ASR1K中通過VRF感知的L2TPv3的Xconnect

目錄

簡介

本檔案介紹設定第2層通道通訊協定(L2TP)v3 Xconnect over IP和多重通訊協定標籤交換(MPLS)網路時，如何使用虛擬路由和轉送(VRF)。

背景資訊

L2TP是網際網路服務提供商(ISP)使用的通道通訊協定，用於在網際網路上的撥號存取空間中提供虛擬私人網路(VPN)。

它融合了思科的第2層轉送(L2F)協定和Microsoft的點對點隧道協定(PPTP)的優勢。 L2TP的主要元件是L2TP訪問控制器(LAC)和L2TP網路伺服器(LNS)。

L2TP訪問控制器：LAC是接入伺服器，連線到公共交換電話網(PSTN)。LAC是呼入呼叫的發起方和撥出呼叫的接收方。它通過LAN或WAN連線到LNS。

L2TP網路伺服器：LNS是L2TP協定的網路伺服器，在該協定中，PPP會話終止並經過身份驗證。LNS是傳出呼叫的發起者和傳入呼叫的接收者。

L2TPv2旨在通過IP網路傳輸PPP流量。網路接入裝置（DSL、電纜數據機或撥號接入介面）接受來自使用者的PPP連線，並通過L2TP將PPP會話隧道化到ISP。新版本L2TPv3設計為除了版本2支援的唯一負載PPP之外，還承載任何第2層負載。具體來說，L2TPv3定義了在IP核心網路上使用第2層VPN隧道化第2層負載的L2TP協定。此功能的優點包括：

- L2TPv3簡化了VPN的部署
- L2TPv3不需要MPLS
- 對於任何負載，L2TPv3支援通過IP的第2層隧道

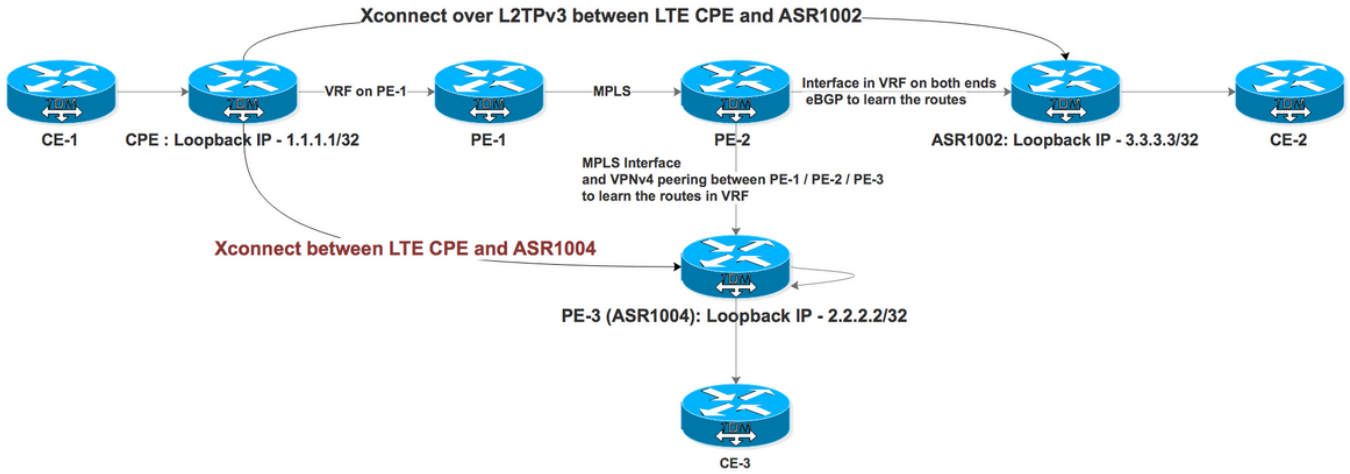
以下是L2TPv3偽線的配置示例：

1. enable
2. configure終端

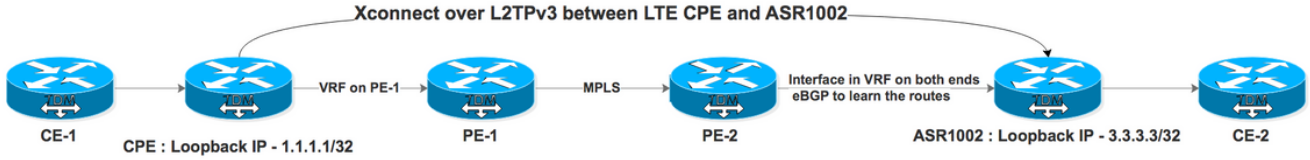
3. interface type slot/port

4. xconnectpeer-ip-address vcidencapsulation l2tpv3pw-classpw-class-name

現在我們來瞭解一下L2TPv3 Xconnect在使用VRF時的行為方式。此處是用來進行演示的拓撲，在該拓撲中，我們在CPE與ASR1002(IP)和ASR1004(MPLS)之間配置了Xconnect，在VRF中ASR1000具有終端（ASR1000平台不支援VRF感知L2TPv3）。



測試案例I:使用VRF中的端點的透過IP網路的L2TPv3 Xconnect



PE-1和PE-2構成了ISP的MPLS網路。CPE通過VRF連線到PE-1,ASR1002通過VRF連線到PE-2。ASR1002在連線到PE-2的介面上也具有VRF。從ASR1002到CPE環回的可達性是通過IP介面的VRF。

CPE上面向ASR1002的Xconnect配置：

```
interface FastEthernet4.2381

encapsulation dot1Q 2381

xconnect 3.3.3.3 2381 encapsulation l2tpv3 pw-class PSEUDO_CLASS >>>>>>>>>>> Xconnect with ASR1002


pseudowire-class PSEUDO_CLASS

encapsulation l2tpv3
```

```
interworking vlan
protocol l2tpv3 L2TP_CLASS
ip local interface Loopback0
ip tos reflect

l2tp-class L2TP_CLASS
authentication
password cisco

interface Gigabit0/1
ip address 192.168.8.190 255.255.255.0
end

Interface Loopback0
ip address 1.1.1.1 255.255.255.255
end

ip route 0.0.0.0 0.0.0.0 192.168.8.1 >>>>>>>>>>>>>> Default route towards PE-1
```

ASR1002上的工作配置：

```
interface GigabitEthernet0/0/0.906 ------------------> Interface connected to PE-2 is in VRF
encapsulation dot1Q 906
ip vrf forwarding L2TP_VRF
ip address 10.1.1.1 255.255.255.252

interface GigabitEthernet0/0/1.2381
encapsulation dot1Q 2381
xconnect 1.1.1.1 2381 encapsulation l2tpv3 pw-class PSEUDO_CLASS

pseudowire-class PSEUDO_CLASS
```

```
encapsulation l2tpv3

interworking vlan

protocol l2tpv3 L2TP_CLASS

ip local interface Loopback11



l2tp-class L2TP_CLASS

authentication

password cisco


interface Loopback11

ip vrf forwarding L2TP_VRF ------------------------------> Source is in VRF

ip address 3.3.3.3 255.255.255.255


router bgp 1


address-family ipv4 vrf L2TP_VRF

redistribute connected

neighbor 10.1.1.2 remote-as 2 ----------------> eBGP with PE-2 in VRF

neighbor 10.1.1.2 activate

neighbor 10.1.1.2 soft-reconfiguration inbound

exit-address-family
```

VRF L2TP_VRF:

```
B       1.1.1.1/32 [20/0] via 10.1.1.2, 1d ----------> Xconnect end point learned via eBGP in VRF
```

現在檢查CPE上Xconnect的狀態：

<#root>

```
CPE #sh xconnect all de
```

```
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down             AD=Admin Down      IA=Inactive
  SB=Standby  HS=Hot Standby      RV=Recovering      NH=No Hardware

XC ST  Segment 1                         S1 Segment 2                         S2
------+--------------------------------+--+--------------------------------+--

UP pri   ac Fa4.2381:2381(Eth VLAN)      UP l2tp 3.3.3.3:2381
DOWN

            Interworking: vlan                   Session ID: 1906980494
                                                 Tunnel ID: 2886222725
                                                Protocol State: DOWN
                                                Remote Circuit State: DOWN
                                                pw-class: PSEUDO_CLASS_VLAN
```

表示網段2已關閉，這意味著從CPE到ASR1002的路徑出現問題。但是，我們可以對終端執行ping。CPE上的調試顯示到終端的隧道失敗或沒有到終端的路由。

```
*Feb 15 08:12:47.225: L2TP _____:18136:8DF92CB9/uid:0[1.1.1.1/2381]: I CDN, flg TLS, ver 3, len 80
*Feb 15 08:12:47.225: L2TP _____:18136:8DF92CB9/uid:0[1.1.1.1/2381]:IETF v2:
*Feb 15 08:12:47.225: L2TP _____:18136:8DF92CB9/uid:0[1.1.1.1/2381]:Result Code
*Feb 15 08:12:47.225: L2TP _____:18136:8DF92CB9/uid:0[1.1.1.1/2381]:   Call disconnected for administra
*Feb 15 08:12:47.225: L2TP _____:18136:8DF92CB9/uid:0[1.1.1.1/2381]:   Error code
*Feb 15 08:12:47.225: L2TP _____:18136:8DF92CB9/uid:0[1.1.1.1/2381]:     No error(0)
*Feb 15 08:12:47.225: L2TP _____:18136:8DF92CB9/uid:0[1.1.1.1/2381]:   Optional msg
*Feb 15 08:12:47.225: L2TP _____:18136:8DF92CB9/uid:0[1.1.1.1/2381]:       "Tunnel failed to 3.3.3.3" >
*Feb 15 08:12:47.225: L2TP _____:18136:8DF92CB9/uid:0[1.1.1.1/2381]:Cisco v3:
```

這裡的主要問題是，終端可以通過ASR1002上的VRF訪問。Xconnect終端需要在全域性路由表中才

能啟動。現在，讓我們為指向介面GigabitEthernet0/0/0.906（自身在VRF中）的全域性中的CPE Loopback 1.1.1.1/32配置路由。

<#root>

```
 ip route 1.1.1.1 255.255.255.255 GigabitEthernet0/0/0.906 10.1.1.2


              S        1.1.1.1/32 [1/0] via 10.1.1.2, GigabitEthernet0/0/0.906
```

配置完虛擬靜態路由後，Xconnect便會啟動。您還可以將其指向Null0。這是一種解決方法，使路由器相信終端可以通過全域性訪問，而不是VRF，並且只用於控制平面。實際資料平面流量將僅通過VRF。

以下是使用VRF和不使用VRF的ping結果：

```
ASR1002 #ping 1.1.1.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:

.....

Success rate is 0 percent (0/5)


Ping vrf L2TP_VRF 1.1.1.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 1.1.1.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 33/50/72 ms
```

CPE上的Xconnect狀態：

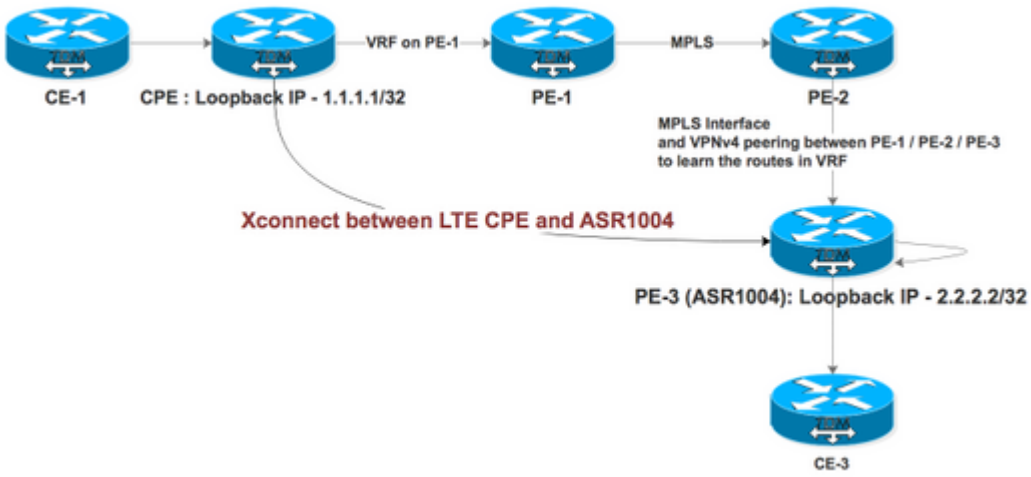
<#root>

```
CPE #sh xconnect all de

Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State

  UP=Up       DN=Down             AD=Admin Down      IA=Inactive

  SB=Standby  HS=Hot Standby      RV=Recovering      NH=No Hardware
```

```
XC ST  Segment 1                          S1 Segment 2                          S2
------+---------------------------------+--+---------------------------------+--

UP pri   ac Fa4.2381:2381(Eth VLAN)      UP l2tp3.3.3.3:2381
UP
```

```
            Interworking: vlan                  Session ID: 1906980494
                                                Tunnel ID: 2886222725
                                               Protocol State: UP
                                               Remote Circuit State: UP
                                               pw-class: PSEUDO_CLASS_VLAN
```

測試案例II:透過MPLS網路進行的L2TPv3 Xconnect，在VRF中具有端點



PE-1、PE-2和PE-3使ISP的MPLS網路充當PE-2充當路由反射器(RR)。CPE通過VRF連線到PE-1,ASR1004通過介面上啟用的MPLS連線到PE-2。ASR1004還具有VRF，其中應通過RR從PE-1接收VPNv4路由。ASR1004的CPE looback可達性通過MPLS介面上的VRF實現。

CPE上面向ASR1004的Xconnect配置：

```
interface FastEthernet4.2380
```

```
encapsulation dot1Q 2380
xconnect 2.2.2.2 2380 encapsulation l2tpv3 pw-class PSEUDO_CLASS  >>>>>>>>>>Xconnect with ASR1004

interface FastEthernet4.2381
encapsulation dot1Q 2381
xconnect 3.3.3.3 2381 encapsulation l2tpv3 pw-class PSEUDO_CLASS >>>>>>>>>>> Xconnect with ASR1002

pseudowire-class PSEUDO_CLASS
encapsulation l2tpv3
interworking vlan
protocol l2tpv3 L2TP_CLASS
ip local interface Loopback0
ip tos reflect

l2tp-class L2TP_CLASS
authentication
password cisco

interface Gigabit0/1
ip address 192.168.8.190 255.255.255.0
end

Interface Loopback0
ip address 1.1.1.1 255.255.255.255
end

ip route 0.0.0.0 0.0.0.0 192.168.8.1 >>>>>>>>>>>>>> Default route towards PE-1
```

ASR1004上的配置：

```
interface GigabitEthernet0/0/1
```

```
no ip address
negotiation auto
service instance 2 ethernet
encapsulation dot1q 2380
xconnect 1.1.1.1 2380 encapsulation l2tpv3 pw-class PSEUDO_CLASS_VLAN
!
end

interface Loopback11
ip vrf forwarding L2TP_VRF ------------------> Source Loopback in in VRF
ip address 2.2.2.2 255.255.255.255
end

pseudowire-class PSEUDO_CLASS_VLAN
encapsulation l2tpv3
interworking vlan
protocol l2tpv3 L2TP_CLASS
ip local interface Loopback11


l2tp-class L2TP_CLASS
authentication
password cisco

router bgp 2
address-family ipv4 vrf L2TP_VRF
redistribute connected
redistribute static
default-information originate
exit-address-family
```

Xconnect端點的路由條目：

<#root>

```
ASR1004#sh ip rou vrf L2TP_VRF 1.1.1.1 .   ------------------> Xconnect End Point also learned via VRF

Routing Table: L2TP_VRF
Routing entry for 1.1.1.1/32
 Known via "bgp 2", distance 200, metric 0, type internal
 Last update from 11.11.11.11 6d17h ago
 Routing Descriptor Blocks:
 * 11.11.11.11 (default), from 22.22.22.22, 6d17h ago
 Route metric is 0, traffic share count is 1
 AS Hops 0
 MPLS label: 18
 MPLS Flags: MPLS Required



We observed that Segment 2 was continuously flapping on both ends.



ASR1004#sh xc all de

Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State

  UP=Up       DN=Down            AD=Admin Down      IA=Inactive

  SB=Standby  HS=Hot Standby     RV=Recovering      NH=No Hardware


XC ST  Segment 1                         S1 Segment 2                         S2

------+--------------------------------+--+--------------------------------+--

DN pri   ac Gi0/0/1:2380(Eth VLAN)       UP l2tp 1.1.1.1:2380
DN

  >>>>>>>>>>>>>>

            Interworking: vlan                  Session ID: 2543426569

                                                Tunnel ID: 3352120314

                                                Protocol State: DOWN

                                                Remote Circuit State: DOWN

                                                pw-class: PSEUDO_CLASS_VLAN

ASR1004#sh xc all de

Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State

  UP=Up       DN=Down            AD=Admin Down      IA=Inactive

  SB=Standby  HS=Hot Standby     RV=Recovering      NH=No Hardware
```

```
XC ST  Segment 1                         S1 Segment 2                         S2
------+--------------------------------+--+--------------------------------+--
UP pri   ac Gi0/0/1:2380(Eth VLAN)       UP l2tp 1.1.1.1,1:2380
UP
 >>>>>>>>>>>>>>>>
            Interworking: vlan                   Session ID: 2543426569
                                                 Tunnel ID: 3352120314
                                                 Protocol State: UP
                                                 Remote Circuit State: UP
                                                 pw-class: PSEUDO_CLASS_VLAN
```

來自CPE的日誌：

```
<#root>
CPE#sh xconnect all de
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down             AD=Admin Down      IA=Inactive
  SB=Standby  HS=Hot Standby      RV=Recovering      NH=No Hardware

XC ST  Segment 1                         S1 Segment 2                         S2
------+--------------------------------+--+--------------------------------+--
DN pri   ac Fa4.2380:2380(Eth VLAN)      UP l2tp 2.2.2.2:2380            DN ---------------à Flapping w
            Interworking: vlan                   Session ID: 3434660693
                                                 Tunnel ID: 1760690853
                                                 Protocol State: DOWN
                                                 Remote Circuit State: DOWN
                                                 pw-class: PSEUDO_CLASS
UP pri   ac Fa4.2381:2381(Eth VLAN)      UP l2tp 3.3.3.3:2381              UP ---------------------à St
            Interworking: vlan                   Session ID: 1906980494
                                                 Tunnel ID: 2886222725
                                                 Protocol State: UP
```

```
                                                Remote Circuit State: UP

                                                pw-class: PSEUDO_CLASS


CPE#sh l2tp session


L2TP Session Information Total tunnels 2 sessions 2


LocID       RemID       TunID       Username, Intf/      State  Last Chg Uniq ID

                                    Vcid, Circuit

2714490989 3697021268 1760690853 2380, Fa4.2380:2380  est

00:00:03 0

  ---------> Flapping with ASR1004

1906980494 2361475239 2886222725 2381, Fa4.2381:2381  est

15:37:06 0

       ---------> Stable with ASR1002
```

在這種情況下，您不能配置靜態路由，因為送出介面是啟用MPLS的介面。作為解決方法，有兩個介面相互環回，並在VRF中配置一個介面，而在全域性中配置另一個介面。然後在全域性中配置指向VRF介面的靜態路由，從而使此Xconnect變得穩定。

```
ASR1004#sh run int gi0/0/2

Building configuration...


Current configuration : 95 bytes

!

interface GigabitEthernet0/0/2 -----------> Looped to Gi0/0/3

ip address 20.20.20.2 255.255.255.252

negotiation auto

end


#sh run int gi0/0/3

Building configuration...
```

```
Current configuration : 126 bytes
!
interface GigabitEthernet0/0/3
ip vrf forwarding L2TP_VRF
ip address 20.20.20.1 255.255.255.252
negotiation auto
end


ip route 10.246.131.62 255.255.255.255 20.20.20.1 -------> Static route pointing towards an IP interfac


CPE#sh xconnect all de
Legend:    XC ST=Xconnect State  S1=Segment1 State  S2=Segment2 State
  UP=Up       DN=Down             AD=Admin Down      IA=Inactive
  SB=Standby  HS=Hot Standby      RV=Recovering      NH=No Hardware

XC ST  Segment 1                         S1 Segment 2                          S2
------+---------------------------------+--+---------------------------------+--
DN pri   ac Fa4.2380:2380(Eth VLAN)      UP l2tp 2.2.2.2:2380            UP
            Interworking: vlan                   Session ID: 3434660693
                                                 Tunnel ID: 1760690853
                                                 Protocol State: DOWN
                                                 Remote Circuit State: DOWN
                                                 pw-class: PSEUDO_CLASS
UP pri   ac Fa4.2381:2381(Eth VLAN)      UP l2tp 3.3.3.3:2381              UP
            Interworking: vlan                   Session ID: 1906980494
                                                 Tunnel ID: 2886222725
                                                 Protocol State: UP
                                                 Remote Circuit State: UP
```

```
                                        pw-class: PSEUDO_CLASS


CPE#sh l2tp session
```

L2TP會話資訊總計隧道2會話2:

```
<#root>
LocID       RemID       TunID       Username, Intf/      State  Last Chg Uniq ID
                                    Vcid, Circuit
2714490989 3697021268 1760690853 2380, Fa4.2380:2380  est
00:20:03 0


1906980494 2361475239 2886222725 2381, Fa4.2381:2381  est
15:37:06 0
```

ASR1004的流量被視為這種情況：

- 當流量來自ASR1004上的CPE時，它進入MPLS介面Gi0/0/1，並直接交換到Gi0/0/0接入埠。
- 當流量來自接入埠Gi0/0/0時，它採用Gi0/0/0 -> Gi0/0/2 -> Gi0/0/3 -> Gi0/0/1的環路。

此解決方法的主要問題是由於資料包處理兩次而導致ASR1000平台上的QFP使用率：

```
ASR1004#  show platform packet-trace summary
Pkt   Input             Output            State  Reason
0     Gi0/0/3           Gi0/0/1           FWD
1     Gi0/0/3           Gi0/0/1           FWD
2     Gi0/0/3           Gi0/0/1           FWD
3     Gi0/0/0           Gi0/0/2           FWD
4     Gi0/0/0           Gi0/0/2           FWD
5     Gi0/0/0           Gi0/0/2           FWD
6     Gi0/0/0           Gi0/0/2           FWD
7     Gi0/0/0           Gi0/0/2           FWD
```

此行為記錄在Doc Bug中：CSCvi42964

關於此翻譯

思科已使用電腦和人工技術翻譯本文件，讓全世界的使用者能夠以自己的語言理解支援內容。請注意，即使是最佳機器翻譯，也不如專業譯者翻譯的內容準確。Cisco Systems, Inc. 對這些翻譯的準確度概不負責，並建議一律查看原始英文文件（提供連結）。