適用於MPLS網路的DiffServ通道模式

目錄

簡介

本檔案介紹適用於基於多協定標籤交換(MPLS)網路環境的差異化服務(DiffServ)通道模式的實作。

必要條件

需求

本文檔的讀者應瞭解以下主題:

- 適用於虛擬私人網路(VPN)的MPLS和MPLS
- 與IP優先順序、服務型別(ToS)和DiffServ相關的概念
- 使用模組化QoS指令行介面CLI(MQC)的服務品質(QoS)封包標籤和分類

採用元件

本文中的資訊係根據以下軟體和硬體版本:

- Cisco IOS軟體®版本12.2(13)T,用於新的QoS功能。版本12.1(5)T包括原始QoS功能。
- 3600系列或更高版本中的任何思科路由器,例如支援MPLS提供商核心(P)路由器/提供商邊緣 (PE)路由器功能的思科3660或7206。

本文中的資訊是根據特定實驗室環境內的裝置所建立。文中使用到的所有裝置皆從已清除(預設
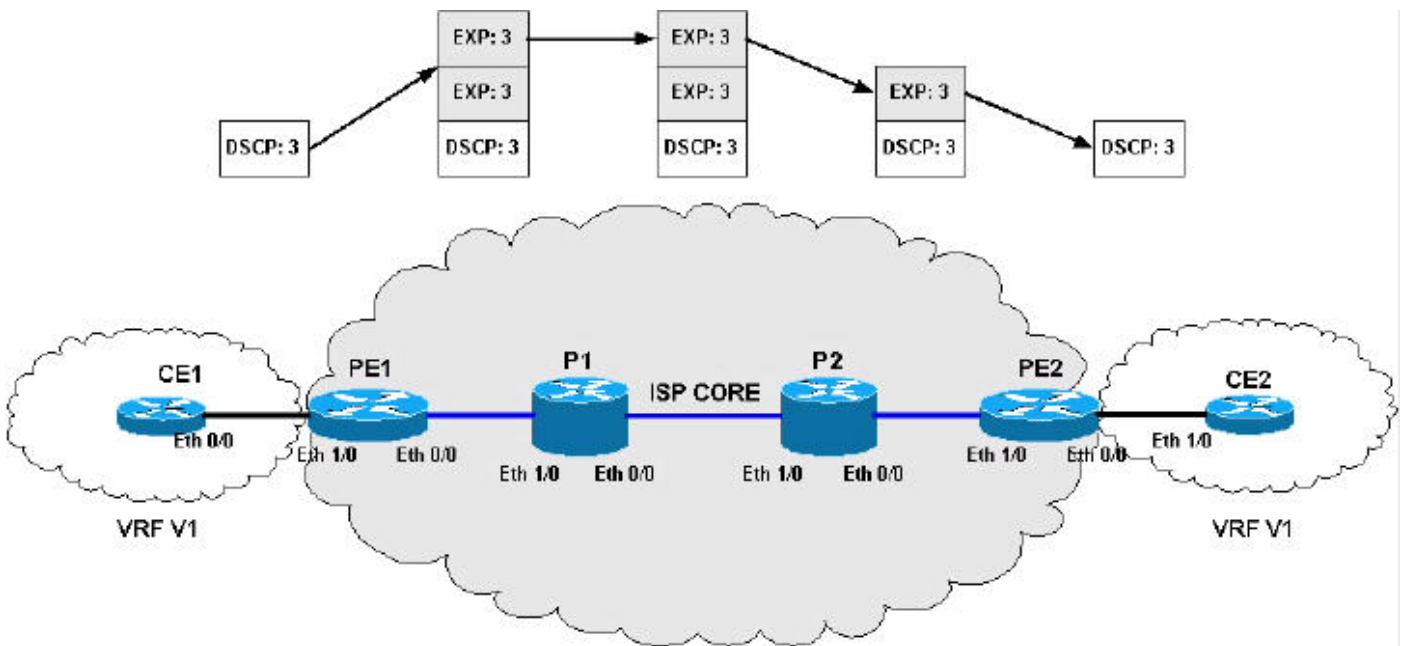
）的組態來啟動。如果您的網路正在作用，請確保您已瞭解任何指令可能造成的影響。

慣例

如需文件慣例的詳細資訊，請參閱思科技術提示慣例。

背景資訊

預設行為

此圖說明當封包透過MPLS核心從一個客戶邊緣(CE)路由器傳送到另一個CE路由器時，DiffServ程式碼點(DSCP)/MPLS試驗(EXP)位元的預設行為：

本節的其餘部分將描述預設行為圖中的活動。

強加標籤（IP ->標籤）：

- 傳入IP封包的IP優先順序會複製到所有已推送標籤的MPLS EXP位元中。
- DSCP位的第三個位被複製到所有推送標籤的MPLS EXP位。
- 這種技術也稱為ToS反射。

MPLS轉發（標籤 — >標籤）：

- 將EXP複製到轉發或強制實施期間交換/推送的新標籤。
- 在設定標籤時，不會修改基礎標籤並將新標籤的值新增到當前標籤堆疊中。
- 在標籤配置中，EXP位不會複製到新暴露的標籤EXP位。

標籤（標籤 — > IP）性質：

- 在標籤配置時，EXP位不會複製到新暴露的IP資料包的IP優先順序/DSCP欄位。

Cisco IOS軟體版本12.2(13)T命令的使用和行為

在IOS版本12.2(13)T之前，set mpls experimental 命令是可用於修改MPLS EXP位元的唯一方法。

Cisco IOS軟體12.2(13)T後命令的使用和行為

在IOS版本12.2(13)T和更新版本中，將**set mpls experimental**命令修改為允許以下選項：

- set mpls experimental top *{mpls-exp-value | qos-group [table table-map-name]}*
- set mpls experimental implementation *{mpls-exp-value | qos-group [table table-map-name]}*

注意：新的**set mpls experimental top**命令等效於舊的**set mpls pementation**命令。

這兩個命令與一些新的命令交換機相結合，可以在標籤推送、交換和pop操作期間更好地控制MPLS EXP位操作。這兩個命令允許您使用DiffServ隧道模式。

DiffServ通道模式

Diffserv通道模式引入了新的每躍點行為(PHB)，允許提供商網路中的差異QoS。隧道模式在網路邊緣定義，通常在PE標籤交換機路由器(LSR)中（入口和出口）。 您可能需要在P路由器上進行更改；還必須考慮由於Penultimate-Hop-Popping(PHP)而從資料包中刪除最頂端的標籤時會發生的情況。 可能需要將MPLS EXP值從正被彈出的頂部標籤複製到新暴露的標籤；這並不總是適用於所有通道模式。

在某些情況下（例如，純非VPN MPLS網路），當接收到只有一個標籤的資料包時，最終P路由器上的PHP操作可能會暴露一個純IP資料包。當輸出LSR(PE)收到此IP封包時，無法根據MPLS EXP位元對封包進行分類，因為現在沒有標籤。在這些情況下，您必須配置輸出PE路由器以通告**顯性null標籤**。當在P路由器上執行PHP操作時，將傳送一個值為零的標籤，使用此特殊標籤可以將EXP位標籤為正常標籤的資料包，從而允許在出口PE路由器上進行正確的分類。

Diffserv規範的MPLS網路支援定義了以下隧道模式：

- 統一
- 管道
- 短管道

下一節將分別檢查每個隧道模式，並提供示例來說明如何配置每個隧道模式。示例包括IP優先順序到MPLS EXP位的完整對映。每個客戶可以有多個不同的QoS引數和隧道模式。

注意：這些配置示例不是特定於MPLS VPN，適用於普通MPLS網路和運營商支援的運營商(CsC)網路。您的網路也可能與另一個網路不同 — 可以使用許多不同的QoS引數和隧道模式。

統一模式

DiffServ通道統一模式只有一層到達端到端的QoS。輸入PE路由器(PE1)將DSCP從傳入IP資料包複製到強加標籤的MPLS EXP位。由於EXP位經過核心，它們可能由中繼P路由器修改，也可能不修改。在本例中，P路由器P1修改頂標籤的EXP位。在輸出P路由器(P2)上，我們將EXP位複製到PHP(Penultimate-Hop-Pop)之後新公開標籤的EXP位中。 最後，在輸出PE路由器(PE2)處，我們將EXP位複製到新暴露的IP資料包的DSCP位。
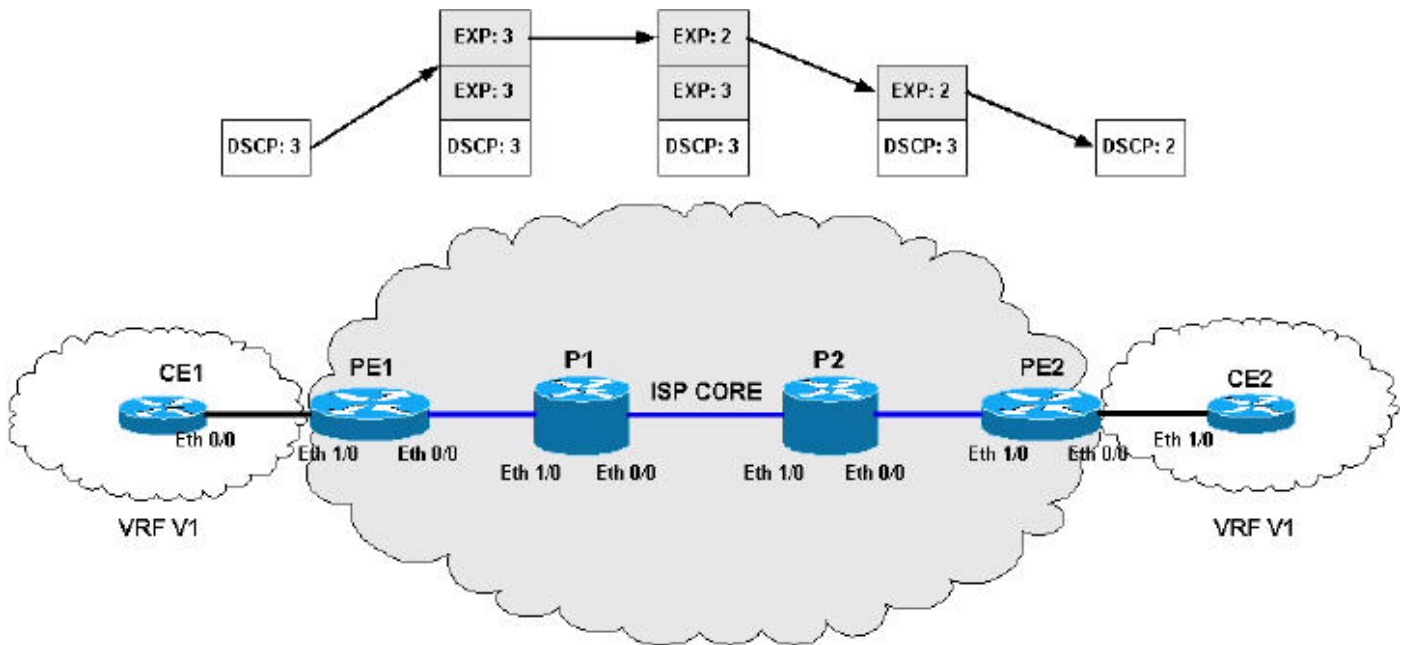
統一模式配置：

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
!
```
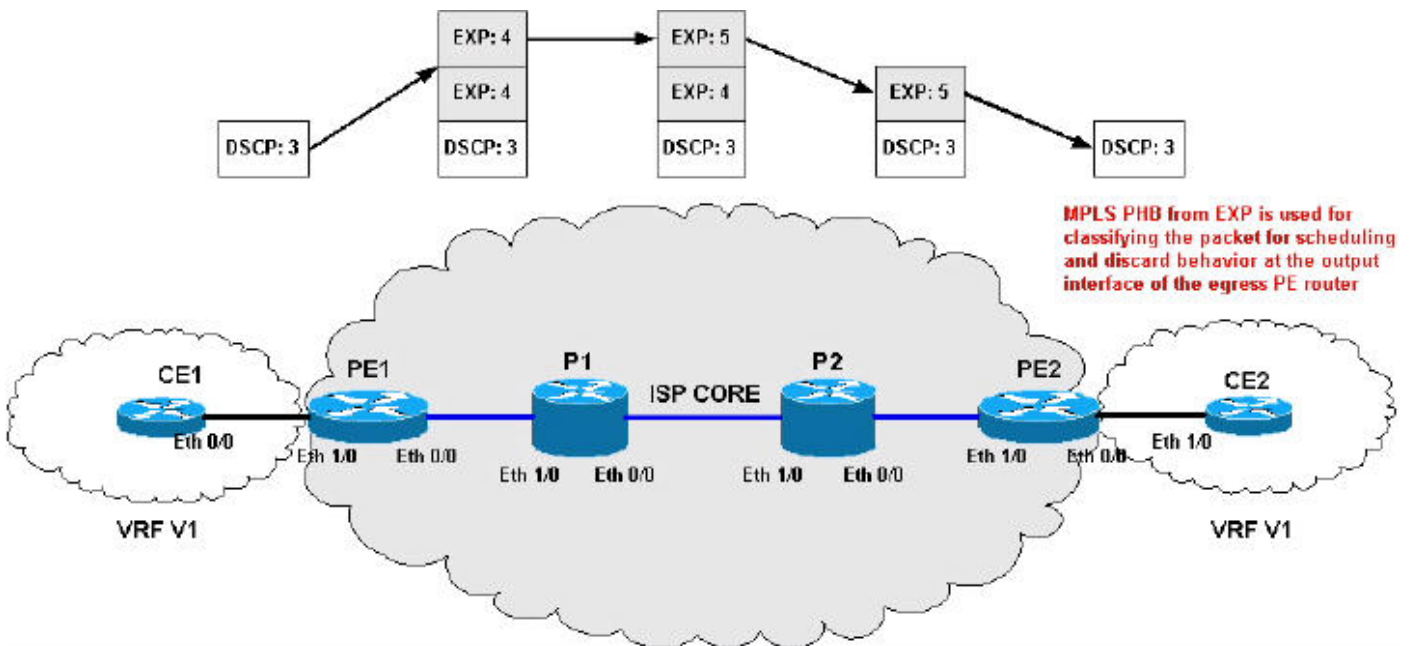
管道模式

Diffserv通道管道模式使用兩層QoS:

1. 資料的底層QoS，在遍歷核心時保持不變。
2. 每核心QoS，與基礎IP資料包的分隔。此按核心QoS PHB對終端使用者保持透明。

當資料包到達MPLS核心的邊緣時，輸出PE路由器(PE2)基於來自最近移除標籤的EXP位的MPLS PHB對新暴露的IP資料包進行出站隊列分類。

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
```
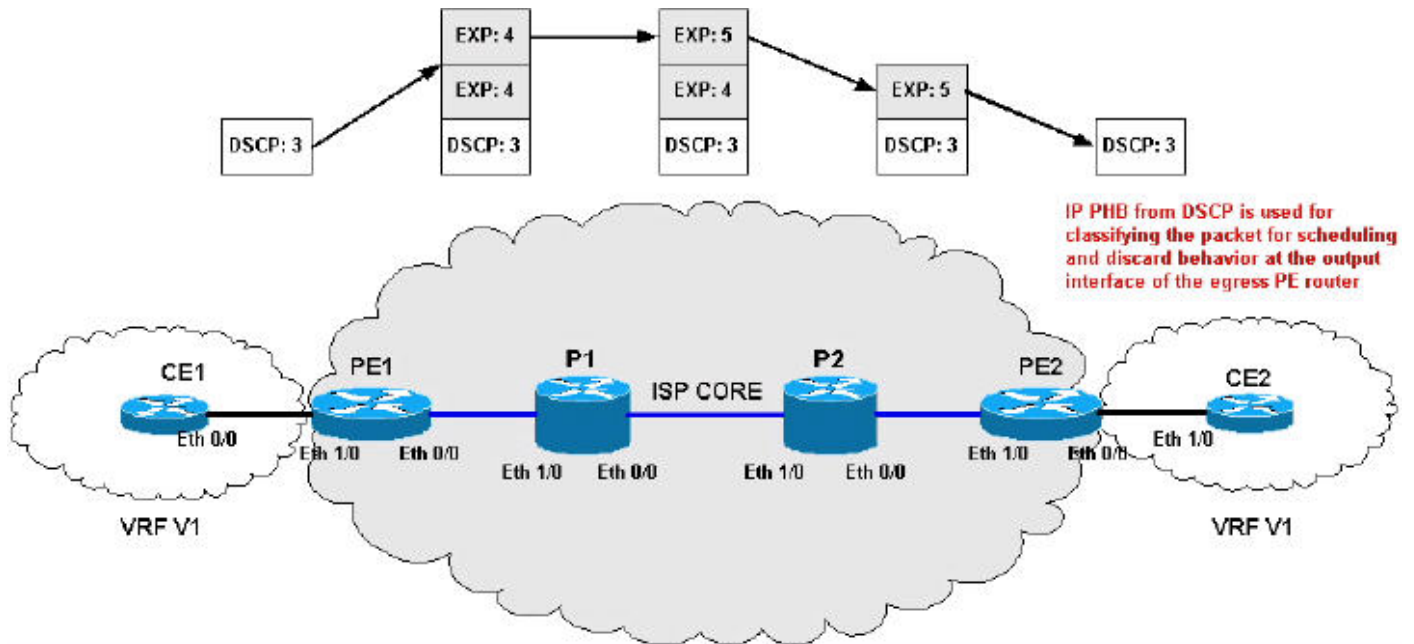
```
class-map match-all MPLS-AF21
  match mpls experimental topmost 2
class-map match-all MPLS-AF22
  match mpls experimental topmost 3
class-map match-all MPLS-AF31
  match mpls experimental topmost 4
class-map match-all MPLS-AF32
  match mpls experimental topmost 5
!
class-map match-all gold
  match 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

Diffserv隧道短管道模式在核心中使用相同的規則和技術。區別在於輸出PE路由器(PE2) — 您根據此IP資料包的DSCP值中的IP PHB對新公開的IP資料包進行出站隊列分類。

IP PHB from DSCP is used for classifying the packet for scheduling and discard behavior at the output interface of the egress PE router

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
!
```

通道模式摘要

下表總結了應用於網路中不同階段的IP或標籤資料包的各種操作：

通道模式	IP ->標籤	標籤 —>標籤	標籤 — > IP
統一	將IP Prec/DiffServ複製到MPLS EXP（也可由SP更改）	SP可能更改MPLS EXP	將MPLS EXP複製到 IP Prec/DiffServ
管道	由SP QoS策略設定的MPLS EXP		保留原始IP Prec/Diffserv（基於MPLS EXP的出口隊列）
短管道			保留原始IP Prec/Diffserv（在IP Prec/DiffServ中基於輸出佇列）

相關資訊

- Cisco IOS軟體 — MPLS
- 問與答 — 多協定標籤交換網路的服務品質
- Cisco IOS交換服務命令參考，版本12.2
- Cisco IOS服務品質解決方案組態設定指南12.2版
- Cisco IOS服務品質解決方案命令參考，版本12.2
- MPLS支援頁面
- QoS支援頁面
- 技術支援 - Cisco Systems