

使用PVP在Cisco Catalyst 8540 MSR增强型ARM(ARM 2)上配置MPLS

目录

[简介](#)

[先决条件](#)

[要求](#)

[使用的组件](#)

[配置](#)

[网络图](#)

[使用增强型ARM进行信元模式MPLS](#)

[配置](#)

[使用增强型ARM实现ATM VP隧道上的帧模式MPLS](#)

[C8540MSR-1\(Catalyst 8540MSR\)](#)

[配置](#)

[验证](#)

[故障排除](#)

[相关信息](#)

简介

本文档提供Catalyst 8540增强型ATM路由器模块(ARM)上多协议层交换(MPLS)的示例配置。ARM模块的主要功能是提高连接两个不同世界的能力 — 分组/交换 (基于帧) 和ATM (基于信元)。此功能也可扩展到MPLS。具有增强型ARM的Catalyst 8540 MSR可安装在基于数据包和信元的网络边缘，在同一机箱中启用两种MPLS模式。Catalyst 8540 MSR上的增强型ARM(ARM2)是ATM接口上标签边缘路由(LER)功能所必需的 — 它充当标签交换路径(LSP)中每个传入和传出ATM接口的代理接口，以执行MPLS数据包处理。Catalyst 8540非常适合信元模式到帧模式MPLS集成 (通过部署增强型ATM路由器模块实现)。单个机箱最多可使用两个ARM2卡。

本文档提供了解释ARM 2用法的两种不同配置的示例。

- 将增强型ARM用于信元模式 (在ARM 2上终止信元模式MPLS)
- 使用增强型ARM，通过ATM VP隧道实现帧模式MPLS。

先决条件

要求

本文档没有任何特定的要求。

使用的组件

本文档中的信息基于以下软件和硬件版本：

- 两个Cisco C8540 MSR , Cisco IOS® 12.1(10)EY版(256 MB DRAM)
- 思科C8510 MSR , 思科IOS版本12.1(7a)EY1(64 MB DRAM)
- C8540-ARM2 (增强型ATM路由器模块)
- WAI-OC3-4MM (4端口OC-3线卡)
- C85MS-4F-OC12MM (4端口OC-12线卡)

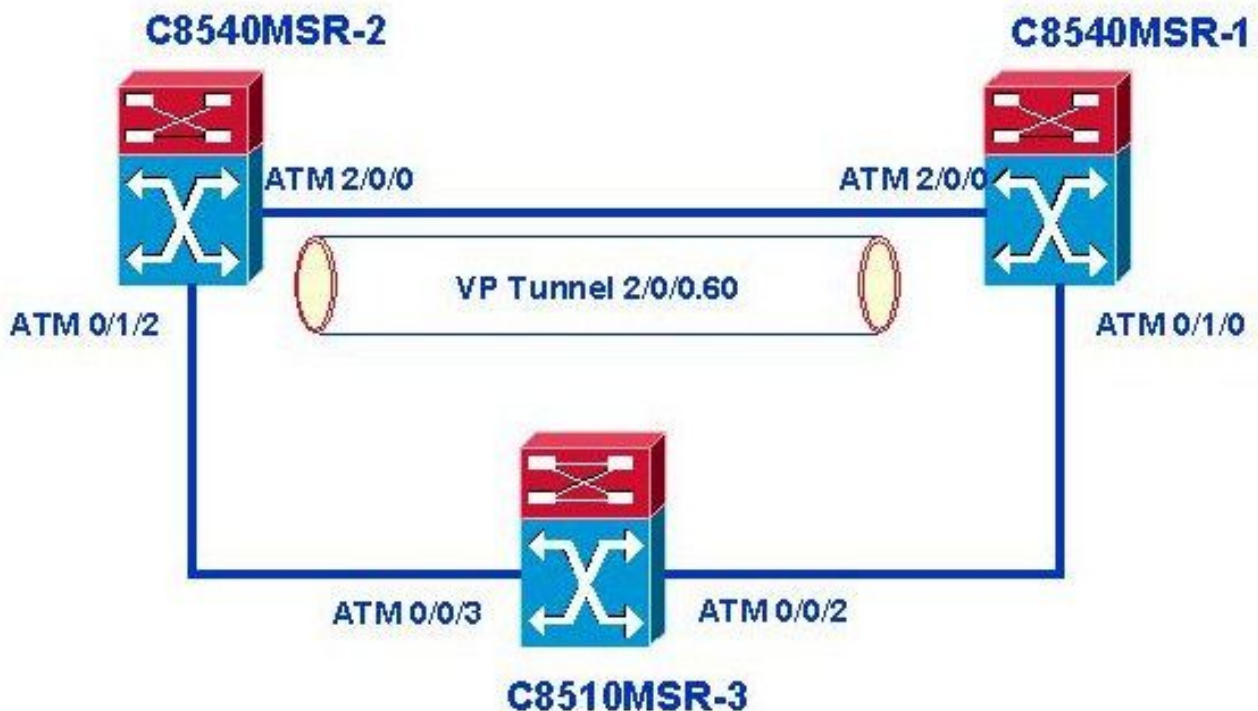
本文档中的信息都是基于特定实验室环境中的设备创建的。本文档中使用的所有设备最初均采用原始(默认)配置。如果您是在真实网络上操作,请确保您在使用任何命令前已经了解其潜在影响。

配置

本部分提供有关如何配置本文档所述功能的信息。OSPF用作内部路由协议。

网络图

本文档使用此图中所示的网络设置：



上图用于以下场景：

- 将增强型ARM用于信元模式(在ARM 2上终止信元模式MPLS)
- 使用增强型ARM,通过ATM VP隧道实现帧模式MPLS。

请注意,信元模式的配置使用路径C8540MSR-2到C8510MSR-3到C8540MSR-1,而本文档中描述的帧模式配置使用VP隧道连接C8540MSR-2和C8540MSR-2到C8540MSR-1。

使用增强型ARM进行信元模式MPLS

在Catalyst 8540 MSR信元模式MPLS在所有ATM接口上受支持,并与ATM信令(如ILMI)和ATM路由(PNNI)并行工作。当您添加mpls ip 接口命令(或旧版Cisco IOS中的tag-switching ip)并要求为每个转发等效类(FEC)或IP目标建立一个单向标签虚电路(LVC)或标记虚电路(TVC)时,将启用

信元模式MPLS。标签虚电路在发起方LER称为**头端LVC**，在目的LER称为**尾端LVC**，在LSR称为**中转LVC**。在Cat8540 MSR充当纯ATM LSR(MPLS Lsr)的情况下p路由器),CPU不为ATM核心中学习的路由建立头端LVC。从CPU发往远程LSR的流量通过MPLS控制VC发送。ATM接口可以链接到ARM2端口，如果是，LVC将终止在ARM2端口上。实际上，当您将ATM接口链接到ARM2端口时，ARM2将充当ATM LER (MPLS PE路由器)，并将为在ATM核心中学习的路由启动头端LVC (终止LVC)。

ATM接口、ATM VP和分层VP隧道可配置为在ARM2端口上终止 (仅在8540 MSR平台上可用)。为实现负载均衡，ATM接口可以链接到增强型ARM的两个端口中的任一个。要在ARM2端口上终止信元模式MPLS，请使用**mpls-forwarding interface ATMx/y/z**接口配置命令，其中ATMx/y/z是增强型ARM端口)。该命令仅适用于主接口。

配置

- [C8540MSR-2](#)
- [C8510MSR-3](#)

C8540MSR-2(Catalyst 8540MSR)

C8540MSR-2#**show hardware**

```
C8540 named c8540MSR-2, Date: 04:46:41 UTC Mon Feb 10 2003
Slot Ctrlr-Type      Part No.  Rev Ser No  Mfg Date  RMA No.  Hw Vrs   Tst  EEP
-----
0/* Super Cam       73-2739-03 B0 03170SXG Apr 27 99 0           3.0
0/1 155MM PAM       73-1496-03 A0 09006167 Aug 01 95 00-00-00 3.1    0    2
2/* OCM Board       73-2833-06 A0 03210XWB May 26 99 0           6.0
2/0 QUAD 622 Gen    73-2852-05 A0 03210YN8 May 26 99 0           5.0
9/* ETHERNET PAM    73-3754-05 A0 03374A9K Mar 17 99 0           4.1
12/* CPM Card       73-3944-05 A0 04209EX0 Aug 29 00 0           5.0
12/0 ARM2 PAM      73-5533-01 A0 0424A160 Aug 29 00 0           5.1
12/1 ARM2 PAM      73-5533-01 A0 0424A183 Aug 29 00 0           5.1
C8540MSR-2#conf t
```

Enter configuration commands, one per line. End with CNTL/Z.

```
C8540MSR-2(config)#int atm 0/1/2
C8540MSR-2(config-if)#mpls ip
! Cell mode MPLS enabled
C8540MSR-2(config-if)#ip add 10.254.14.237 255.255.255.252
C8540MSR-2(config-if)#mpls label protocol ldp
! LDP enabled on the interface
C8540MSR-2(config-if)#end
```

C8540MSR-2#**show atm vc int atm 0/1/2**

Interface	VPI	VCI	Type	X-Interface	X-VPI	X-VCI	Encap	Status
ATM0/1/2	0	5	PVC	ATM0	0	57	QSAAL	UP
ATM0/1/2	0	16	PVC	ATM0	0	37	ILMI	UP
ATM0/1/2	0	18	PVC	ATM0	0	202	PNNI	UP
ATM0/1/2	0	32	PVC	ATM0	0	256	SNAP	UP

C8540MSR-2#**show mpls int atm 0/1/2**

Interface	IP	Tunnel	Operational
ATM0/1/2	Yes (ldp)	No	Yes (ATM labels)

C8540MSR-2#**show mpls int atm 0/1/2 det**

Interface ATM0/1/2:

```

IP labeling enabled (ldp)
LSP Tunnel labeling not enabled
MPLS operational
MTU = 4470
ATM tagging: Label VPI = 1
Label VCI range = 33 - 65535
Control VC = 0/32

```

```

C8540MSR-2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
C8540MSR-2(config)#int atm 0/1/2
C8540MSR-2(config-if)#mpls-forwarding int atm 12/0/1
! Terminate Cell mode MPLS on ARM2
C8540MSR-2(config-if)#end
C8540MSR-2#show atm vc int atm 0/1/2

```

Interface	VPI	VCI	Type	X-Interface	X-VPI	X-VCI	Encap	Status
ATM0/1/2	0	5	PVC	ATM0	0	57	QSAAL	UP
ATM0/1/2	0	16	PVC	ATM0	0	37	ILMI	UP
ATM0/1/2	0	18	PVC	ATM0	0	202	PNNI	UP
ATM0/1/2	0	32	PVC	ATM12/0/1	2	120	SNAP	UP
ATM0/1/2	1	35	TVC(O)	ATM12/0/1	2	121	MUX	UP
ATM0/1/2	1	36	TVC(O)	ATM12/0/1	2	122	MUX	UP
ATM0/1/2	1	37	TVC(O)	ATM12/0/1	2	123	MUX	UP
ATM0/1/2	1	41	TVC(O)	ATM12/0/1	2	124	MUX	UP

```

C8540MSR-2#show mpls int

```

Interface	IP	Tunnel	Operational
FastEthernet9/0/0	Yes (ldp)	No	Yes
ATM0/1/2	Yes (ldp)	No	Yes (ATM labels)

! *Note: ATM labels -> Cell mode*

```

ATM12/0/0.60      Yes(ldp)      No      Yes

```

注意：第二个8540 MSR(C8540MSR-1)上应使用先前显示的相同配置过程。此配置不在此处显示，因为启动和运行MPLS需要相同的步骤。

C8510MSR-3(Catalyst 8510MSR)

```

C8510MSR-1#show running-config
Building configuration...

!
interface Loopback0
ip address 10.254.231.1 255.255.255.255
! interface ATM0/0/2
ip address 10.254.14.245 255.255.255.252
logging event subif-link-status
no atm ilmi-keepalive
mpls label protocol ldp
tag-switching ip
!
interface ATM0/0/3
ip address 10.254.14.238 255.255.255.252
logging event subif-link-status
load-interval 30
no atm ilmi-keepalive
mpls label protocol ldp
tag-switching ip
!
router ospf 1
log-adjacency-changes

```

```
network 10.0.0.0 0.255.255.255 area 0.0.0.0
```

使用增强型ARM实现ATM VP隧道上的帧模式MPLS

带有增强型ARM线卡的Catalyst 8540 MSR还可以在ATM上运行帧模式MPLS。为了说明增强型ARM在帧模式MPLS中的使用，请查看本文档中的“在ATM隧道上使用增强型ARM for Frame Mode MPLS”配置示例。ATM VP隧道有时用于连接两个站点。可以使用大型“管道”VP隧道，而不是配置单个VC。为了说明此选项（通常需要在远程站点之间使用大量虚电路的公司使用），在C8540MSR-1和C8540MSR-2之间创建了VP隧道。两个8540MSR直接通过ATM2/0/0(OC)连接-12，已使用分层VP隧道ATM2/0/0.60)。两个增强型ARM模块在ATM子接口上运行帧模式MPLS。因此，已配置数据PVC/aal5snap。

此示例显示在C8540MSR-1中为在ATM VP隧道上配置帧模式MPLS的增强型ARM所执行的步骤。

C8540MSR-1(Catalyst 8540MSR)

```
C8540MSR-1#show hardware
```

```
C8540 named c8540-r6-1, Date: 04:46:41 UTC Mon Feb 10 2003
```

Slot	Ctrlr-Type	Part No.	Rev	Ser No	Mfg Date	RMA No.	Hw Vrs	Tst	EEP
0/*	Super Cam	73-2739-03	B0	03170SUQ	Apr 27 99	0			3.0
0/1	155MM PAM	73-1496-03	A6	03199939	Aug 01 95	00-00-00			3.1 0 2
2/*	OCM Board	73-2833-06	A0	03210XWB	May 26 99	0			6.0
2/0	QUAD 622 Gen	73-2852-05	A0	03210YN8	May 26 99	0			5.0
9/*	ETHERNET PAM	73-3754-05	A0	031111EO	Mar 17 99	0			4.1
11/*	CMPM Card	73-3944-05	A0	04209F5E	Aug 29 00	0			5.0
11/0	ARM2 PAM	73-5533-01	A0	0424A162	Aug 29 00	0			5.1
11/1	ARM2 PAM	73-5533-01	A0	0424A17C	Aug 29 00	0			5.1

```
C8540MSR-1#conf t
```

```
Enter configuration commands, one per line. End with CNTL/Z.
```

```
C8540MSR-1(config)#atm hierarchical-tunnel
```

```
C8540MSR-1(config)#atm connection-traffic-table-row index 60 cbr pbr 120000
```

```
C8540MSR-1(config)#int atm 2/0/0
```

```
C8540MSR-1(config-if)#atm pvp 6 hierarchical rx-cttr 60 tx-cttr 60
```

```
C8540MSR-1(config-if)#int atm 2/0/0.60
```

```
C8540MSR-1(config-subif)#exit
```

```
C8540MSR-1(config)#int atm 11/0/0.60 point-to-point
```

```
C8540MSR-1(config-subif)#ip address 10.254.14.10 255.255.255.252
```

```
C8540MSR-1(conf-sif)#atm pvc 2 60 pd on encap aal5snap int atm 2/0/0.60 60 60
```

```
C8540MSR-1(config-subif)#mpls label protocol ldp
```

```
C8540MSR-1(config-subif)#mpls ip
```

```
C8540MSR-1(config-subif)#end
```

```
C8540MSR-1#show atm vc int atm 11/0/0.60 | include ATM2/
```

```
ATM11/0/0 2 60 PVC ATM2/0/0.60 60 60 SNAP UP
```

```
C8540MSR-1#show mpls int
```

Interface	IP	Tunnel	Operational
ATM0/0/1	Yes (ldp)	No	Yes (ATM labels)
ATM0/0/2	Yes	No	No (ATM labels)
FastEthernet9/0/4	Yes	No	No
ATM0/1/0	Yes (ldp)	No	No (ATM labels)
ATM11/0/1	Yes	No	No
ATM11/0/0.5	Yes (tdp)	No	Yes
ATM11/0/0.60	Yes (ldp)	No	Yes

! Note: no ATM labels -> Frame mode

```
C8540MSR-1#show mpls int atm 11/0/0.60 det
```

```
Interface ATM11/0/0.60:
```

```
    IP labeling enabled (ldp)          LSP Tunnel labeling not enabled
    MPLS operational                   MTU = 4470
```

```
C8540MSR-1#show atm vp
```

```
Interface      VPI  Type  X-Interface      X-VPI  Status
ATM2/0/0       60   PVP                    HIE. TUNNEL
```

配置

网络图中MSR配置的相关部分如下所示：

- [C8540MSR-2](#)
- [C8540MSR-1](#)
- [C8510MSR-3](#)(此配置与使用增强型ARM进行信元模式MPLS的配置相同。)

C8540MSR-2(Catalyst 8540MSR)

```
C8540MSR-2#show running-config
```

```
Building configuration...
```

```
!
mpls label protocol ldp
atm hierarchical-tunnel
atm connection-traffic-table-row index 60 cbr pcr 120000

!
interface Loopback0
 ip address 10.254.225.1 255.255.255.255
!
interface ATM0/1/2
 description IP subnet 10.254.14.236
 ip address 10.254.14.237 255.255.255.252
 ip ospf cost 4
 no atm ilmi-keepalive
 mpls label protocol ldp
 tag-switching ip
 mpls-forwarding interface ATM12/0/1
 ! terminates cell mode MPLS on the ARM module
interface ATM2/0/0
 no ip address
 no atm ilmi-keepalive
 atm pvp 60 hierarchical rx-cttr 60 tx-cttr 60
!
interface ATM2/0/0.60 point-to-point
 description Hierarchical VP Tunnel for frame mode MPLS over ATM
!
interface FastEthernet9/0/0
 ip address 10.64.0.2 255.255.255.252
 load-interval 30
 duplex full
 speed 100
 tag-switching ip
 mpls-forwarding interface ATM12/0/0
 ! EPIF based FE line cards do not support MPLS natively
 ! link to ARM2 (ATM 12/0/0) enables MPLS on those cards
interface ATM12/0/0

 description Enhanced ARM - ARM2
```

```
no ip address
```

```
!  
interface ATM12/0/0.60 point-to-point  
  
description ARM2 subinterface used for Frame mode MPLS over HVPT 60  
ip address 10.254.14.9 255.255.255.252  
atm pvc 2 60 pd on encap  
aal5snap interface ATM2/0/0.60 60 60  
mpls label protocol ldp tag-switching ip  
! an ARM2 point-to-point subinterface (point-to-point) supported as of  
! Cisco IOS release 12.1(10)EY only  
!  
router ospf 1  
router-id 10.254.225.1  
log-adjacency-changes network 10.0.0.0 0.255.255.255 area 0.0.0.0  
!
```

C8540MSR-1(Catalyst 8540MSR)

```
C8540MSR-1#show running-config  
Building configuration...  
sdm sram Label 32768  
sdm sram Tag-Cos 32768  
! tag-switching tdp router-id Loopback0  
!  
atm hierarchical-tunnel  
atm connection-traffic-table-row index 60 cbr pcr 120000  
!  
interface Loopback0  
ip address 10.254.232.1 255.255.255.255  
!  
interface ATM0/1/0  
ip address 10.254.14.246 255.255.255.252  
ip ospf cost 100  
logging event subif-link-status  
no atm ilmi-keepalive  
mpls label protocol ldp  
tag-switching ip  
mpls-forwarding interface ATM11/0/0  
!  
interface ATM2/0/0  
no ip address  
no atm ilmi-keepalive  
atm pvp 60 hierarchical rx-cttr 60 tx-cttr 60  
!  
interface ATM2/0/0.60 point-to-point  
no atm ilmi-keepalive  
!  
interface FastEthernet9/0/4  
ip address 10.177.1.1 255.255.255.252  
tag-switching ip  
mpls-forwarding interface ATM11/0/0  
!  
interface ATM11/0/0  
no ip address  
!  
interface ATM11/0/0.60 point-to-point  
ip address 10.254.14.10 255.255.255.252  
atm pvc 2 60 pd on encap aal5snap interface ATM2/0/0.60 60 60  
mpls label protocol ldp  
tag-switching ip  
!  
router ospf 1
```

```

router-id 10.254.232.1
log-adjacency-changes
network 10.177.1.0 0.0.0.3 area 0.0.0.0
network 10.254.0.0 0.0.255.255 area 0.0.0.0
!
end

```

验证

使用以下命令验证MPLS是否正常运行：

- **show mpls interfaces [detail]** — 验证标签分发协议是否在请求的接口上运行
- **show mpls ldp neighbors** — 显示LDP会话/邻居连接的状态
- **show mpls ldp discovery** — 确定接口的LDP标识符和LDP hello交换状态
- **show mpls forwarding-table** -检查MPLS转发信息库(FIB)表
- **show mpls ip binding** -检查MPLS IP标签信息库(LIB)表

C8540MSR-1#show mpls interfaces

Interface	IP	Tunnel	Operational
ATM0/0/1	Yes (ldp)	No	Yes (ATM labels)
ATM0/1/0	Yes (ldp)	No	Yes (ATM labels)
ATM11/0/0.60	Yes (ldp)	No	Yes

C8540MSR-1#show mpls interfaces atm 0/1/0 detail

```

Interface ATM0/1/0:
  IP labeling enabled (ldp)
  LSP Tunnel labeling not enabled
MPLS operational
  MTU = 4470
  ATM tagging: Label VPI = 1
                Label VCI range = 33 - 65535
                Control VC = 0/32

```

C8540MSR-1#show mpls ldp neighbor

```

Peer LDP Ident: 10.254.225.1:0; Local LDP Ident 10.254.232.1:0
TCP connection: 10.254.225.1.646 - 10.254.232.1.11016
State: Oper; Msgs sent/rcvd: 106/93; Downstream
Up time: 00:56:36
LDP discovery sources:
  ATM11/0/0.60, Src IP addr: 10.254.14.9
Addresses bound to peer LDP Ident:
  2.2.2.1      10.64.4.190    10.254.225.1    1.254.8.1
  10.254.14.221 10.254.14.225    10.254.14.237  10.254.14.9
Peer LDP Ident: 10.254.231.1:4; Local LDP Ident 10.254.232.1:2
TCP connection: 10.254.14.245.646 - 10.254.14.246.11017
State: Oper; Msgs sent/rcvd: 45/45; Downstream on demand
Up time: 00:38:27
LDP discovery sources:
  ATM0/1/0, Src IP addr: 10.254.14.245

```

C8540MSR-1#show mpls ldp discovery

```

Local LDP Identifier:      10.254.232.1:0
Discovery Sources:
Interfaces:

ATM0/1/0 (ldp): xmit/rcv      LDP Id: 10.254.231.1:4; IP addr:      10.254.14.245
ATM11/0/0.60 (ldp): xmit/rcv  LDP Id: 10.254.225.1:0

```


C8540MSR-1#show mpls forwarding-table

Local tag	Outgoing tag or VC	Prefix or Tunnel Id	Bytes tag switched	Outgoing interface	Next Hop
16	Untagged	10.254.14.220/30	0	AT11/0/0.60	point2point
17	27	10.254.247.1/32	0	AT11/0/0.60	
point2point					
20	22	10.254.14.240/30	0	AT11/0/0.60	
point2point					
21	26	10.254.231.1/32	0	AT11/0/0.60	
point2point					
24	Untagged	10.254.14.224/30	0	AT11/0/0.60	
point2point					
25	24	10.254.227.1/32	0	AT11/0/0.60	
point2point					
26	Pop tag	10.254.14.236/30	0	AT11/0/0.60	
point2point					
33	Untagged	10.254.221.1/32	0	AT11/0/0.60	
point2point					
45	18	10.254.14.12/30	0	AT11/0/0.60	point2point

SORBRCV0(c8540-r6-1)#show mpls ip bind

```

...
10.254.221.1/32
  in label: 33
10.254.222.1/32
  in label: 36
  out vc label: 1/53      lsr: 10.254.233.1:2  ATM0/0/1
  Active      ingress 4 hops (vcd 49)
10.254.223.1/32
  in label: 34
  out vc label: 1/54      lsr: 10.254.233.1:2  ATM0/0/1
  Active      ingress 3 hops (vcd 43)
10.254.225.1/32
  in label: 28
  out label: imp-null    lsr: 10.254.225.1:0
10.254.227.1/32
  in label: 25
  out label: 24          lsr: 10.254.225.1:0
10.254.232.1/32
  in label: imp-null
  in vc label: 1/34      lsr: 10.254.233.1:2  ATM0/0/1
  Active      egress (vcd 59)
  out label: 33          lsr: 10.254.225.1:0
10.254.233.1/32
  in label: 29
  out label: 34          lsr: 10.254.225.1:0
  out vc label: 1/60      lsr: 10.254.233.1:2  ATM0/0/1
  Active      ingress 2 hops (vcd 38)
10.254.242.1/32
  in label: 19
  out vc label: 1/61      lsr: 10.254.233.1:2  ATM0/0/1
  Active      ingress 5 hops (vcd 50)
10.254.247.1/32
  in label: 17
  out label: 27          lsr: 10.254.225.1:0

```

故障排除

有关MPLS故障排除的其他信息，请参阅MPLS故障[排除](#)一般故障排除文档，该文档详细解释了MPLS故障排除。

相关信息

- [MPLS技术支持](#)
- [ATM技术支持](#)
- [工具和资源 - Cisco Systems](#)
- [技术支持和文档 - Cisco Systems](#)