

配置在Cisco Catalyst 8540 MSR增强型ARM (用PVP的ARM 2)的MPLS

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简介

本文为Multiprotocol Layer Switching (MPLS)提供一配置示例在Catalyst 8540增强ATM路由器模块 (ARM)。ARM模块的主要功能将增加功能连接两个不同的世界-数据包/是基于的帧)的交换(和基本存储单元)的ATM。此功能能对MPLS被扩展。Catalyst 8540 MSR用增强型ARM可以安装在数据包的边缘和基本存储单元的网络同启用的两个MPLS模式在同一个机箱。在Catalyst 8540 MSR的 Enhanced ARM (ARM2)为在ATM接口的Label Edge Routing (LER)功能要求-作为每个流入和流出的ATM接口的代理接口在标记交换路径(LSP)执行MPLS数据包处理。Catalyst 8540理想地说适用与信元模式对帧模式MPLS集成(完成由高级ATM路由模块的部署)。两个ARM2卡可以用于单个机箱。

本文提供解释ARM 2.的使用情况两不同的配置的示例。

- 请使用增强型ARM信元模式(终止在ARM 2)的信元模式MPLS
- 请使用增强型ARM在ATM VP隧道的帧模式ATM上的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Cisco C8540 MSRs , Cisco IOS版本12.1(10)EY (256 MB DRAM)
- Cisco C8510 MSR , Cisco IOS版本版本12.1(7a)EY1 (64 MB DRAM)
- C8540-ARM2 (高级ATM路由模块)
- WAI-OC3-4MM (4个端口OC-3线卡)
- C85MS-4F-OC12MM (4个端口OC-12线卡)

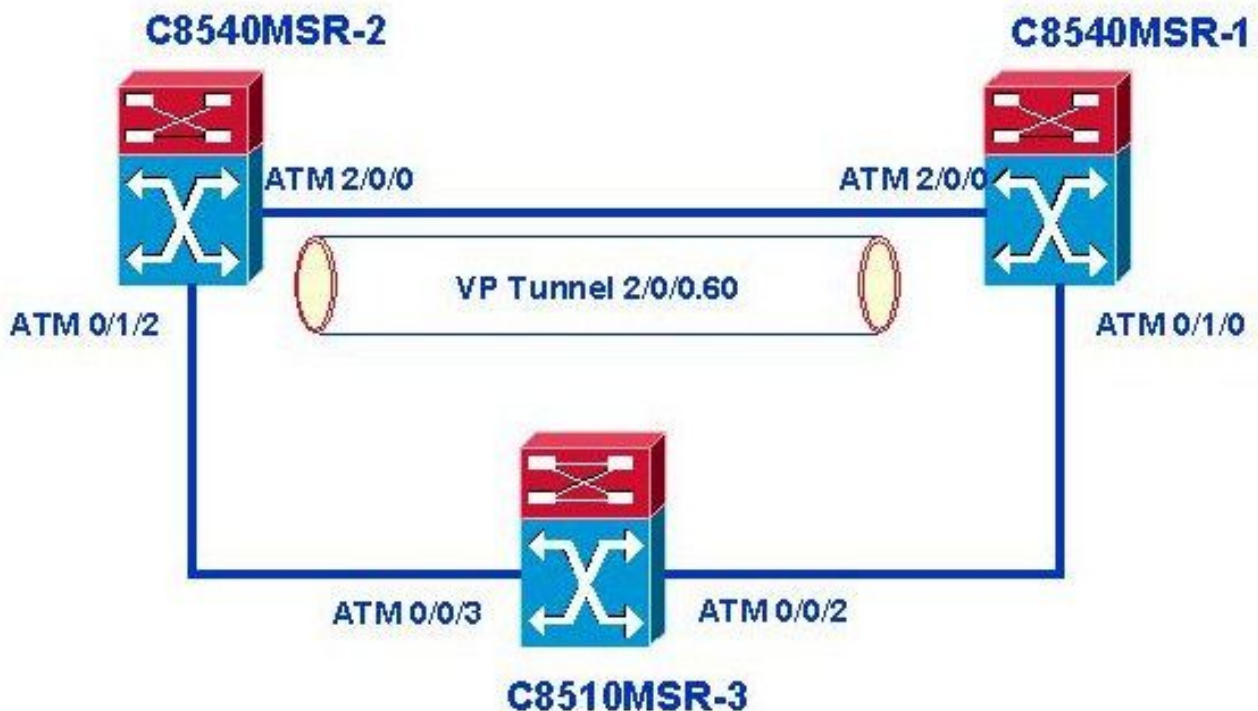
本文档中的信息都是基于特定实验室环境中的设备创建的。本文档中使用的所有设备最初均采用原始(默认)配置。如果您是在真实网络上操作,请确保您在使用任何命令前已经了解其潜在影响。

配置

本部分提供有关如何配置本文档所述功能的信息。OSPF使用了作为一个内部路由协议。

网络图

本文档使用此图中所示的网络设置:



上一个图表使用这些方案:

- 请使用增强型ARM信元模式(终止在ARM 2)的信元模式MPLS
- 请使用增强型ARM在ATM VP隧道的帧模式ATM上的MPLS。

注意信元模式的配置使用路径C8540MSR-2对C8510MSR-3对C8540MSR-1,而在帧模式的本文描述的配置使用VP隧道连接C8540MSR-2和C8540MSR-1。

请使用增强型ARM信元模式MPLS

在Catalyst 8540 MSR上所有ATM接口支持信元模式MPLS并且工作与ATM信令(例如ILMI)和ATM路由平行(PNNI)。信元模式MPLS启用,当您添加在更旧的Cisco IOS版本的mpls ip interface命令(或标记交换IP)时并且需要一条单向的标签虚拟电路(LVC)的建立,或者每个转发等价类(FEC)或IP目的

地的标签虚拟电路(TVC)。标签虚拟电路叫作在创建人LER的**首端LVC**，在目的地LER的**尾端LVC**和在LSR的**传输LVC**。万-Cat8540MSR作为一纯ATM LSR (MPLS P路由器)，CPU在ATM核心不设立获知的路由的首端LVC。于CPU起源和被注定对一远程LSR的流量在MPLS控制VC发送。ATM接口可能与ARM2端口连接，并且LVC在ARM2端口将终止，如果那是实际情形。实际上，当您与ARM2端口时连接ATM接口，ARM2作为ATM LER (MPLS PE路由器)和启动首端LVC (终止LVC)在ATM核心的获知的路由的。

ATM接口、ATM VP和分层VP通道在ARM2端口(在仅8540 MSR平台的联机可以配置终止)。对于负载均衡目的，ATM接口可以与增强型ARM的两个端口之一连接。为了终止在ARM2端口的信元模式MPLS，请使用转发接口Atmx/y/z接口配置命令，Atmx/y/z是增强型ARM端口)。该命令适用对仅主接口。

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)
<i>! Note: ATM labels -> Cell mode</i>			
ATM12/0/0.60	Yes(ldp)	No	Yes

Note:在第二8540 MSR应该使用以前显示的相同的配置步骤(C8540MSR-1).This配置没有显示此处，因为同样步骤要求获得MPLS正在运行。

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
```

请使用增强型ARM帧模式ATM上的MPLS VP隧道

有增强型ARM线卡的Catalyst 8540 MSR能也运行帧模式ATM上的MPLS。为了说明增强型ARM的使用情况在帧模式MPLS的，请查看帧模式的ATM上的MPLS增强型ARM在本文建立隧道”配置示例查找的“使用。ATM VP隧道有时用于连接两个站点。而不是配置个人VC，可以使用大“管道”VP隧道。为了说明此选项，公司通常使用需要在远程站点之间的很大数量的VC，VP隧道创建在C8540MSR-1和C8540MSR-2之间。两个8540MSR's通过ATM2/0/0直接地连接(分级VP隧道ATM2/0/0.60使用了OC-12)。两个增强型ARM模块运行在ATM子接口的帧模式MPLS。因此，数据PVC/aal5snap配置。

此示例显示在C8540MSR-1执行的步骤为了配置帧模式ATM上的MPLS VP隧道的增强型ARM。

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

MSR的配置的相关部分从网络图的其次显示：

- [C8540MSR-2](#)
- [C8540MSR-1](#)
- [C8510MSR-3](#) (此配置是相同的象那个[在使用中信元模式的MPLS增强型ARM。](#))

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

如果MPLS上并且适当地，运作请使用这些命令为了验证：

- **show mpls interfaces [detail]** -验证标签转发协议是否在请求的接口运行
- **show mpls ldp neighbors** -显示LDP会话/邻接的连接状况
- **show mpls ldp discovery** -确定接口的LDP标识符和LDP Hello交换状况
- **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 switched	tag	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

关于MPLS故障排除的更多信息，参考详细解释MPLS故障排除的[MPLS故障排除通用故障排除文档](#)

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](#)