

差分服务MPLS网络的隧道模式

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本文描述差异化服务(DiffServ)多协议标签交换(MPLS)基于网络环境的建立隧道可用模式的实施。

[Prerequisites](#)

[Requirements](#)

本文档的读者应掌握以下这些主题的相关知识：

- MPLS和MPLS虚拟私有网络(VPN)的
- 与IP优先级、服务类型(ToS)和DiffServ相关的概念
- 服务质量(QoS)数据包标记和分类使用模块化QoS Line命令接口CLI (MQC)

[Components Used](#)

本文档中的信息基于以下软件和硬件版本：

- Cisco IOS软件新的QoS功能[®]版本12.2(13)T。版本12.1(5)T包括原始QoS功能。
- 从3600系列的任何Cisco路由器或以上，例如支持MPLS供应商核心(p)路由器/服务商边缘路由器功能的Cisco 3660或7206。

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.

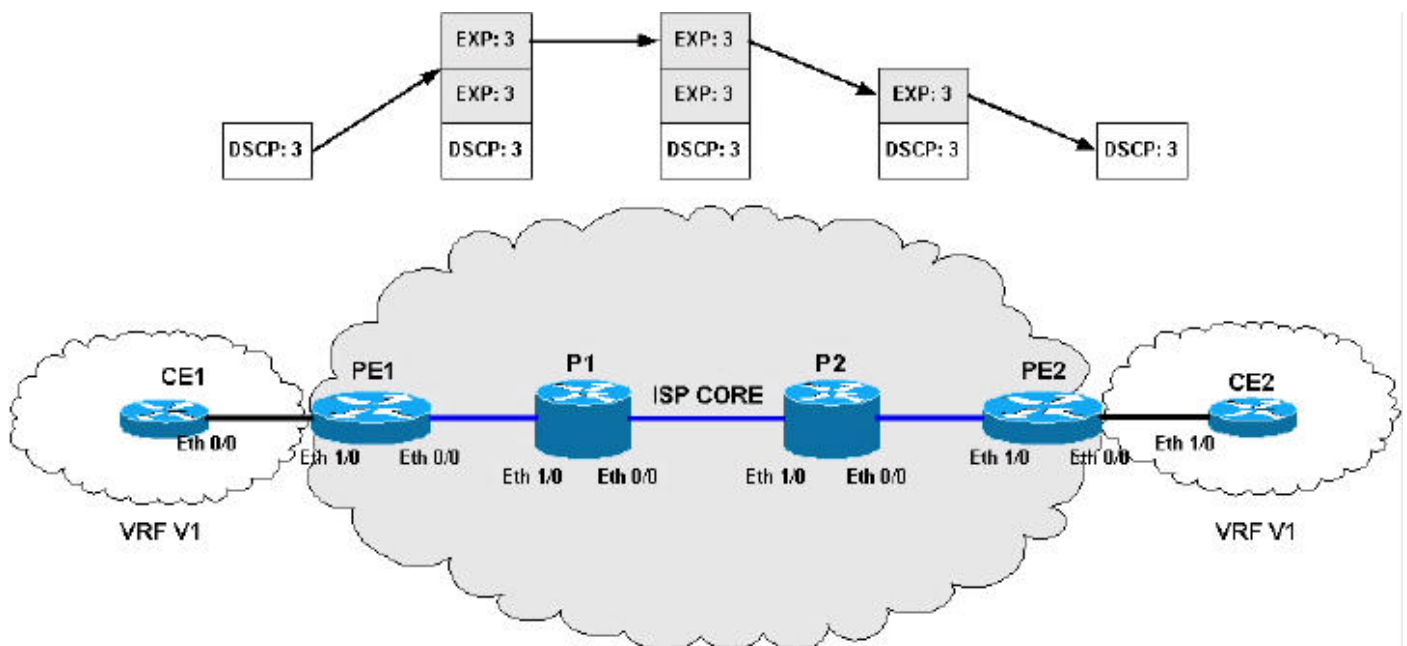
Conventions

有关文档规则的详细信息，请参阅 [Cisco 技术提示规则](#)。

背景信息

默认行为

此图表描述差分服务代码点(DSCP) /MPLS实验(EXP)位的默认行为，当信息包从一个用户边缘(CE)路由器移动到在MPLS核心间的另一个CE路由器：



此部分此剩下的事描述在默认行为图表内的活动。

标签(IP的税收- > 标签) :

- 流入的IP信息包的IP优先级被复制到MPLS EXP位所有被压入的标签。
- DSCP位的第1三位被复制到MPLS EXP位所有被压入的标签。
- 亦称此技术是Tos反映。

MPLS转发(标签- > 标签) :

- EXP被复制到在转发或税收时被交换/被压入的新的标签。
- 在标签强制，强调的标签没有修改与被添加到当前标签栈的新的标签的值。
- 在标签处理，EXP位没有被复制下来到最近显示的标签EXP位。

标签(标签的处理- > IP) :

- 在标签处理EXP位没有被复制下来到最近显示的IP信息包的IP precedence/DSCP字段。

Cisco IOS前软件12.2(13)T Usage命令和工作情况

在IOS版本12.2(13)T前， [set mpls experimental命令](#)是可用唯一的方法修改MPLS EXP位。

[过帐Cisco IOS软件12.2\(13\)T Usage命令和工作情况](#)

使用IOS版本12.2(13)T和以后， [set mpls experimental命令](#)修改允许这些选项：

- [设置MPLS实验最上面 {mpls-exp-value/QoS组\[table table-map-name\]}](#)
- [set mpls experimental imposition {mpls-exp-value/QoS组\[table table-map-name\]}](#)

Note: 新[set mpls experimental topmost命令](#)与老[set mpls imposition命令](#)是等同的。

在标签推进、交换和弹出操作期间，这两个命令，与一些new命令交换机的组合，允许MPLS EXP二进制处理更好的控制。这两个命令允许您使用DiffServ隧道模式。

[DiffServ隧道模式](#)

DiffServ隧道模式引入新的每跳行为(PHB)，允许在提供商网络的被区分的QoS。隧道模式被定义在网络的边缘，通常在PE标签交换路由器(LSRs) (入口和出口)。您可能需要做P路由器的变动;您也必须也考虑什么发生，当最上面的标签从信息包被去除由于Penultimate Hop Popping (PHP)时。从弹出对最近显示的标签的顶部标签复制MPLS EXP值可能是必要的;这总是不适用于所有隧道模式。

有时(例如，无格式Non-VPN MPLS网络)，对最终P路由器的PHP动作能显示一个无格式IP信息包，当与一个标签的一个信息包只收到时。当此IP信息包由出口LSR (PE)收到，分类根据MPLS EXP位的信息包是不可能的，因为当前没有标签。在这些情况下，您必须配置出口PE路由器通告 **explicit-null** 标签。当PHP动作在P路由器时进行，为零发送与值的一个标签，并且用此特殊标签您能标记EXP位作为通常标记的信息包，允许在出口PE路由器的正确的分类。

DiffServ规格MPLS网络支持定义了这些隧道模式：

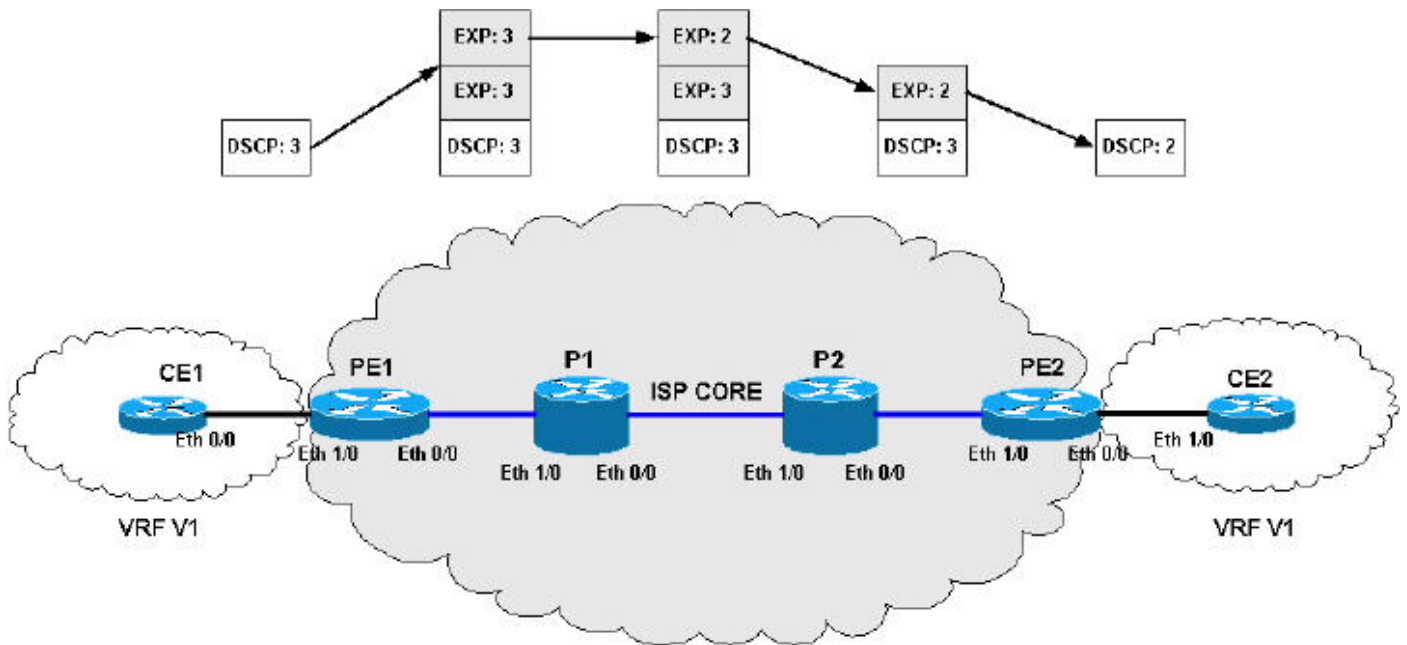
- [统一](#)
- [管道](#)
- [短管道](#)

以下部分分开检查每个隧道模式，并且提供示例显示如何可以配置每个隧道模式。示例包括IP优先级一个充分的映射对MPLS EXP位。有一定数量不同的QoS参数和隧道模式每位用户的是可能的。

Note: 配置示例为MPLS VPN不是特定的，并且为无格式MPLS网络和载波支持的载波(Csc)网络是可适用的。也很可能，您的网络能从另一网络变化—可以使用许多不同的QoS参数和隧道模式。

[统一模式](#)

建立隧道统一模式的DiffServ只有QoS一个层，到达端到端。入口PE路由器(PE1)从流入的IP信息包复制DSCP到被强加的标签的MPLS EXP位。当EXP位游遍核心，他们可以或不可以由半成品P路由器修改。在本例中，P路由器P1修改顶部标签的EXP位。在出口P路由器(P2)我们复制EXP位到最近显示的标签的EXP位在PHP (Penultimate-Hop-Pop)以后。最终在出口PE路由器(PE2)我们然后复制EXP位到最近显示的IP信息包的DSCP位。



统一模式配置：

PE1

```

!--- This configuration maps the IP Precedence !--- of
the incoming IP packets to the MPLS EXP bits. class-map
match-all IP-AF11 match ip precedence 0 class-map match-
all IP-AF12 match ip precedence 1 class-map match-all
IP-AF21 match ip precedence 2 class-map match-all IP-
AF22 match ip precedence 3 class-map match-all IP-
AF31 match ip precedence 4 class-map match-all IP-AF32 match
ip precedence 5 class-map match-all MPLS-AF11 match mpls
experimental topmost 0 class-map match-all MPLS-AF12
match mpls experimental topmost 1 class-map match-all
MPLS-AF21 match mpls experimental topmost 2 class-map
match-all MPLS-AF22 match mpls experimental topmost 3
class-map match-all MPLS-AF31 match mpls experimental
topmost 4 class-map match-all MPLS-AF32 match mpls
experimental topmost 5 policy-map set-MPLS-PHB
  class IP-AF11
    police 8000 conform-action set-mpls-exp-imposition-
transmit
                                0 exceed-
action drop
  class IP-AF12
    police 10000 conform-action set-mpls-exp-imposition-
transmit
                                1 exceed-action set-mpls-exp-imposition-
transmit 0
  class IP-AF21
    police 12000 conform-action set-mpls-exp-imposition-
transmit
                                2 exceed-action set-mpls-exp-imposition-
transmit 1
  class IP-AF22
    police 12000 conform-action set-mpls-exp-imposition-
transmit
                                3 exceed-action set-mpls-exp-imposition-
transmit 2
  class IP-AF31

```

```
police 12000 conform-action set-mpls-exp-imposition-
transmit
    4 exceed-action set-mpls-exp-imposition-
transmit 3
class IP-AF32
    police 12000 conform-action set-mpls-exp-imposition-
transmit
    5 exceed-action set-mpls-exp-imposition-
transmit 4
```

policy-map output-qos

```
class MPLS-AF11
    bandwidth percent 5
    random-detect
class MPLS-AF12
    bandwidth percent 10
    random-detect
class MPLS-AF21
    bandwidth percent 10
    random-detect
class MPLS-AF22
    bandwidth percent 15
    random-detect
class MPLS-AF31
    bandwidth percent 20
    random-detect
class MPLS-AF32
    bandwidth percent 30
    random-detect
```

```
interface Ethernet0/0
    ip address 192.168.0.1 255.255.255.0
    max-reserved-bandwidth 90
    service-policy output output-qos
    tag-switching ip
!
```

```
interface Ethernet1/0
    ip vrf forwarding v1
    ip address 10.0.0.2 255.255.255.0
    service-policy input set-MPLS-PHB
!
```

P1

```
!-- This configuration swaps the top label from 3 to 2,
!-- which does not need to occur to follow the previous
configuration. class-map match-all mpls-in match mpls
experimental topmost 3 ! policy-map mpls-in
    class mpls-in
        set mpls experimental topmost 2
!
interface Ethernet0/0
    ip address 192.168.1.1 255.255.255.0
    tag-switching ip
!
interface Ethernet1/0
    ip address 192.168.0.2 255.255.255.0
    service-policy input mpls-in
    tag-switching ip
!
```

P2

```
!--- Remember to copy down the MPLS EXP value !--- from
the newly exposed label after the PHP. class-map match-
all MPLS-AF11 match mpls experimental topmost 0 class-
map match-all MPLS-AF12 match mpls experimental topmost
1 class-map match-all MPLS-AF21 match mpls experimental
topmost 2 class-map match-all MPLS-AF22 match mpls
experimental topmost 3 class-map match-all MPLS-AF31
match mpls experimental topmost 4 class-map match-all
MPLS-AF32 match mpls experimental topmost 5 ! class-map
match-all qos-group-AF11 match qos-group 0 class-map
match-all qos-group-AF12 match qos-group 1 class-map
match-all qos-group-AF21 match qos-group 2 class-map
match-all qos-group-AF22 match qos-group 3 class-map
match-all qos-group-AF31 match qos-group 4 class-map
match-all qos-group-AF32 match qos-group 5 ! policy-map
qos-group-in
  class MPLS-AF11
    set qos-group mpls experimental topmost
  class MPLS-AF12
    set qos-group mpls experimental topmost
  class MPLS-AF21
    set qos-group mpls experimental topmost
  class MPLS-AF22
    set qos-group mpls experimental topmost
  class MPLS-AF31
    set qos-group mpls experimental topmost
  class MPLS-AF32
    set qos-group mpls experimental topmost
!
policy-map qos-group-out
  class qos-group-AF11
    bandwidth percent 5
    random-detect
    set mpls experimental topmost qos-group
  class qos-group-AF12
    bandwidth percent 10
    random-detect
    set mpls experimental topmost qos-group
  class qos-group-AF21
    bandwidth percent 10
    random-detect
    set mpls experimental topmost qos-group
  class qos-group-AF22
    bandwidth percent 15
    random-detect
    set mpls experimental topmost qos-group
  class qos-group-AF31
    bandwidth percent 20
    random-detect
    set mpls experimental topmost qos-group
  class qos-group-AF32
    bandwidth percent 30
    random-detect
    set mpls experimental topmost qos-group
!
interface Ethernet0/0
  ip address 192.168.2.1 255.255.255.0
  max-reserved-bandwidth 90
  service-policy output qos-group-out
  tag-switching ip
!
```

```
interface Ethernet1/0
 ip address 192.168.1.2 255.255.255.0
 service-policy input qos-group-in
 tag-switching ip
!
```

PE2

```
!--- Remember to copy down the MPLS EXP bits to the IP
Precedence !--- of the newly exposed IP packet. class-
map match-all MPLS-AF11 match mpls experimental topmost
0 class-map match-all MPLS-AF12 match mpls experimental
topmost 1 class-map match-all MPLS-AF21 match mpls
experimental topmost 2 class-map match-all MPLS-AF22
match mpls experimental topmost 3 class-map match-all
MPLS-AF31 match mpls experimental topmost 4 class-map
match-all MPLS-AF32 match mpls experimental topmost 5 !
class-map match-all qos-group-AF11 match qos-group 0
class-map match-all qos-group-AF12 match qos-group 1
class-map match-all qos-group-AF21 match qos-group 2
class-map match-all qos-group-AF22 match qos-group 3
class-map match-all qos-group-AF31 match qos-group 4
class-map match-all qos-group-AF32 match qos-group 5 !
policy-map qos-group-in
 class MPLS-AF11
   set qos-group mpls experimental topmost
 class MPLS-AF12
   set qos-group mpls experimental topmost
 class MPLS-AF21
   set qos-group mpls experimental topmost
 class MPLS-AF22
   set qos-group mpls experimental topmost
 class MPLS-AF31
   set qos-group mpls experimental topmost
 class MPLS-AF32
   set qos-group mpls experimental topmost
!
policy-map qos-group-out
 class qos-group-AF11
   bandwidth percent 5
   random-detect
   set precedence qos-group
 class qos-group-AF12
   bandwidth percent 10
   random-detect
   set precedence qos-group
 class qos-group-AF21
   bandwidth percent 10
   random-detect
   set precedence qos-group
 class qos-group-AF22
   bandwidth percent 15
   random-detect
   set precedence qos-group
 class qos-group-AF31
   bandwidth percent 20
   random-detect
   set precedence qos-group
 class qos-group-AF32
   bandwidth percent 30
   random-detect
   set precedence qos-group
```



```

!
interface Ethernet0/0
 ip vrf forwarding v1
 ip address 10.0.1.1 255.255.255.0
 max-reserved-bandwidth 90
 service-policy output qos-group-out
!
interface Ethernet1/0
 ip address 192.168.2.2 255.255.255.0
 service-policy input qos-group-in
 tag-switching ip
!

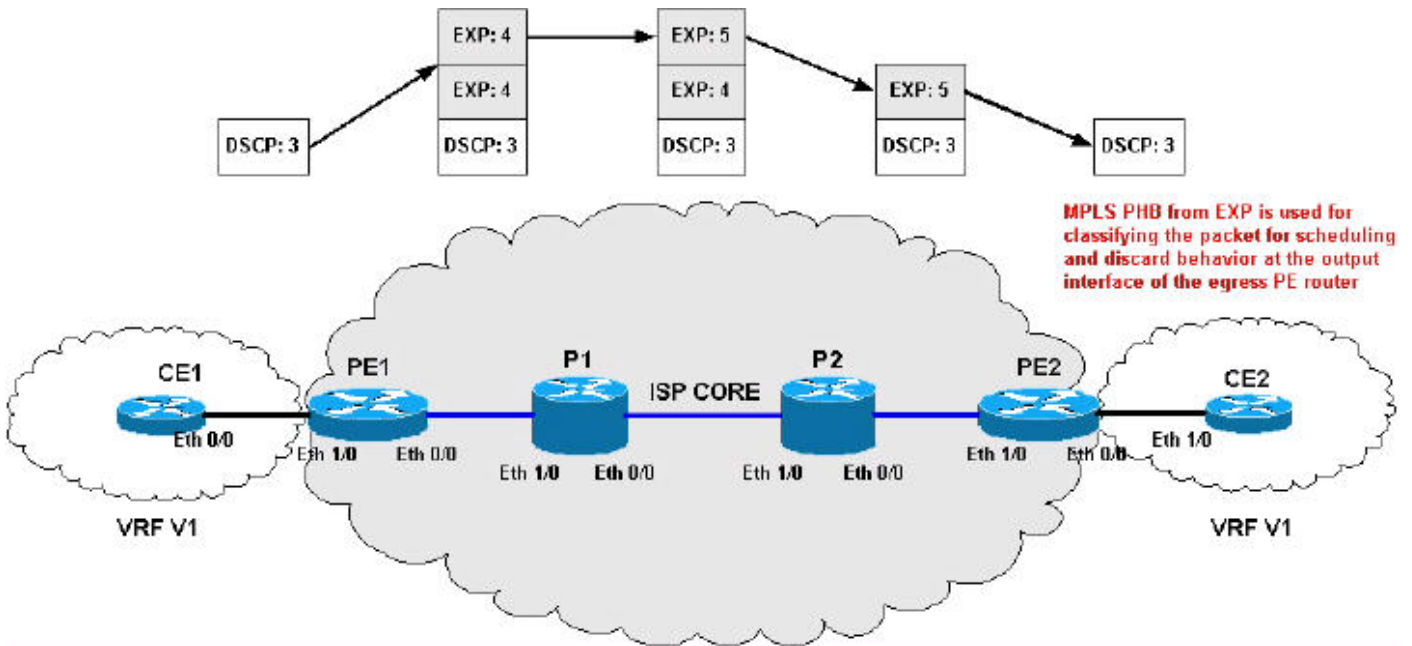
```

管道模式

DiffServ隧道管道模式使用QoS两个层：

1. 数据的基础QoS，保持不变，当横断核心时。
2. 每个核心QoS，是分别于那基础IP信息包。此每个核心QoS PHB保持透明对终端用户。

当信息包到达MPLS核心的边缘时，出口PE路由器(PE2)分类根据从最近被去除的标签的EXP位的MPLS PHB的outbound排队的最近显示的IP信息包。



管道模式配置：

PE1

```

!--- On input, the IP Precedence is copied to the MPLS
EXP !--- on label imposition and when leaving the
router, the !--- MPLS EXP bits are used to classify the
traffic into three !--- traffic classes-gold, silver,
and bronze (the topmost). class-map match-all IP-AF22
match ip precedence 0 1 class-map match-all IP-AF31
match ip precedence 2 3 class-map match-all IP-AF32
match ip precedence 4 5 ! class-map match-all bronze
match mpls experimental topmost 2 3 class-map match-all
silver match mpls experimental topmost 4 class-map
match-all gold match mpls experimental topmost 5 !

```



```

policy-map set-MPLS-PHB
  class IP-AF22
    police 12000 conform-action set-mpls-exp-imposition-
transmit
      3 exceed-action set-mpls-exp-imposition-
transmit 2
    class IP-AF31
      police 12000 conform-action set-mpls-exp-imposition-
transmit
        4 exceed-action set-mpls-exp-imposition-
transmit 3
    class IP-AF32
      police 12000 conform-action set-mpls-exp-imposition-
transmit
        5 exceed-action set-mpls-exp-imposition-
transmit 4
  !
policy-map output-qos
  class gold
    bandwidth 40
    random-detect
  class silver
    bandwidth 30
    random-detect
  class bronze
    bandwidth 20
    random-detect
  !
interface Ethernet0/0
  ip address 192.168.0.1 255.255.255.0
  max-reserved-bandwidth 90
  service-policy output output-qos
  tag-switching ip
  !
interface Ethernet1/0
  ip vrf forwarding v1
  ip address 10.0.0.2 255.255.255.0
  service-policy input set-MPLS-PHB
  !

```

P1

```

!--- This configuration swaps the top label from 4 to 5,
!--- which does not need to occur to follow the previous
configuration. class-map match-all mpls-in match mpls
experimental topmost 4 ! policy-map mpls-in
  class mpls-in
    set mpls experimental topmost 5
  !
interface Ethernet0/0
  ip address 192.168.1.1 255.255.255.0
  tag-switching ip
  !
interface Ethernet1/0
  ip address 192.168.0.2 255.255.255.0
  service-policy input mpls-in
  tag-switching ip
  !

```

P2

```

!--- Remember to copy down the MPLS EXP value from !---
the newly exposed label after the PHP. class-map match-
all MPLS-AF11 match mpls experimental topmost 0 class-
map match-all MPLS-AF12 match mpls experimental topmost
1 class-map match-all MPLS-AF21 match mpls experimental
topmost 2 class-map match-all MPLS-AF22 match mpls
experimental topmost 3 class-map match-all MPLS-AF31
match mpls experimental topmost 4 class-map match-all
MPLS-AF32 match mpls experimental topmost 5 ! class-map
match-all gold match qos-group 5 class-map match-all
silver match qos-group 4 class-map match-all bronze
match qos-group 3 match qos-group 2 ! policy-map qos-
group-in
  class MPLS-AF11
    set qos-group mpls experimental topmost
  class MPLS-AF12
    set qos-group mpls experimental topmost
  class MPLS-AF21
    set qos-group mpls experimental topmost
  class MPLS-AF22
    set qos-group mpls experimental topmost
  class MPLS-AF31
    set qos-group mpls experimental topmost
  class MPLS-AF32
    set qos-group mpls experimental topmost
!
policy-map qos-group-out
  class gold
    bandwidth 40
    random-detect
    set mpls experimental topmost qos-group
  class silver
    bandwidth 30
    random-detect
    set mpls experimental topmost qos-group
  class bronze
    bandwidth 20
    random-detect
    set mpls experimental topmost qos-group
!
interface Ethernet0/0
  ip address 192.168.2.1 255.255.255.0
  max-reserved-bandwidth 90
  service-policy output qos-group-out
  tag-switching ip
!
interface Ethernet1/0
  ip address 192.168.1.2 255.255.255.0
  service-policy input qos-group-in
  tag-switching ip
!

```

PE2

!--- Remember to queue the newly exposed IP packet based in !--- the MPLS EXP bits of the label we just removed. Use !--- qos-groups to keep track of this value.

```

class-map match-all MPLS-AF11
  match mpls experimental topmost 0
class-map match-all MPLS-AF12
  match mpls experimental topmost 1

```

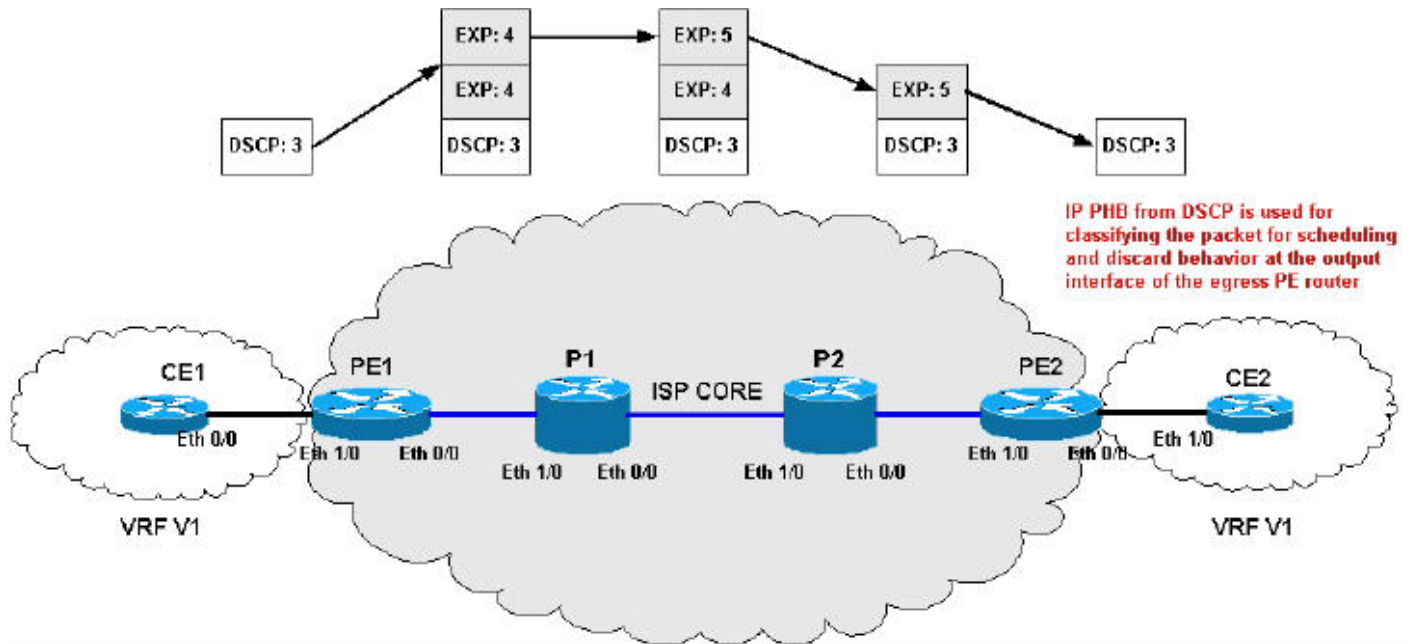
```

class-map match-all MPLS-AF21
  match mpls experimental topmost 2
class-map match-all MPLS-AF22
  match mpls experimental topmost 3
class-map match-all MPLS-AF31
  match mpls experimental topmost 4
class-map match-all MPLS-AF32
  match mpls experimental topmost 5
!
class-map match-all gold
  match qos-group 5
class-map match-all silver
  match qos-group 4
class-map match-all bronze
  match qos-group 3
  match qos-group 2
!
policy-map qos-group-in
  class MPLS-AF11
    set qos-group mpls experimental topmost
    set discard-class 0
  class MPLS-AF12
    set qos-group mpls experimental topmost
    set discard-class 1
  class MPLS-AF21
    set qos-group mpls experimental topmost
    set discard-class 2
  class MPLS-AF22
    set qos-group mpls experimental topmost
    set discard-class 3
  class MPLS-AF31
    set qos-group mpls experimental topmost
    set discard-class 4
  class MPLS-AF32
    set qos-group mpls experimental topmost
    set discard-class 5
!
policy-map qos-group-out
  class gold
    bandwidth 40
    random-detect discard-class-based
  class silver
    bandwidth 30
    random-detect discard-class-based
  class bronze
    bandwidth 20
    random-detect discard-class-based
!
interface Ethernet0/0
  ip vrf forwarding v1
  ip address 10.0.1.1 255.255.255.0
  max-reserved-bandwidth 90
  service-policy output qos-group-out
!
interface Ethernet1/0
  ip address 192.168.2.2 255.255.255.0
  service-policy input qos-group-in
  tag-switching ip
!

```

短管道模式

建立隧道短管道模式的DiffServ使用同样规则和技术在核心间。区别在出口PE路由器(PE2) —您分类根据从此IP信息包的DSCP值的IP PHB的outbound排队的最近显示的IP信息包。



短管道模式配置：

```

PE1

!--- On input, the IP Precedent is copied to the MPLS
EXP !--- on label imposition. When leaving the router,
the !--- MPLS EXP bits are used to classify the traffic
into three !--- traffic classes-gold, silver and bronze
(the topmost). class-map match-all IP-AF22 match ip
precedence 0 1 class-map match-all IP-AF31 match ip
precedence 2 3 class-map match-all IP-AF32 match ip
precedence 4 5 ! class-map match-all bronze match mpls
experimental topmost 2 3 class-map match-all silver
match mpls experimental topmost 4 class-map match-all
gold match mpls experimental topmost 5 ! policy-map set-
MPLS-PHB
  class IP-AF22
    police 12000 conform-action set-mpls-exp-imposition-
transmit
      3 exceed-action set-mpls-exp-imposition-
transmit 2
  class IP-AF31
    police 12000 conform-action set-mpls-exp-imposition-
transmit
      4 exceed-action set-mpls-exp-imposition-
transmit 3
  class IP-AF32
    police 12000 conform-action set-mpls-exp-imposition-
transmit
      5 exceed-action set-mpls-exp-imposition-
transmit 4
!
policy-map output-qos
  class gold
    bandwidth 40
    random-detect
  class silver

```

```

bandwidth 30
random-detect
class bronze
bandwidth 20
random-detect
!
interface Ethernet0/0
ip address 192.168.0.1 255.255.255.0
max-reserved-bandwidth 90
service-policy output output-qos
tag-switching ip
!
interface Ethernet1/0
ip vrf forwarding v1
ip address 10.0.0.2 255.255.255.0
service-policy input set-MPLS-PHB
!

```

P1

```

!--- This configuration swaps the top label from 4 to 5,
!--- which does not need to occur to follow the previous
configuration. class-map match-all mpls-in match mpls
experimental topmost 4 ! policy-map mpls-in
class mpls-in
set mpls experimental topmost 5
!
interface Ethernet0/0
ip address 192.168.1.1 255.255.255.0
tag-switching ip
!
interface Ethernet1/0
ip address 192.168.0.2 255.255.255.0
service-policy input mpls-in
tag-switching ip
!

```

P2

```

!--- Remember to copy down the MPLS EXP value from !---
the newly exposed label after the PHP. class-map match-
all MPLS-AF11 match mpls experimental topmost 0 class-
map match-all MPLS-AF12 match mpls experimental topmost
1 class-map match-all MPLS-AF21 match mpls experimental
topmost 2 class-map match-all MPLS-AF22 match mpls
experimental topmost 3 class-map match-all MPLS-AF31
match mpls experimental topmost 4 class-map match-all
MPLS-AF32 match mpls experimental topmost 5 ! class-map
match-all gold match qos-group 5 class-map match-all
silver match qos-group 4 class-map match-all bronze
match qos-group 3 match qos-group 2 ! policy-map qos-
group-in
class MPLS-AF11
set qos-group mpls experimental topmost
class MPLS-AF12
set qos-group mpls experimental topmost
class MPLS-AF21
set qos-group mpls experimental topmost
class MPLS-AF22
set qos-group mpls experimental topmost
class MPLS-AF31

```

```

    set qos-group mpls experimental topmost
class MPLS-AF32
    set qos-group mpls experimental topmost
!
policy-map qos-group-out
class gold
    bandwidth 40
    random-detect
    set mpls experimental topmost qos-group
class silver
    bandwidth 30
    random-detect
    set mpls experimental topmost qos-group
class bronze
    bandwidth 20
    random-detect
    set mpls experimental topmost qos-group
!
interface Ethernet0/0
    ip address 192.168.2.1 255.255.255.0
    max-reserved-bandwidth 90
    service-policy output qos-group-out
    tag-switching ip
!
interface Ethernet1/0
    ip address 192.168.1.2 255.255.255.0
    service-policy input qos-group-in
    tag-switching ip
!

```

PE2

```

!--- Remember to queue the newly exposed IP packet !---
based on the value of the IP Precedent. class-map match-
all gold match precedence 4 5 class-map match-all silver
match precedence 2 3 class-map match-all bronze match
precedence 0 1 ! policy-map qos-group-out
class gold
    bandwidth 40
    random-detect prec-based
class silver
    bandwidth 30
    random-detect prec-based
class bronze
    bandwidth 20
    random-detect prec-based
!
interface Ethernet0/0
    ip vrf forwarding v1
    ip address 10.0.1.1 255.255.255.0
    max-reserved-bandwidth 90
    service-policy output qos-group-out
!
interface Ethernet1/0
    ip address 192.168.2.2 255.255.255.0
    tag-switching ip
!

```

隧道模式汇总

此表总结适用于IP或标记的信息包在网络的多种阶段的多种动作：

隧道模式	IP -> 标签	标签 -> 标签	标签 -> IP
统一	复制IP Prec/DiffServ 到MPLS EXP (可以被SP也 更改)	MPLS EXP可能被 SP更改	MPLS EXP被复制到 IP Prec/DiffServ
管道	MPLS EXP由 SP QoS策略 设置		原始IP保留的 Prec/DiffServ (根据 MPLS EXP的出口排 队)
短管道			原始IP保留的 Prec/DiffServ (在IP Prec/DiffServ根据的出 口排队)

[Related Information](#)

- [Cisco IOS软件- MPLS](#)
- [Q & A -多协议标签交换网络的服务质量](#)
- [Cisco IOS交换服务命令参考, 版本12.2](#)
- [Cisco IOS服务质量解决方案配置指南, 版本12.2](#)
- [Cisco IOS服务质量解决方案命令参考, 版本12.2](#)
- [MPLS Support Page](#)
- [QoS 支持页](#)
- [Technical Support - Cisco Systems](#)