr TX, 117023 vbr RX, 117023 vbr TX,
117023 abr RX, 117023 abr TX, 117023 ubr RX, 117023 ubr TX

```

Allocated bit rates:

```

30720 cbr RX, 30720 cbr TX, 0 vbr RX, 0 vbr TX,
0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX

```

Best effort connections: 0 pvcs, 4 svcs

5500-asp-f Sample Configuration

The switch is configured for VP switching.

5500-asp-f

```

5500-asp-f# show running-config

Building configuration...
Current configuration:
!
version 11.3
no service padservice timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname 5500-asp-f
!
!
!
atm connection-traffic-table-row index 63997 vbr-nrt pcr 20480 scr10 9000 mbs 100
atm connection-traffic-table-row index 64000 cbr pcr 10240 cdvt 500
atm address 47.0091.8100.0000.0050.5308.2401.0050.5308.2401.00
atm router pnni
no aesa embedded-number left-justified
node 1 level 56 lowest
redistribute atm-static
!
!
!
interface ATM11/0/0
no ip address
!
interface ATM11/0/1
no ip address
atm pvp 5 interface ATM11/0/0 10
atm pvp 6 rx-cttr 64000 tx-cttr 64000 interface ATM11/0/0 6 rx-cttr 64000 tx-cttr 64000
atm pvp 7 rx-cttr 63997 tx-cttr 63997 interface ATM11/0/0 7 rx-cttr 63997 tx-cttr 63997
!
interface ATM13/0/0
no ip address
atm maxvp-number 0

```

```

!
interface Ethernet13/0/0
  no ip address
!
ip classless
!
!
line con 0
line aux 0
line vty 0 4
  login
!
end

```

Feature Display

To verify that VP is operational, issue the **show atm vp** command:

```
5500-asp-f# show atm vp
```

Interface	VPI	Type	X-Interface	X-VPI	Status
ATM11/0/0	6	PVP	ATM11/0/1	6	UP
ATM11/0/0	7	PVP	ATM11/0/1	7	UP
ATM11/0/0	10	PVP	ATM11/0/1	5	UP
ATM11/0/1	5	PVP	ATM11/0/0	10	UP
ATM11/0/1	6	PVP	ATM11/0/0	6	UP
ATM11/0/1	7	PVP	ATM11/0/0	7	UP

8540-MSR Sample Configuration

8540-MSR

```
8540-MSR# show running-config
```

```
Building configuration...
```

```
Current configuration:
```

```

!
version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname 8540-MSR
!
logging buffered 4096 debugging
!
redundancy
  main-cpu
    sync config startup
    sync config running
facility-alarm core-temperature major 53
facility-alarm core-temperature minor 45
ip subnet-zero
!
atm connection-traffic-table-row index 63997 vbr-nrt pcr 20480 scr10 9000 mbs 100
atm connection-traffic-table-row index 63998 cbr pcr 10000
atm connection-traffic-table-row index 63999 cbr pcr 10240 cdvt 500
atm lecs-address-default 47.0091.8100.0000.0090.2144.8401.0090.2144.8405.00 1
atm address 47.0091.8100.0000.0090.2144.8401.0090.2144.8401.00
atm router pnni
  no aesa embedded-number left-justified
  node 1 level 56 lowest
  redistribute atm-static

```

```
!  
!  
lane database PVP  
  name test server-atm-address 47.00918100000009021448401.009021448403.01  
!  
!  
interface CBR1/0/0  
  no ip address  
  no ip directed-broadcast  
  shutdown  
  ces circuit 0 circuit-name test  
  ces pvc 0 interface ATM2/1/0.6 vpi 6 vci 100  
!  
interface ATM2/1/0  
  no atm signaling enable  
  no ip address  
  no ip directed-broadcast  
  atm pvp 6 shaped rx-cttr 63999 tx-cttr 63999  
  atm pvp 7 shaped rx-cttr 63999 tx-cttr 63999  
  atm pvp 10 shaped rx-cttr 63999 tx-cttr 63999  
!  
interface ATM2/1/0.6 point-to-point  
  no ip directed-broadcast  
!  
interface ATM2/1/0.7 point-to-point  
  no ip directed-broadcast  
  atm cac service-category cbr deny  
  atm cac service-category vbr-nrt permit  
  atm pvc 7 100 rx-cttr 63997 tx-cttr 63997 interface ATM1/1/0 0 100  
!  
interface ATM2/1/0.10 point-to-point  
  no ip directed-broadcast  
  atm cac service-category cbr deny  
  atm cac service-category ubr permit  
!  
interface ATM2/1/1  
  no ip address  
  no ip directed-broadcast  
!  
interface ATM2/1/2  
  no ip address  
  no ip directed-broadcast  
!  
interface ATM2/1/3  
  no ip address  
  no ip directed-broadcast  
!  
interface ATM0  
  no ip address  
  no ip directed-broadcast  
  atm maxvp-number 0  
  lane config auto-config-atm-address  
  lane config database PVP  
!  
interface ATM0.1 multipoint  
  ip address 100.100.100.1 255.255.255.0  
  no ip directed-broadcast  
  lane server-bus ethernet test  
  lane client ethernet test  
!  
interface Ethernet0  
  no ip address  
  no ip directed-broadcast  
!  
ip classless  
!
```



```
!  
line con 0  
transport input none  
line aux 0  
line vty 0 4  
!  
end
```

Feature Displays

You can use the **show** commands in this section to verify configuration features on the device.

```
8540-MSR# show atm interface resource atm2/1/0.7
```

Resource Management configuration:

Service Categories supported: vbr-nrt

Link Distance: 0 kilometers

Best effort connection limit: disabled 0 max connections

Max traffic parameters by service (rate in Kbps, tolerance in cell-times):

Peak-cell-rate RX: none vbr,

Peak-cell-rate TX: none vbr,

Sustained-cell-rate: none vbr RX, none vbr TX

Minimum-cell-rate RX:

Minimum-cell-rate TX:

CDVT RX: none vbr,

CDVT TX: none vbr,

MBS: none vbr RX, none vbr TX

Resource Management state:

Available bit rates (in Kbps):

0 cbr RX, 0 cbr TX, 613 vbr RX, 613 vbr TX,

0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX

Allocated bit rates:

0 cbr RX, 0 cbr TX, 9114 vbr RX, 9114 vbr TX,

0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX

```
8540-MSR# show atm interface resource atm2/1/0
```

Resource Management configuration:

Service Classes:

Service Category map: c2 cbr, c2 vbr-rt, c3 vbr-nrt, c4 abr, c5 ubr

Scheduling: RS c1 WRR c2, WRR c3, WRR c4, WRR c5

WRR Weight: 8 c2, 1 c3, 1 c4, 1 c5

Pacing: disabled 0 Kbps rate configured, 0 Kbps rate installed

Service Categories supported: cbr,vbr-rt,vbr-nrt,abr,ubr

Link Distance: 0 kilometers

Controlled Link sharing:

Max aggregate guaranteed services: none RX, none TX

Max bandwidth: none cbr RX, none cbr TX, none vbr RX, none vbr TX,

none abr RX, none abr TX, none ubr RX, none ubr TX

Min bandwidth: none cbr RX, none cbr TX, none vbr RX, none vbr TX,

none abr RX, none abr TX, none ubr RX, none ubr TX

Best effort connection limit: disabled 0 max connections

Max traffic parameters by service (rate in Kbps, tolerance in cell-times):

Peak-cell-rate RX: none cbr, none vbr, none abr, none ubr

Peak-cell-rate TX: none cbr, none vbr, none abr, none ubr

Sustained-cell-rate: none vbr RX, none vbr TX

Minimum-cell-rate RX: none abr, none ubr

Minimum-cell-rate TX: none abr, none ubr

CDVT RX: none cbr, none vbr, none abr, none ubr

CDVT TX: none cbr, none vbr, none abr, none ubr

MBS: none vbr RX, none vbr TX

Resource Management state:

Available bit rates (in Kbps):

117023 cbr RX, 117023 cbr TX, 117023 vbr RX, 117023 vbr TX,

117023 abr RX, 117023 abr TX, 117023 ubr RX, 117023 ubr TX
Allocated bit rates:
30720 cbr RX, 30720 cbr TX, 0 vbr RX, 0 vbr TX,
0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX
Best effort connections: 0 pvcs, 0 svcs

8540-MSR# show atm interface resource atm2/1/0.6

Resource Management configuration:

Service Categories supported: cbr
Link Distance: 0 kilometers
Best effort connection limit: disabled 0 max connections
Max traffic parameters by service (rate in Kbps, tolerance in cell-times):
Peak-cell-rate RX: none cbr,
Peak-cell-rate TX: none cbr,
Minimum-cell-rate RX:
Minimum-cell-rate TX:
CDVT RX: none cbr,
CDVT TX: none cbr,

Resource Management state:

Available bit rates (in Kbps):
9727 cbr RX, 9727 cbr TX, 0 vbr RX, 0 vbr TX,
0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX
Allocated bit rates:
1741 cbr RX, 1741 cbr TX, 0 vbr RX, 0 vbr TX,
0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX

8540-MSR# show atm interface resource atm2/1/0.7

Resource Management configuration:

Service Categories supported: vbr-nrt
Link Distance: 0 kilometers
Best effort connection limit: disabled 0 max connections
Max traffic parameters by service (rate in Kbps, tolerance in cell-times):
Peak-cell-rate RX: none vbr,
Peak-cell-rate TX: none vbr,
Sustained-cell-rate: none vbr RX, none vbr TX
Minimum-cell-rate RX:
Minimum-cell-rate TX:
CDVT RX: none vbr,
CDVT TX: none vbr,
MBS: none vbr RX, none vbr TX

Resource Management state:

Available bit rates (in Kbps):
0 cbr RX, 0 cbr TX, 613 vbr RX, 613 vbr TX,
0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX
Allocated bit rates:
0 cbr RX, 0 cbr TX, 9114 vbr RX, 9114 vbr TX,
0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX

8540-MSR# show atm interface resource atm2/1/0.10

Resource Management configuration:

Service Categories supported: ubr
Link Distance: 0 kilometers
Best effort connection limit: disabled 0 max connections
Max traffic parameters by service (rate in Kbps, tolerance in cell-times):
Peak-cell-rate RX: none ubr
Peak-cell-rate TX: none ubr
Minimum-cell-rate RX: none ubr
Minimum-cell-rate TX: none ubr
CDVT RX: none ubr
CDVT TX: none ubr

```
Resource Management state:
  Available bit rates (in Kbps):
    0 cbr RX, 0 cbr TX, 0 vbr RX, 0 vbr TX,
    0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX
  Allocated bit rates:
    0 cbr RX, 0 cbr TX, 0 vbr RX, 0 vbr TX,
    0 abr RX, 0 abr TX, 0 ubr RX, 0 ubr TX
```

Troubleshoot

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

Related Information

- **VP (Virtual Path) Switching and Tunnels Technology Support**
 - **LANE (LAN Emulation) Technology Support**
 - **CES (Circuit Emulation Service) Technology Support**
 - **Technical Support & Documentation – Cisco Systems**
-

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