在IOS-XE上使用PIM-SM的組播服務反射：組播到單播

目錄

簡介

本文旨在通過配置實驗指南的形式讓您瞭解使用IOS-XE平台的MSR（組播服務複製）的基本工作。

必要條件

需求

對PIM-SM的基本理解

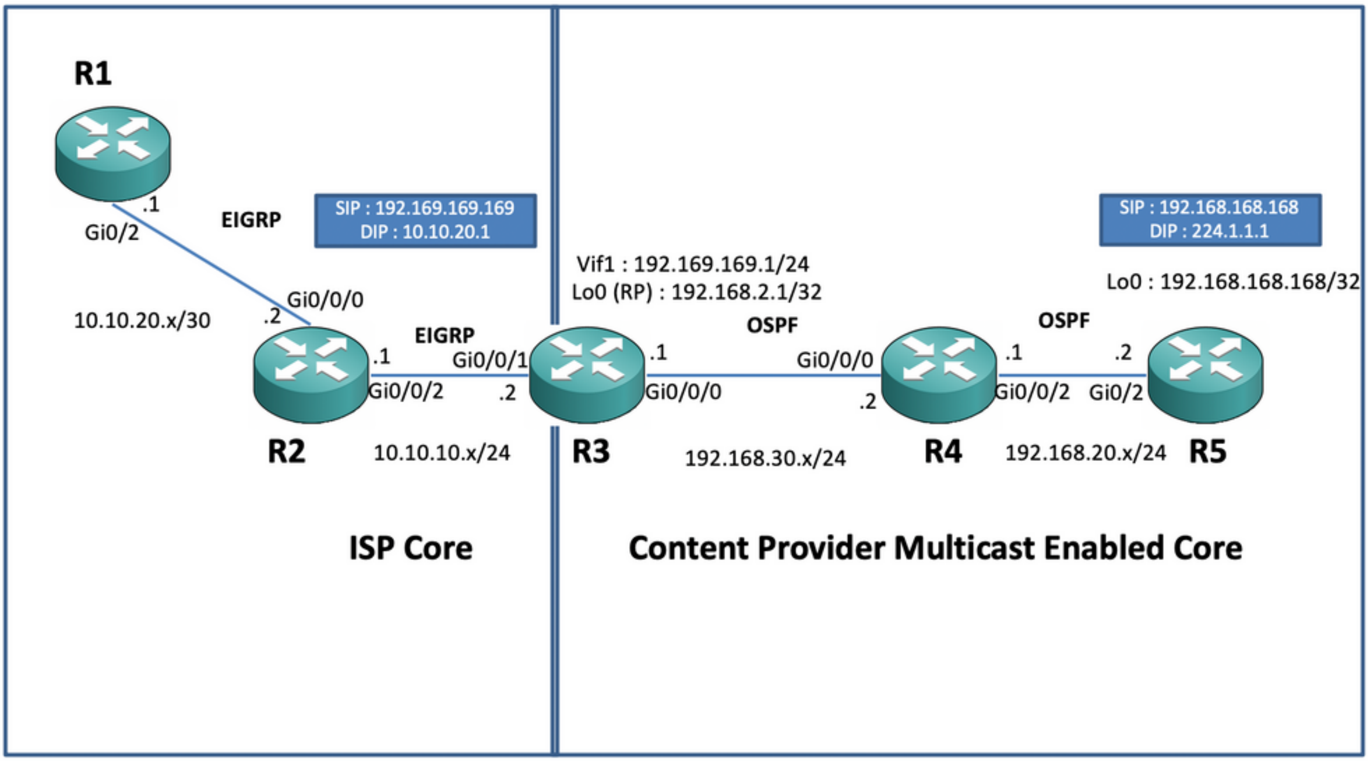
採用元件

ASR1000（R2和R4）、ISR4300(R3)、ISR2900（R1和R5）

設定

我們會根據以下用於傳輸組播的圖解方案顯示以下端到端配置。

網路圖表



組態

在上圖中，節點R1充當接收器，該接收器應該只從組播源獲取單播組播資料饋送。

節點R5充當組播源，生成源自loopback 0介面的組播ICMP流量。

節點R2位於內容提供商組播核心域下，運行有OSPF底層的PIM-SM。

節點R3充當運行組播服務複製應用的路由器，在本例中是組播邊界路由器，組播資料流量應該從此點轉換為單播資料包傳送到接收器。它分別使用內容提供商和ISP的OSPF和EIGRP，並將RP（Rendezvouz點）放在組播核心域中的環回介面上。

節點R4受ISP核心控制，未啟用組播，僅知道如何使用底層EIGRP路由到達R3節點。

在下面，您可以找到上述拓撲圖中顯示的節點上的相關配置：

R1:

```
! no ip domain lookup ip cef no ipv6 cef ! interface GigabitEthernet0/2 ip address 10.10.20.1 255.255.255.0 duplex auto speed auto end ! router eigrp 100 network 10.10.20.0 0.0.0.255 !
```

R2：

```
! interface GigabitEthernet0/0/0 ip address 10.10.20.2 255.255.255.0 negotiation auto ! interface GigabitEthernet0/0/2 ip address 10.10.10.1 255.255.255.0 negotiation auto ! router eigrp 100 network 10.10.10.0 0.0.0.255 network 10.10.20.0 0.0.0.255 !
```

R3:

```
! ip multicast-routing distributed ! interface Loopback0 ip address 192.168.2.1 255.255.255.255 ip pim sparse-mode ip ospf 1 area 0 ! interface GigabitEthernet0/0/0 ip address 192.168.30.1
```

```
255.255.255.0 ip pim sparse-mode ip ospf 1 area 0 negotiation auto ! interface GigabitEthernet0/0/1 ip address 10.10.10.2 255.255.255.0 negotiation auto ! interface Vif1 ip address 192.169.169.1 255.255.255.0 ip pim sparse-mode ip service reflect GigabitEthernet0/0/0 destination 224.1.1.0 to 10.10.20.0 mask-len 24 source 192.169.169.169 <<<< ip igmp static-group 224.1.1.1 ip ospf 1 area 0 ! router eigrp 100 network 10.10.10.0 0.0.0.255 ! router ospf 1 ! ip pim rp-address 192.168.2.1 !
```

R4:

```
! ip multicast-routing distributed ! interface GigabitEthernet0/0/0 ip address 192.168.30.2 255.255.255.0 ip pim sparse-mode ip ospf 1 area 0 negotiation auto ! interface GigabitEthernet0/0/2 ip address 192.168.20.1 255.255.255.0 ip pim sparse-mode ip ospf 1 area 0 negotiation auto ! router ospf 1 ! ip pim rp-address 192.168.2.1 !
```

R5:

```
! ip multicast-routing ip cef no ipv6 cef ! interface Loopback0 ip address 192.168.168.168 255.255.255.255 ip pim sparse-mode ip ospf 1 area 0 ! interface GigabitEthernet0/2 ip address 192.168.20.2 255.255.255.0 ip pim sparse-mode ip ospf 1 area 0 duplex auto speed auto ! router ospf 1 ! ip pim rp-address 192.168.2.1 !
```

驗證

我們可以執行測試ping來模擬來自R5路由器的組播流量，該路由器的loopback 0介面的源[192.168.168.168]以組播地址224.1.1.1為目的地。然後檢查運行MSR應用程式的節點上的mroute條目，即R3：

```
R5(config)#do ping 224.1.1.1 sou lo 0 rep 10000000 Type escape sequence to abort. Sending 10000000, 100-byte ICMP Echos to 224.1.1.1, timeout is 2 seconds: Packet sent with a source address of 192.168.168.168 ............................
```

```
R3#sh ip mroute 224.1.1.1 IP Multicast Routing Table Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected, L - Local, P - Pruned, R - RP-bit set, F - Register flag, T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet, X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement, U - URD, I - Received Source Specific Host Report, Z - Multicast Tunnel, z - MDT-data group sender, Y - Joined MDT-data group, y - Sending to MDT-data group, G - Received BGP C-Mroute, g - Sent BGP C-Mroute, N - Received BGP Shared-Tree Prune, n - BGP C-Mroute suppressed, Q - Received BGP S-A Route, q - Sent BGP S-A Route, V - RD & Vector, v - Vector, p - PIM Joins on route, x - VxLAN group, c - PFP-SA cache created entry Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join Timers: Uptime/Expires Interface state: Interface, Next-Hop or VCD, State/Mode (*, 224.1.1.1), 00:47:41/stopped, RP 192.168.2.1, flags: SJC Incoming interface: Null, RPF nbr 0.0.0.0 Outgoing interface list: Vif1, Forward/Sparse, 00:46:36/00:01:23 <<<< (192.168.168.168, 224.1.1.1), 00:00:20/00:02:43, flags: T Incoming interface: GigabitEthernet0/0/0, RPF nbr 192.168.30.2 Outgoing interface list: Vif1, Forward/Sparse, 00:00:20/00:02:39 <<<<
```

```
R3#sh ip mroute 224.1.1.1 count Use "show ip mfib count" to get better response time for a large number of mroutes. IP Multicast Statistics 3 routes using 2938 bytes of memory 2 groups, 0.50 average sources per group Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second Other counts: Total/RPF failed/Other drops(OIF-null, rate-limit etc) Group: 224.1.1.1, Source count: 1, Packets forwarded: 1455, Packets received: 1458 <<<< RP-tree: Forwarding: 1/0/100/0, Other: 1/0/0 Source: 192.168.168.168/32, Forwarding: 1454/1/113/0, Other: 1457/3/0 R3#sh ip mroute 224.1.1.1 count Use "show ip mfib count" to get better response time for a large number of mroutes. IP Multicast Statistics 3 routes using 2938 bytes of memory 2 groups, 0.50 average sources per group Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second Other counts: Total/RPF failed/Other drops(OIF-null, rate-limit etc) Group: 224.1.1.1, Source count: 1, Packets forwarded: 1465, Packets received: 1468 <<<< RP-tree: Forwarding: 1/0/100/0, Other: 1/0/0 Source: 192.168.168.168/32, Forwarding: 1464/1/113/0, Other: 1467/3/0
```

此外，您還可以在IOS-XE路由器上使用EPC（嵌入式資料包捕獲）功能，獲取捕獲，以驗證資料包

是否確實被轉換為R2節點上的目標單播目標地址：

```
R2#mon cap TAC int gi 0/0/2 both match any R2#mon cap TAC buff siz 50 circular R2#mon cap TAC start Started capture point : TAC R2# *Aug 12 06:50:40.195: %BUFCAP-6-ENABLE: Capture Point TAC enabled. R2#sh mon cap TAC buff br | i ICMP 6 114 10.684022 192.169.169.169 -> 10.10.20.1 0 BE ICMP <<<< 7 114 10.684022 192.169.169.169 -> 10.10.20.1 0 BE ICMP <<<< 8 114 12.683015 192.169.169.169 -> 10.10.20.1 0 BE ICMP <<<< 9 114 12.683015 192.169.169.169 -> 10.10.20.1 0 BE ICMP <<<<
```

這裡需要注意的重要一點是，通常當您在「實驗室環境」中執行多點傳送ICMP ping時，會預期您從接收端傳回封包至來源，假設兩者（來源和接收器）之間完全可連線。 但是，在此場景中，必須注意的是，即使我們嘗試為組播ICMP資料包（即192.169.169.169）一直通告NATted源地址，直到接收方（即R1）通過EIGRP，單播ICMP回應仍然不會通過R3路由器，因為MSR應用節點上未配置反向NAT。我們可以通過嘗試將R3上Vif 1介面的EIGRP路由通告傳送到EIGRP（ISP核心路由）來測試這一點：

```
ISR4351(config)#router eigrp 100 ISR4351(config-router)#network 192.169.169.0 0.0.0.255 <<<<
```

現在，我們可以檢查向R3傳送的ICMP回應應答中R2節點上捕獲的捕獲：

```
R2#sh mon cap TAC buff br | i ICMP
```

但是ping仍會失敗，如源R5所示：

```
R5(config)#do ping 224.1.1.1 sou lo 0 rep 10000000 Type escape sequence to abort. Sending 10000000, 100-byte ICMP Echos to 224.1.1.1, timeout is 2 seconds: Packet sent with a source address of 192.168.168.168
......................................................................
......................................................................
```

現在，為了讓應答一直到達源地址，我們可以在MSR應用節點R3上配置NAT埠轉發，通過配置可擴展的NAT，將目的地流量轉換為192.169.169.169到192.168.168.168:

```
R3(config)#int gi 0/0/1 R3(config-if)#ip nat out R3(config-if)#int gi 0/0/0 R3(config-if)#ip nat ins R3(config-if)#exit R3(config)#ip nat inside source static 192.168.168.168 192.169.169.169 extendable <<<<
```

現在檢查源R5節點後，我們可以看到響應返回：

```
R5(config)#do ping 224.1.1.1 sou lo 0 rep 10000000 Type escape sequence to abort. Sending 10000000, 100-byte ICMP Echos to 224.1.1.1, timeout is 2 seconds: Packet sent with a source address of 192.168.168.168
......................................................................
```

以上內容僅用於解釋資料包流，並瞭解如何為資料流量和下游組播流量建立反向單播路徑/流。因為在常規生產方案中，您通常不會遇到在伺服器/源端運行的多播應用程式要求從接收器以單播形式傳送反向確認資料包的情況/例項。

通過上述測試和驗證，它應該簡要概述如何在一個組播邊界節點上運行組播服務複製應用程式，以及如何部署上面所示的相同程式以擴展為大規模部署。