# 排除DMVPN第2階段分支到分支隧道故障

## 目錄



## 簡介

本文檔介紹如何在階段2分支到分支DMVPN隧道未建立時對其進行故障排除。

## 必要條件

### 需求

思科建議您具備以下主題的知識：

- 動態多點虛擬私人網路(DMVPN)
- IKE/IPSEC通訊協定
- 下一個躍點解析通訊協定(NHRP)

### 採用元件

本檔案以下列軟體版本為基礎：

- 思科CSR1000V (VXE) -版本17.03.08

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。如果您的網路運作中，請確保您瞭解任何指令可能造成的影響。

## 背景資訊

本文檔介紹如何針對常見的DMVPN問題配置和使用不同的故障排除工具。 問題在於第2階段DMVPN通道的協商失敗，在該階段，源分支，DMVPN狀態顯示為與目標分支的正確非廣播多路訪問(NBMA)/隧道對映。但是，在目標分支上顯示的對映不正確。

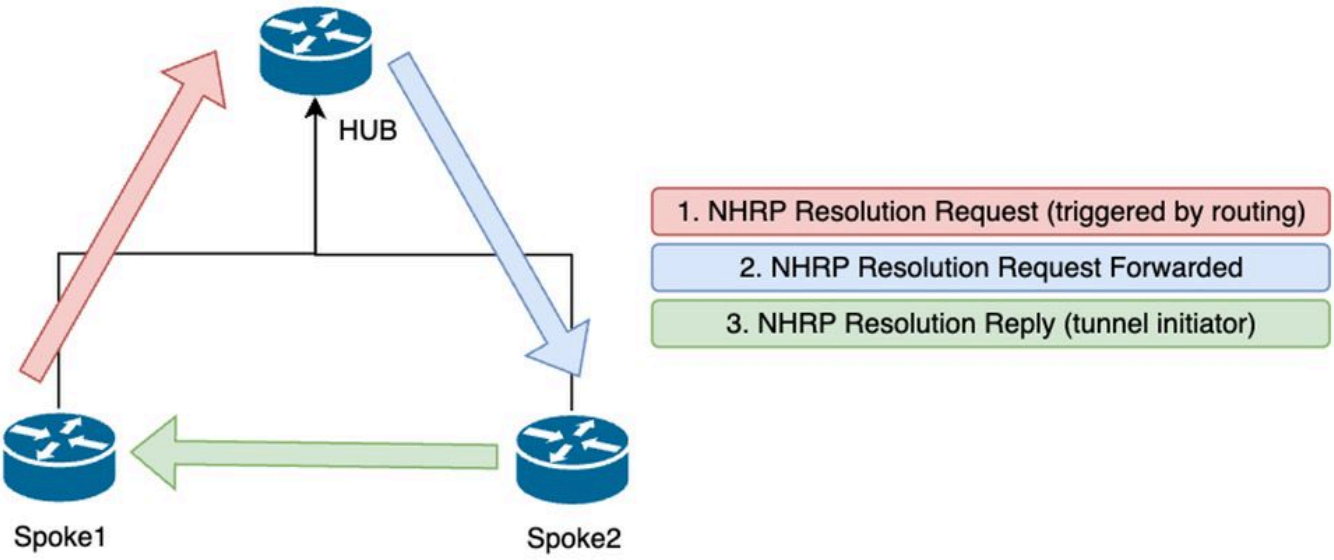
## 理論背景

在設定DMVPN第2階段時，必須瞭解分支到分支隧道的建立方式。本節簡要概述此階段的NHRP過程。

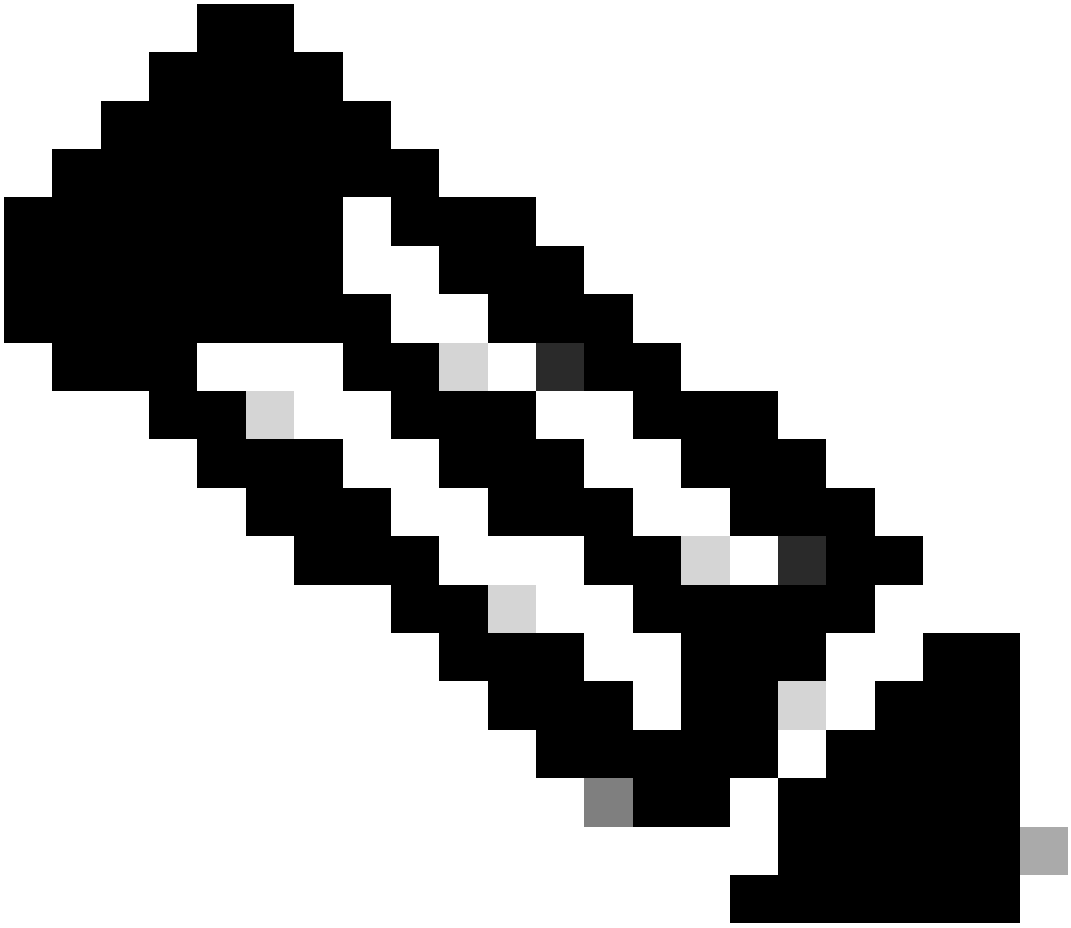
在DMVPN第2階段，您可以根據需要構建動態分支到分支隧道。 這是因為在DMVPN雲（集線器和分支）內的所有裝置上，隧道介面的模式更改為通用路由封裝(GRE)多點。此階段的一個關鍵特徵是，其他裝置不會將集線器視為下一跳。反之，所有輻條都擁有彼此的路由資訊。 在第2階段中建立分支到分支隧道時，會觸發NHRP進程，分支會獲取有關其他分支的資訊，並在NBMA和隧道IP地址之間進行對映。

以下步驟列出了NHRP解析過程的觸發方式：

1. 當源分支嘗試到達目標分支的LAN時，它會執行路由查詢並觸發解析請求消息，以獲取目標分支的NBMA地址。源分支將此初始消息傳送到中心。
2. 中心路由器接收解析請求並將其轉發到目標分支。
3. 目標分支向源分支傳送解析回覆。如果隧道配置連結了IPSEC配置檔案：
    - NHRP解析過程被延遲到IKE/IPSEC協定可以建立為止。
    - 目標分支發起並建立IKE/IPSEC隧道。
    - 然後，NHRP進程將恢復，並且目標分支使用IPSEC隧道作為傳輸方法向源分支傳送解析應答。



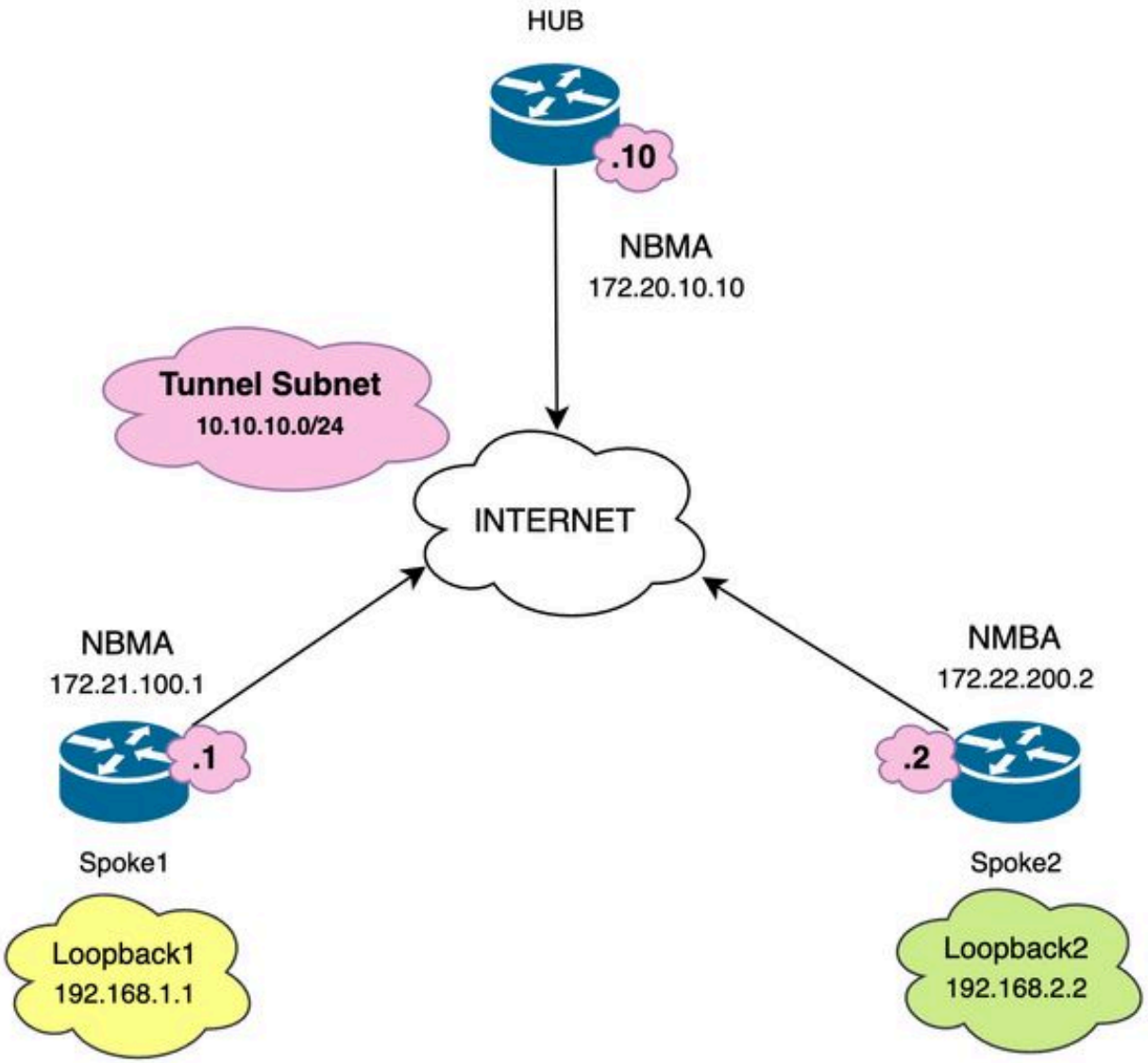

第2階段分支之間的NHRP消息流



注意：必須先在HUB中註冊所有分支，才能開始解析過程。

## 拓撲

此圖顯示案例所使用的拓撲：




使用的網路圖和IP子網

# 疑難排解步驟

在此場景中，未建立Spoke1和Spoke2之間的分支到分支隧道，這會影響其本地資源（由環回介面表示）之間的通訊，因為它們無法相互通訊。

```
SPOKE1#ping 192.168.2.2 source loopback1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.2, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
```

## 初始驗證

遇到這種情況時，首先驗證隧道配置並確保兩台裝置具有正確的值非常重要。要檢視隧道配置，請運行命令show running-config interface tunnel<ID>。

分支1隧道配置：

<#root>

```
SPOKE1#show running-config interface tunnel10
Building configuration...

Current configuration : 341 bytes
!
interface Tunnel10
ip address 10.10.10.1 255.255.255.0
no ip redirects
ip nhrp authentication DMVPN


ip nhrp map 10.10.10.10 172.20.10.10


ip nhrp map multicast 172.20.10.10


ip nhrp network-id 10
ip nhrp nhs 10.10.10.10


tunnel source GigabitEthernet1
tunnel mode gre multipoint


tunnel protection IPSEC profile IPSEC_Profile_1


end
```

分支2隧道配置：

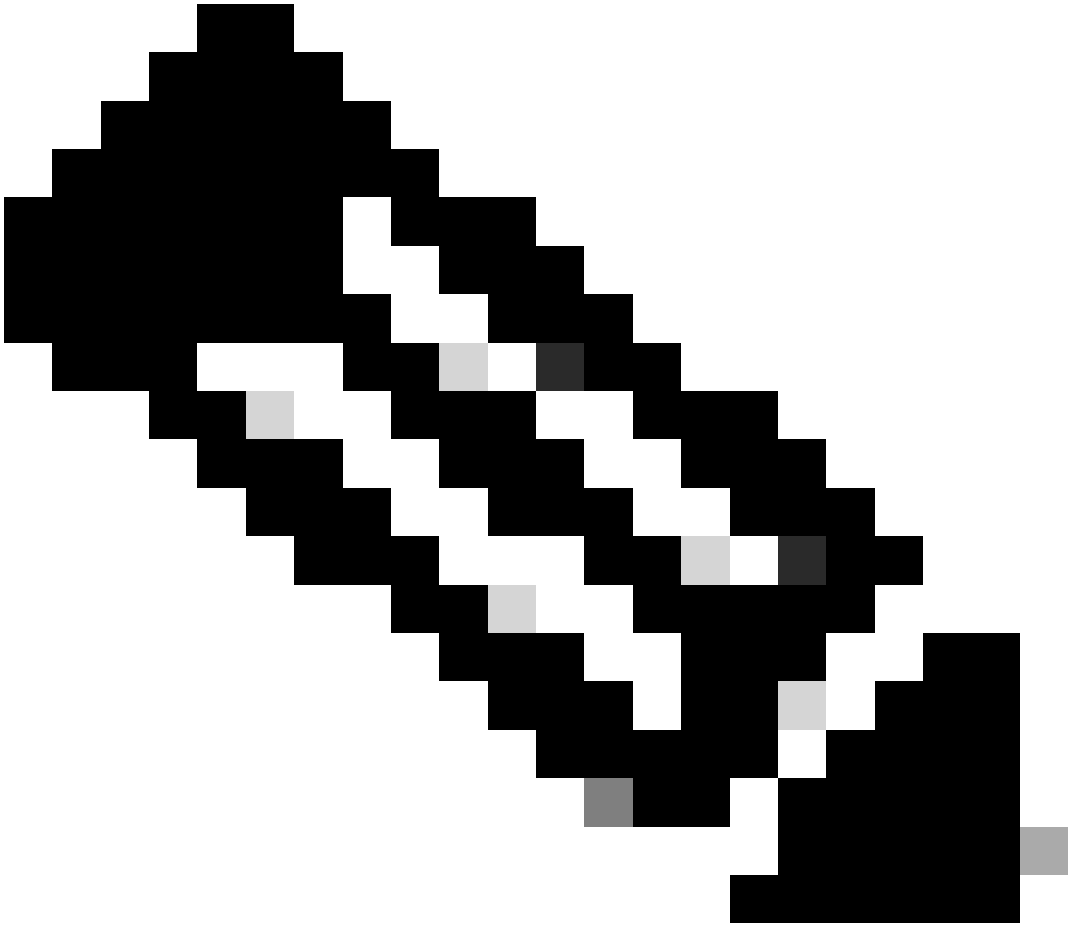
<#root>

```
SPOKE2#show running-config interface tunnel10
Building configuration...

Current configuration : 341 bytes
!
interface Tunnel10
ip address 10.10.10.2 255.255.255.0
no ip redirects
ip nhrp authentication DMVPN
```

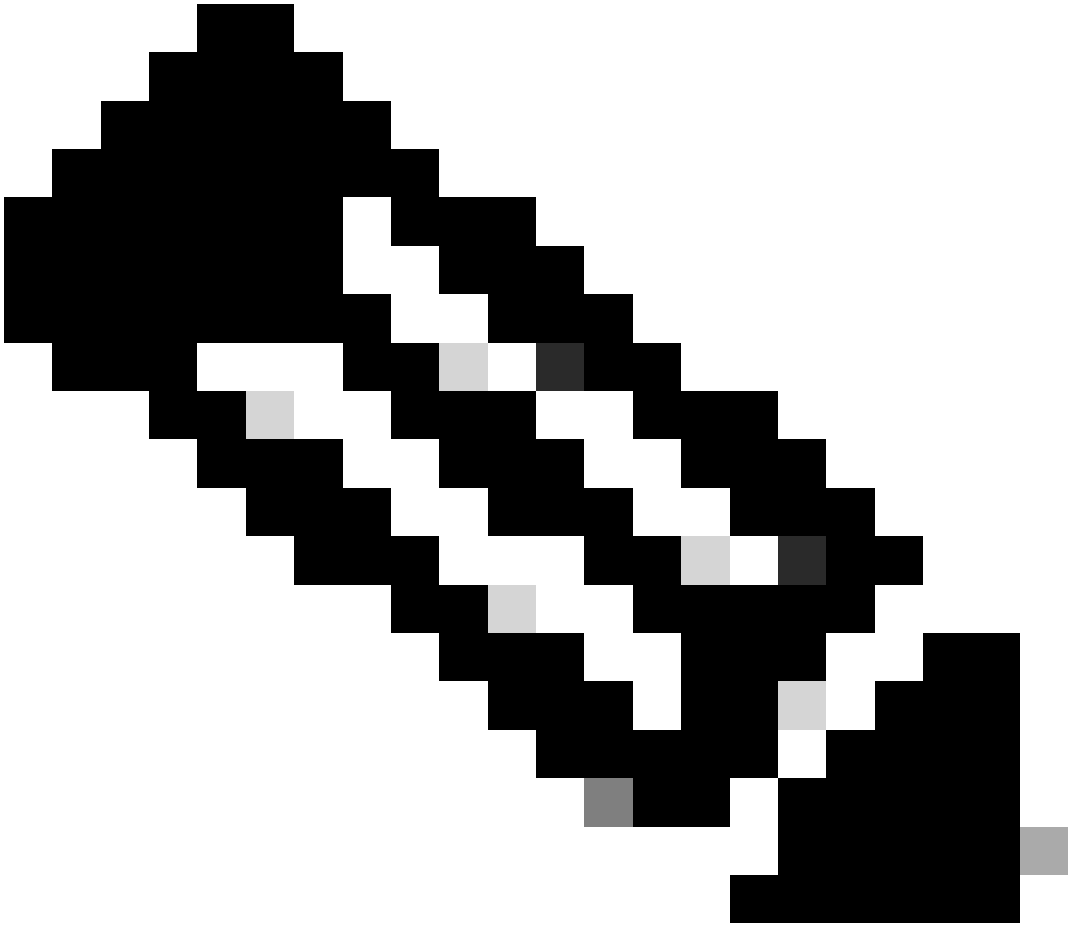
```
ip nhrp map 10.10.10.10 172.20.10.10


ip nhrp map multicast 172.20.10.10

ip nhrp network-id 10
ip nhrp nhs 10.10.10.10

tunnel source GigabitEthernet1
tunnel mode gre multipoint


tunnel protection IPSEC profile IPSEC_Profile_1

end
```

在配置上，您需要驗證到HUB的對映是否正確，裝置之間的NHRP身份驗證字串是否匹配，兩個分支配置了相同的DMVPN階段，如果使用IPSEC保護，請驗證應用了正確的加密配置。

如果配置正確並且包括IPSEC保護，則需要驗證IKE和IPSEC協定是否正常工作。這是因為NHRP使用IPSEC通道作為傳輸方法來完全協商。要驗證IKE/IPSEC協定的狀態，請運行命令show crypto IPSEC sa peer x.x.x.x（其中x.x.x.x是您要嘗試用來建立隧道的分支的NBMA IP地址）。



注意：要驗證IPSEC隧道是否已啟用，入站和出站封裝安全負載(ESP)部分必須具有隧道資訊（SPI、轉換集等）。此部分中顯示的所有值在兩端都必須匹配。



注意：如果確定存在IKE/IPSEC的任何問題，則故障排除必須集中在這些協定。

---

Spoke1上的IKE/IPSEC通道狀態：

<#root>

SPOKE1#

**show crypto IPSEC sa peer 172.22.200.2**

```
interface: Tunnel10
Crypto map tag: Tunnel10-head-0, local addr 172.21.100.1

protected vrf: (none)
local ident (addr/mask/prot/port): (172.21.100.1/255.255.255.255/47/0)
remote ident (addr/mask/prot/port): (172.22.200.2/255.255.255.255/47/0)
current_peer 172.22.200.2 port 500
PERMIT, flags={origin_is_acl,}
```

**#pkts encaps: 0, #pkts encrypt: 0, #pkts digest: 0**

**#pkts decaps: 0, #pkts decrypt: 0, #pkts verify: 0**

#pkts compressed: 0, #pkts decompressed: 0
#pkts not compressed: 0, #pkts compr. failed: 0
#pkts not decompressed: 0, #pkts decompress failed: 0
#send errors 0, #recv errors 0

local crypto endpt.: 172.21.100.1, remote crypto endpt.: 172.22.200.2
plaintext mtu 1458, path mtu 1500, ip mtu 1500, ip mtu idb GigabitEthernet1
current outbound spi: 0x6F6BF94A(1869347146)
PFS (Y/N): N, DH group: none

**inbound esp sas:**

**spi: 0x84502A19(2219846169)**

**transform: esp-256-aes esp-sha256-hmac**

 ,
in use settings ={Transport, }
conn id: 2049, flow_id: CSR:49, sibling_flags FFFFFFFF80000008, crypto map: Tunnel10-head-0
sa timing: remaining key lifetime (k/sec): (4608000/28716)
IV size: 16 bytes
replay detection support: Y
Status: ACTIVE(ACTIVE)

inbound ah sas:

inbound pcp sas:

**outbound esp sas:**

**spi: 0x6F6BF94A(1869347146)**

**transform: esp-256-aes esp-sha256-hmac**

 ,
in use settings ={Transport, }
conn id: 2050, flow_id: CSR:50, sibling_flags FFFFFFFF80000008, crypto map: Tunnel10-head-0
sa timing: remaining key lifetime (k/sec): (4608000/28716)
IV size: 16 bytes
replay detection support: Y
Status: ACTIVE(ACTIVE)

outbound ah sas:

outbound pcp sas:

Spoke2上的IKE/IPSEC通道狀態：

<#root>

SPOKE2#

**show crypto IPSEC sa peer 172.21.100.1**

interface: Tunnel10
Crypto map tag: Tunnel10-head-0, local addr 172.22.200.2

protected vrf: (none)
local ident (addr/mask/prot/port): (172.22.200.2/255.255.255.255/47/0)
remote ident (addr/mask/prot/port): (172.21.100.1/255.255.255.255/47/0)
current_peer 172.21.100.1 port 500
PERMIT, flags={origin_is_acl,}

**#pkts encaps: 16, #pkts encrypt: 16, #pkts digest: 16**

**#pkts decaps: 0, #pkts decrypt: 0, #pkts verify: 0**

#pkts compressed: 0, #pkts decompressed: 0
#pkts not compressed: 0, #pkts compr. failed: 0
#pkts not decompressed: 0, #pkts decompress failed: 0
#send errors 0, #recv errors 0

local crypto endpt.: 172.22.200.2, remote crypto endpt.: 172.21.100.1
plaintext mtu 1458, path mtu 1500, ip mtu 1500, ip mtu idb GigabitEthernet1
current outbound spi: 0x84502A19(2219846169)
PFS (Y/N): N, DH group: none

**inbound esp sas:**

**spi: 0x6F6BF94A(1869347146)**

**transform: esp-256-aes esp-sha256-hmac ,**

in use settings ={Transport, }
conn id: 2045, flow_id: CSR:45, sibling_flags FFFFFFFF80004008, crypto map: Tunnel10-head-0
sa timing: remaining key lifetime (k/sec): (4608000/28523)
IV size: 16 bytes
replay detection support: Y
Status: ACTIVE(ACTIVE)

inbound ah sas:

inbound pcp sas:

**outbound esp sas:**

```
spi: 0x84502A19(2219846169)


transform: esp-256-aes esp-sha256-hmac

 ,
in use settings ={Transport, }
conn id: 2046, flow_id: CSR:46, sibling_flags FFFFFFFF80004008, crypto map: Tunnel10-head-0
sa timing: remaining key lifetime (k/sec): (4607998/28523)
IV size: 16 bytes
replay detection support: Y
Status: ACTIVE(ACTIVE)

outbound ah sas:

outbound pcp sas:
```

輸出顯示兩個分支上的IPSEC隧道均啟用，但Spoke2顯示加密資料包（封裝）但沒有解密資料包（解密）。同時，Spoke1不會顯示流經IPSEC隧道的任何資料包。這表明問題可能出在NHRP協定上。

## 疑難排解工具

執行初始驗證並確認配置和IKE/IPSEC協定（如果需要）未導致通訊問題後，您可以使用本節中提供的工具繼續故障排除。

有用的命令

命令show dmvpn interface tunnel<ID>提供DMVPN特定會話資訊(NBMA/隧道IP地址、隧道狀態、打開/關閉時間和屬性)。可以使用detail關鍵字顯示加密會話/套接字的詳細資訊。必須強調的是，兩端的隧道狀態必須匹配。

分支1 show dmvpn interface tunnel<ID>輸出：

```
<#root>

SPOKE1#

show dmvpn interface tunnel10


Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
N - NATed, L - Local, X - No Socket
T1 - Route Installed, T2 - Nexthop-override, B - BGP
C - CTS Capable, I2 - Temporary
# Ent --> Number of NHRP entries with same NBMA peer
NHS Status: E --> Expecting Replies, R --> Responding, W --> Waiting
UpDn Time --> Up or Down Time for a Tunnel
==========================================================================

Interface: Tunnel10, IPv4 NHRP Details
Type:Spoke, NHRP Peers:1,

# Ent Peer NBMA Addr Peer Tunnel Add  State UpDn Tm  Attrb
```

```
----- --------------- --------------- ----- -------- -----
   2

172.20.10.10     10.10.10.2      UP  00:00:51  I2

                        10.10.10.10     UP  02:53:27  S
```

分支2 show dmvpn interface tunnel<ID> 輸出：

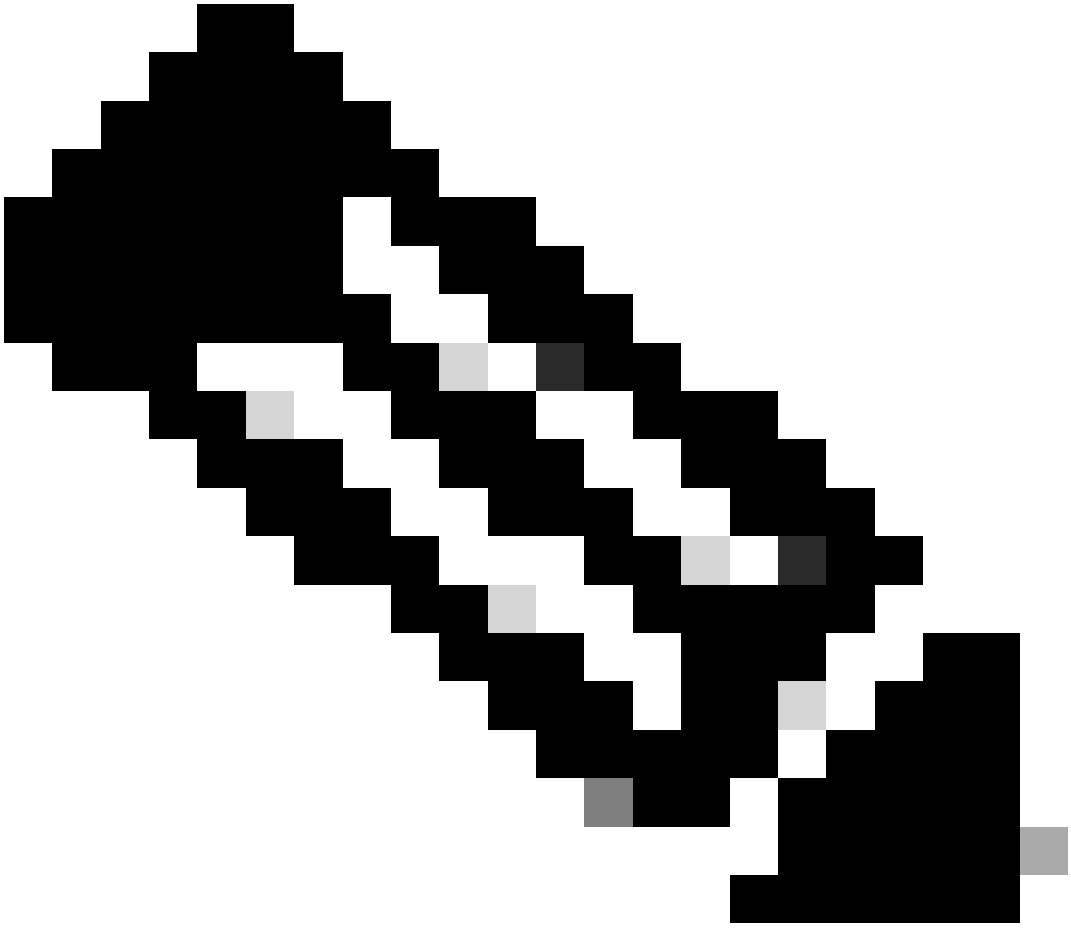
<#root>

```
SPOKE2#

show dmvpn interface tunnel10


Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
N - NATed, L - Local, X - No Socket
T1 - Route Installed, T2 - Nexthop-override, B - BGP
C - CTS Capable, I2 - Temporary
# Ent --> Number of NHRP entries with same NBMA peer
NHS Status: E --> Expecting Replies, R --> Responding, W --> Waiting
UpDn Time --> Up or Down Time for a Tunnel
==========================================================================

Interface: Tunnel10, IPv4 NHRP Details
Type:Spoke, NHRP Peers:2,

# Ent Peer NBMA Addr Peer Tunnel Add State UpDn Tm Attrb
----- --------------- --------------- ----- -------- -----


1    172.21.100.1     10.10.10.1     UP  00:03:53   D


  1    172.20.10.10     10.10.10.10    UP  02:59:14   S
```

每個裝置上的輸出顯示每個分支的不同資訊。在Spoke1表中，您可以看到Spoke 2的條目不包含正確的NBMA IP地址，並且屬性顯示為不完整(I2)。另一方面，Spoke2表顯示正確的對映（NBMA/隧道IP地址）和狀態為up，表示隧道已完全協商。

在故障排除過程中，以下命令很有幫助：

- show ip nhrp：顯示NHRP對映資訊
- show ip nhrp traffic interface tunnel10：顯示NHRP流量統計資訊



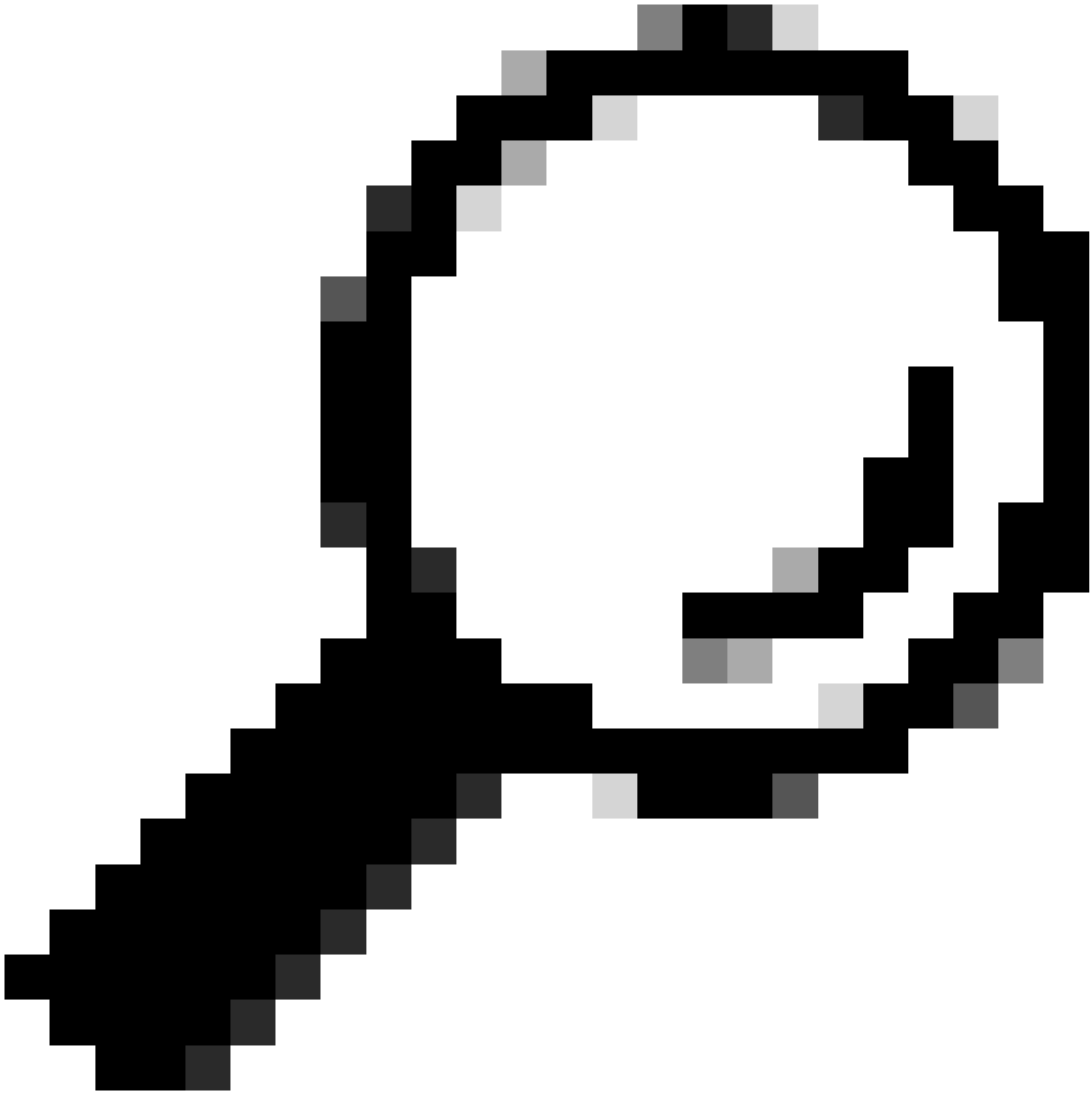
注意：有關命令規範（語法、說明、關鍵字、示例），請參閱命令參考：Cisco IOS安全命令參考：命令S到Z

---

調試

在驗證之前的資訊並確認隧道遇到協商問題後，必須啟用調試以觀察如何交換NHRP資料包。必須在所有相關裝置上啟用下一個調試：

1. debug dmvpn condition peer NBMA x.x.x.x（其中x.x.x.x是遠端裝置IP地址）。
2. debug dmvpn all：此命令啟用ISAKMP、IKEv2、IPSEC、DMVPN和NHRP調試命令。



提示：建議每次啟用調試時使用peer condition命令，以便檢視該特定隧道的協商。

為了檢視完整的NHRP流程，每台裝置上都使用了以下調試命令：

分支1

```
debug dmvpn condition peer NBMA 172.22.200.2
debug dmvpn condition peer NBMA 172.20.10.10
debug dmvpn all all
```

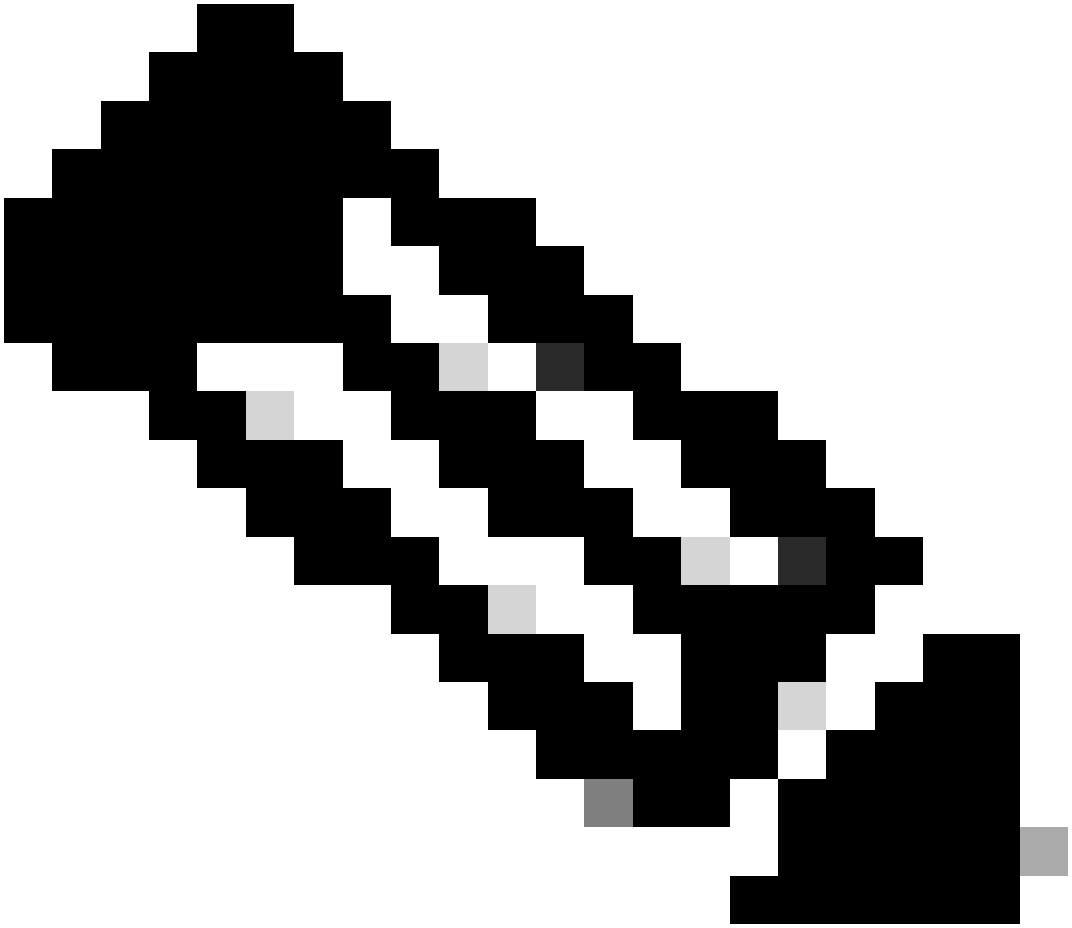
集線器

```
debug dmvpn condition peer NBMA 172.21.100.1
debug dmvpn condition peer NBMA 172.22.200.2
debug dmvpn all all
```

分支2

```
debug dmvpn condition peer NBMA 172.21.100.1
debug dmvpn condition peer NBMA 172.20.10.10
debug dmvpn all all
```

---



注意：必須在所有相關裝置上同時啟用和收集調試。

---

所有裝置上啟用的調試都使用show debug命令顯示：

<#root>

ROUTER#

**show debug**

IOSXE Conditional Debug Configs:

Conditional Debug Global State: Stop

IOSXE Packet Tracing Configs:

Packet Infra debugs:

Ip Address Port
------------------------------------------------------|----------

NHRP:
NHRP protocol debugging is on
NHRP activity debugging is on
NHRP detail debugging is on
NHRP extension processing debugging is on
NHRP cache operations debugging is on
NHRP routing debugging is on
NHRP rate limiting debugging is on
NHRP errors debugging is on
NHRP events debugging is on

Cryptographic Subsystem:
Crypto ISAKMP debugging is on
Crypto ISAKMP Error debugging is on
Crypto IPSEC debugging is on
Crypto IPSEC Error debugging is on
Crypto secure socket events debugging is on
IKEV2:
IKEv2 error debugging is on
IKEv2 default debugging is on
IKEv2 packet debugging is on
IKEv2 packet hexdump debugging is on
IKEv2 internal debugging is on
Tunnel Protection Debugs:
Generic Tunnel Protection debugging is on

DMVPN:
DMVPN error debugging is on
DMVPN UP/DOWN event debugging is on
DMVPN detail debugging is on
DMVPN packet debugging is on
DMVPN all level debugging is on

收集所有調試後，必須開始分析源分支(Spoke1)上的調試，這樣您就可以從開始跟蹤協商。

Spoke1調試輸出：

<#root>

```
---------- [IKE/IPSEC DEBUG OUTPUTS OMITTED]----------

*Feb 1 01:31:34.657: ISAKMP: (1016):

Old State = IKE_QM_R_QM2 New State = IKE_QM_PHASE2_COMPLETE


*Feb 1 01:31:34.657: IPSEC(key_engine): got a queue event with 1 KMI message(s)
*Feb 1 01:31:34.657: IPSEC(key_engine_enable_outbound): rec'd enable notify from ISAKMP
*Feb 1 01:31:34.657: CRYPTO_SS(TUNNEL SEC): Sending MTU Changed message
*Feb 1 01:31:34.661: IPSEC-IFC MGRE/Tu10(172.21.100.1/172.22.200.2): Got MTU message mtu 1458
*Feb 1 01:31:34.661: IPSEC-IFC MGRE/Tu10(172.21.100.1/172.22.200.2): connection lookup returned 80007F2
*Feb 1 01:31:34.662: CRYPTO_SS(TUNNEL SEC): Sending Socket Up message
*Feb 1 01:31:34.662: IPSEC-IFC MGRE/Tu10(172.21.100.1/172.22.200.2): connection lookup returned 80007F2
*Feb 1 01:31:34.662: IPSEC-IFC MGRE/Tu10(172.21.100.1/172.22.200.2):

tunnel_protection_socket_up


*Feb 1 01:31:34.662: IPSEC-IFC MGRE/Tu10(172.21.100.1/172.22.200.2): Signalling NHRP
*Feb 1 01:31:36.428: NHRP: Checking for delayed event NULL/10.10.10.2 on list (Tunnel10 vrf: global(0x0)
*Feb 1 01:31:36.429: NHRP: No delayed event node found.
*Feb 1 01:31:36.429: NHRP: There is no VPE Extension to construct for the request
*Feb 1 01:31:36.429: NHRP: Sending NHRP Resolution Request for dest: 10.10.10.2 to nexthop: 10.10.10.2
*Feb 1 01:31:36.429: NHRP: Attempting to send packet through interface Tunnel10 via DEST dst 10.10.10.2
*Feb 1 01:31:36.429: NHRP-DETAIL: First hop route lookup for 10.10.10.2 yielded 10.10.10.2, Tunnel10
*Feb 1 01:31:36.429: NHRP:

Send Resolution Request via Tunnel10 vrf: global(0x0), packet size: 85


*Feb 1 01:31:36.429: src: 10.10.10.1, dst: 10.10.10.2
*Feb 1 01:31:36.429: (F) afn: AF_IP(1), type: IP(800), hop: 255, ver: 1
*Feb 1 01:31:36.429: shtl: 4(NSAP), sstl: 0(NSAP)
*Feb 1 01:31:36.429: pktsz: 85 extoff: 52
*Feb 1 01:31:36.429: (M) flags: "router auth src-stable nat ",

reqid: 10


*Feb 1 01:31:36.429:

src NBMA: 172.21.100.1


*Feb 1 01:31:36.429:

src protocol: 10.10.10.1, dst protocol: 10.10.10.2


*Feb 1 01:31:36.429: (C-1) code: no error(0), flags: none
*Feb 1 01:31:36.429: prefix: 0, mtu: 9976, hd_time: 600
*Feb 1 01:31:36.429: addr_len: 0(NSAP), subaddr_len: 0(NSAP), proto_len: 0, pref: 255
*Feb 1 01:31:36.429: Responder Address Extension(3):
*Feb 1 01:31:36.429: Forward Transit NHS Record Extension(4):
*Feb 1 01:31:36.429: Reverse Transit NHS Record Extension(5):
*Feb 1 01:31:36.429: Authentication Extension(7):
*Feb 1 01:31:36.429: type:Cleartext(1),

data:DMVPN


*Feb 1 01:31:36.429: NAT address Extension(9):
*Feb 1 01:31:36.430: NHRP: Encapsulation succeeded. Sending NHRP Control Packet NBMA Address: 172.20.10
*Feb 1 01:31:36.430: NHRP: 109 bytes out Tunnel10
```

```
*Feb 1 01:31:36.430: NHRP-RATE:
Retransmitting Resolution Request for 10.10.10.2, reqid 10, (retrans ivl 4 sec)

*Feb 1 01:31:39.816: NHRP: Checking for delayed event NULL/10.10.10.2 on list (Tunnel10 vrf: global(0x0)
*Feb 1 01:31:39.816: NHRP: No delayed event node found.
*Feb 1 01:31:39.816: NHRP: There is no VPE Extension to construct for the request
*Feb 1 01:31:39.817: NHRP: Sending NHRP Resolution Request for dest: 10.10.10.2 to nexthop: 10.10.10.2 (
*Feb 1 01:31:39.817: NHRP: Attempting to send packet through interface Tunnel10 via DEST dst 10.10.10.2
*Feb 1 01:31:39.817: NHRP-DETAIL: First hop route lookup for 10.10.10.2 yielded 10.10.10.2, Tunnel10
*Feb 1 01:31:39.817: NHRP:
Send Resolution Request via Tunnel10 vrf: global(0x0), packet size: 85

*Feb 1 01:31:39.817: src: 10.10.10.1, dst: 10.10.10.2
*Feb 1 01:31:39.817: (F) afn: AF_IP(1), type: IP(800), hop: 255, ver: 1
*Feb 1 01:31:39.817: shtl: 4(NSAP), sstl: 0(NSAP)
*Feb 1 01:31:39.817: pktsz: 85 extoff: 52
*Feb 1 01:31:39.817: (M) flags: "router auth src-stable nat ",
reqid: 10

*Feb 1 01:31:39.817:
src NBMA: 172.21.100.1

*Feb 1 01:31:39.817:
src protocol: 10.10.10.1, dst protocol: 10.10.10.2

*Feb 1 01:31:39.817: (C-1) code: no error(0), flags: none
*Feb 1 01:31:39.817: prefix: 0, mtu: 9976, hd_time: 600
*Feb 1 01:31:39.817: addr_len: 0(NSAP), subaddr_len: 0(NSAP), proto_len: 0, pref: 255
*Feb 1 01:31:39.817: Responder Address Extension(3):
*Feb 1 01:31:39.817: Forward Transit NHS Record Extension(4):
*Feb 1 01:31:39.817: Reverse Transit NHS Record Extension(5):
*Feb 1 01:31:39.817: Authentication Extension(7):
*Feb 1 01:31:39.817: type:Cleartext(1),
data:DMVPN

*Feb 1 01:31:39.817: NAT address Extension(9):
*Feb 1 01:31:39.817: NHRP: Encapsulation succeeded. Sending NHRP Control Packet NBMA Address: 172.20.10
*Feb 1 01:31:39.818: NHRP: 109 bytes out Tunnel10
*Feb 1 01:31:39.818: NHRP-RATE:
Retransmitting Resolution Request for 10.10.10.2, reqid 10, (retrans ivl 8 sec)

*Feb 1 01:31:46.039: NHRP: Checking for delayed event NULL/10.10.10.2 on list (Tunnel10 vrf: global(0x0)
*Feb 1 01:31:46.040: NHRP: No delayed event node found.
*Feb 1 01:31:46.040: NHRP: There is no VPE Extension to construct for the request
```

Spoke1 NHRP進程開始後，日誌顯示裝置正在傳送NHRP解析請求。資料包包含一些重要資訊，如src NMBA和src protocol，它們是源分支(Spoke1)的NBMA IP地址和隧道IP地址。您還可以看到具有目標分支(Spoke2)的隧道IP地址的dst protocol值。這表示Spoke1要求Spoke2的NBMA地址來完

成對映。 此外，在資料包上，您可以找到reqid值，該值可幫助您跟蹤沿路徑的資料包。此值在整個過程中將保持不變，並有助於跟蹤NHRP協商的特定流程。資料包具有另一個對協商很重要的值，如NHRP身份驗證字串。

裝置傳送NHRP解析請求後，日誌顯示已傳送重新傳輸。這是因為裝置未看到NHRP解析響應，因此它會再次傳送資料包。由於Spoke1沒有看到響應，因此有必要跟蹤路徑中下一個裝置（即HUB）上的資料包。

集線器調試輸出：

```
<#root>

*Feb 1 01:31:34.262:

NHRP: Receive Resolution Request via Tunnel10 vrf: global(0x0), packet size: 85


*Feb 1 01:31:34.262: (F) afn: AF_IP(1), type: IP(800), hop: 255, ver: 1
*Feb 1 01:31:34.262: shtl: 4(NSAP), sstl: 0(NSAP)
*Feb 1 01:31:34.263: pktsz: 85 extoff: 52
*Feb 1 01:31:34.263: (M) flags: "router auth src-stable nat ",

reqid: 10


*Feb 1 01:31:34.263:

src NBMA: 172.21.100.1


*Feb 1 01:31:34.263:

src protocol: 10.10.10.1, dst protocol: 10.10.10.2


*Feb 1 01:31:34.263: (C-1) code: no error(0), flags: none
*Feb 1 01:31:34.263: prefix: 0, mtu: 9976, hd_time: 600
*Feb 1 01:31:34.263: addr_len: 0(NSAP), subaddr_len: 0(NSAP), proto_len: 0, pref: 255
*Feb 1 01:31:34.263: Responder Address Extension(3):
*Feb 1 01:31:34.263: Forward Transit NHS Record Extension(4):
*Feb 1 01:31:34.263: Reverse Transit NHS Record Extension(5):
*Feb 1 01:31:34.263: Authentication Extension(7):
*Feb 1 01:31:34.263: type:Cleartext(1), data:DMVPN
*Feb 1 01:31:34.263: NAT address Extension(9):
*Feb 1 01:31:34.263: NHRP-DETAIL: netid_in = 10, to_us = 0
*Feb 1 01:31:34.263: NHRP-DETAIL:

Resolution request for afn 1 received on interface Tunnel10

 , for vrf: global(0x0) label: 0
*Feb 1 01:31:34.263: NHRP-DETAIL: Multipath IP route lookup for 10.10.10.2 in vrf: global(0x0) yielded
*Feb 1 01:31:34.263: NHRP:

Route lookup for destination 10.10.10.2

 in vrf: global(0x0) yielded interface Tunnel10, prefixlen 24
*Feb 1 01:31:34.263: NHRP-DETAIL: netid_out 10, netid_in 10
*Feb 1 01:31:34.263: NHRP: Forwarding request due to authoritative request.
*Feb 1 01:31:34.263: NHRP-ATTR:

NHRP Resolution Request packet is forwarded to 10.10.10.2 using vrf: global(0x0)
```

```
*Feb 1 01:31:34.263: NHRP: Attempting to forward to destination: 10.10.10.2 vrf: global(0x0)
*Feb 1 01:31:34.264: NHRP: Forwarding: NHRP SAS picked source: 10.10.10.10 for destination: 10.10.10.2
*Feb 1 01:31:34.264: NHRP: Attempting to send packet through interface Tunnel10 via DEST dst 10.10.10.2
*Feb 1 01:31:34.264: NHRP-DETAIL: First hop route lookup for 10.10.10.2 yielded 10.10.10.2, Tunnel10
*Feb 1 01:31:34.264: NHRP:
```

**Forwarding Resolution Request via Tunnel10 vrf: global(0x0), packet size: 105**

```
*Feb 1 01:31:34.264: src: 10.10.10.10, dst: 10.10.10.2
*Feb 1 01:31:34.264: (F) afn: AF_IP(1), type: IP(800), hop: 254, ver: 1
*Feb 1 01:31:34.264: shtl: 4(NSAP), sstl: 0(NSAP)
*Feb 1 01:31:34.264: pktsz: 105 extoff: 52
*Feb 1 01:31:34.264: (M) flags: "router auth src-stable nat ",
```

**reqid: 10**

```
*Feb 1 01:31:34.264:
```

**src NBMA: 172.21.100.1**

```
*Feb 1 01:31:34.264:
```

**src protocol: 10.10.10.1, dst protocol: 10.10.10.2**

```
*Feb 1 01:31:34.264: (C-1) code: no error(0), flags: none
*Feb 1 01:31:34.264: prefix: 0, mtu: 9976, hd_time: 600
*Feb 1 01:31:34.264: addr_len: 0(NSAP), subaddr_len: 0(NSAP), proto_len: 0, pref: 255
*Feb 1 01:31:34.264: Responder Address Extension(3):
*Feb 1 01:31:34.264: Forward Transit NHS Record Extension(4):
*Feb 1 01:31:34.264: (C-1)
```

**code: no error(0)**

```
, flags: none
*Feb 1 01:31:34.264: prefix: 0, mtu: 9976, hd_time: 600
*Feb 1 01:31:34.264: addr_len: 4(NSAP), subaddr_len: 0(NSAP), proto_len: 4, pref: 255
*Feb 1 01:31:34.264:
```

**client NBMA: 172.20.10.10**

```
*Feb 1 01:31:34.264:
```

**client protocol: 10.10.10.10**

```
*Feb 1 01:31:34.264: Reverse Transit NHS Record Extension(5):
*Feb 1 01:31:34.264: Authentication Extension(7):
*Feb 1 01:31:34.264: type:Cleartext(1),
```

**data:DMVPN**

```
*Feb 1 01:31:34.265: NAT address Extension(9):
*Feb 1 01:31:34.265: NHRP: Encapsulation succeeded. Sending NHRP Control Packet NBMA Address: 172.22.20
*Feb 1 01:31:34.265: NHRP: 129 bytes out Tunnel10
```

使用reqid的值，您可以觀察到HUB接收了Spoke1傳送的解析請求。在資料包中，src NBMA和src

protocol的值是來自Spoke1的資訊，而dst protocol的值是來自Spoke2的隧道IP，正如Spoke1的調試中所示。當HUB收到解析請求時，它會執行路由查詢並將資料包轉發到Spoke2。在轉發的資料包中，集線器增加了一個包含自身資訊（NBMA IP地址和隧道IP地址）的擴展。

前面的調試顯示HUB正將解析請求正確轉發到分支2。因此，下一步是確認Spoke2正在接收它，正確處理它，並將解析回覆傳送給Spoke1。

Spoke2調試輸出：

<#root>

```
---------------------- [IKE/IPSEC DEBUG OUTPUTS OMITTED]----------------------

*Feb 1 01:31:34.647: ISAKMP: (1015):

Old State = IKE_QM_IPSEC_INSTALL_AWAIT New State = IKE_QM_PHASE2_COMPLETE


*Feb 1 01:31:34.647: NHRP: Process delayed resolution request src:10.10.10.1 dst:10.10.10.2 vrf: global
*Feb 1 01:31:34.648: NHRP-DETAIL: Resolution request for afn 1 received on interface Tunnel10 , for vrf
*Feb 1 01:31:34.648: NHRP-DETAIL: Multipath IP route lookup for 10.10.10.2 in vrf: global(0x0) yielded
*Feb 1 01:31:34.648: NHRP:

Route lookup for destination 10.10.10.2 in vrf: global(0x0) yielded interface Tunnel10, prefixlen 24


*Feb 1 01:31:34.648: NHRP-ATTR: smart spoke feature and attributes are not configured
*Feb 1 01:31:34.648:

NHRP:


Request was to us. Process the NHRP Resolution Request.


*Feb 1 01:31:34.648: NHRP-DETAIL: Multipath IP route lookup for 10.10.10.2 in vrf: global(0x0) yielded
*Feb 1 01:31:34.648: NHRP: nhrp_rtlookup for 10.10.10.2 in vrf: global(0x0) yielded interface Tunnel10,
*Feb 1 01:31:34.648: NHRP: Request was to us, responding with ouraddress
*Feb 1 01:31:34.648: NHRP: Checking for delayed event 10.10.10.1/10.10.10.2 on list (Tunnel10 vrf: globa
*Feb 1 01:31:34.648: NHRP: No delayed event node found.
*Feb 1 01:31:34.648: IPSEC-IFC MGRE/Tu10: Checking to see if we need to delay for src 172.22.200.2 dst
*Feb 1 01:31:34.648: IPSEC-IFC MGRE/Tu10: crypto_ss_listen_start already listening
*Feb 1 01:31:34.648: IPSEC-IFC MGRE/Tu10(172.22.200.2/172.21.100.1): Opening a socket with profile IPSE
*Feb 1 01:31:34.648: IPSEC-IFC MGRE/Tu10(172.22.200.2/172.21.100.1): connection lookup returned 80007F1
*Feb 1 01:31:34.648: IPSEC-IFC MGRE/Tu10(172.22.200.2/172.21.100.1): Socket is already open. Ignoring.
*Feb 1 01:31:34.648: IPSEC-IFC MGRE/Tu10(172.22.200.2/172.21.100.1): connection lookup returned 80007F1
*Feb 1 01:31:34.648: IPSEC-IFC MGRE/Tu10(172.22.200.2/172.21.100.1): tunnel is already open!
*Feb 1 01:31:34.648: NHRP: No need to delay processing of resolution event NBMA src:172.22.200.2 NBMA d
*Feb 1 01:31:34.648: NHRP-MEF: No vendor private extension in NHRP packet
*Feb 1 01:31:34.649: NHRP-CACHE: Tunnel10: Cache update for target 10.10.10.1/32 vrf: global(0x0) label
*Feb 1 01:31:34.649: 172.21.100.1 (flags:0x2080)
*Feb 1 01:31:34.649: NHRP:

Adding Tunnel Endpoints (VPN: 10.10.10.1, NBMA: 172.21.100.1)


*Feb 1 01:31:34.649: IPSEC-IFC MGRE/Tu10: crypto_ss_listen_start already listening
*Feb 1 01:31:34.649: IPSEC-IFC MGRE/Tu10(172.22.200.2/172.21.100.1): Opening a socket with profile IPSE
*Feb 1 01:31:34.649: IPSEC-IFC MGRE/Tu10(172.22.200.2/172.21.100.1): connection lookup returned 80007F1
```

```
*Feb 1 01:31:34.649: IPSEC-IFC MGRE/Tu10(172.22.200.2/172.21.100.1): Found an existing tunnel endpoint
*Feb 1 01:31:34.649: IPSEC-IFC MGRE/Tu10(172.22.200.2/172.21.100.1): tunnel_protection_stop_pending_tim
*Feb 1 01:31:34.649: IPSEC-IFC MGRE/Tu10(172.22.200.2/172.21.100.1): Socket is already open. Ignoring.
*Feb 1 01:31:34.653:
```

**NHRP: Successfully attached NHRP subblock for Tunnel Endpoints (VPN: 10.10.10.1, NBMA: 172.21.100.1)**

```
*Feb 1 01:31:34.653: NHRP: Peer capability:0
*Feb 1 01:31:34.653: NHRP-CACHE: Inserted subblock node(1 now) for cache: Target 10.10.10.1/32 nhop 10.
*Feb 1 01:31:34.653: NHRP-CACHE: Converted internal dynamic cache entry for 10.10.10.1/32 interface Tun
*Feb 1 01:31:34.653: NHRP-EVE: NHP-UP: 10.10.10.1, NBMA: 172.21.100.1
*Feb 1 01:31:34.653: NHRP-MEF: No vendor private extension in NHRP packet
*Feb 1 01:31:34.653: NHRP-CACHE: Tunnel10: Internal Cache add for target 10.10.10.2/32 vrf: global(0x0)
*Feb 1 01:31:34.653: 172.22.200.2 (flags:0x20)
*Feb 1 01:31:34.653: NHRP: Attempting to send packet through interface Tunnel10 via DEST dst 10.10.10.1
*Feb 1 01:31:34.654: NHRP-DETAIL: First hop route lookup for 10.10.10.1 yielded 10.10.10.1, Tunnel10
*Feb 1 01:31:34.654:
```

**NHRP: Send Resolution Reply via Tunnel10 vrf: global(0x0), packet size: 133**

```
*Feb 1 01:31:34.654: src: 10.10.10.2, dst: 10.10.10.1
*Feb 1 01:31:34.654: (F) afn: AF_IP(1), type: IP(800), hop: 255, ver: 1
*Feb 1 01:31:34.654: shtl: 4(NSAP), sstl: 0(NSAP)
*Feb 1 01:31:34.654: pktsz: 133 extoff: 60
*Feb 1 01:31:34.654: (M) flags: "router auth dst-stable unique src-stable nat ",
```

**reqid: 10**

```
*Feb 1 01:31:34.654:
```

**src NBMA: 172.21.100.1**

```
*Feb 1 01:31:34.654:
```

**src protocol: 10.10.10.1, dst protocol: 10.10.10.2**

```
*Feb 1 01:31:34.654: (C-1) code: no error(0), flags: none
*Feb 1 01:31:34.654: prefix: 32, mtu: 9976, hd_time: 599
*Feb 1 01:31:34.654: addr_len: 4(NSAP), subaddr_len: 0(NSAP), proto_len: 4, pref: 255
*Feb 1 01:31:34.654:
```

**client NBMA: 172.22.200.2**

```
*Feb 1 01:31:34.654:
```

**client protocol: 10.10.10.2**

```
*Feb 1 01:31:34.654: Responder Address Extension(3):
*Feb 1 01:31:34.654: (C) code: no error(0), flags: none
*Feb 1 01:31:34.654: prefix: 0, mtu: 9976, hd_time: 600
*Feb 1 01:31:34.654: addr_len: 4(NSAP), subaddr_len: 0(NSAP), proto_len: 4, pref: 255
*Feb 1 01:31:34.654:
```

**client NBMA: 172.22.200.2**

```
*Feb 1 01:31:34.654:
```

**client protocol: 10.10.10.2**

```
*Feb 1 01:31:34.654: Forward Transit NHS Record Extension(4):
*Feb 1 01:31:34.654: (C-1) code: no error(0), flags: none
*Feb 1 01:31:34.654: prefix: 0, mtu: 9976, hd_time: 600
*Feb 1 01:31:34.654: addr_len: 4(NSAP), subaddr_len: 0(NSAP), proto_len: 4, pref: 255
*Feb 1 01:31:34.654:
client NBMA: 172.20.10.10

*Feb 1 01:31:34.654:
client protocol: 10.10.10.10

*Feb 1 01:31:34.654: Reverse Transit NHS Record Extension(5):
*Feb 1 01:31:34.654: Authentication Extension(7):
*Feb 1 01:31:34.654: type:Cleartext(1),
data:DMVPN

*Feb 1 01:31:34.655: NAT address Extension(9):
*Feb 1 01:31:34.655: NHRP: Encapsulation succeeded. Sending NHRP Control Packet NBMA Address: 172.21.10
*Feb 1 01:31:34.655: NHRP: 157 bytes out Tunnel10
*Feb 1 01:31:34.655: IPSEC-IFC MGRE/Tu10(172.22.200.2/172.21.100.1): connection lookup returned 80007F1
*Feb 1 01:31:34.655: NHRP-DETAIL: Deleted delayed event on interfaceTunnel10 dest: 172.21.100.1
```

reqid與之前輸出中看到的值匹配，因此確認Spoke1傳送的NHRP解析請求資料包到達Spoke2。此資料包在Spoke2上觸發路由查詢，並意識到解析請求是自用的，因此，Spoke2將來自Spoke1的資訊增加到其NHRP表中。在將解析應答資料包傳送回Spoke1之前，裝置會增加自己的資訊（NBMA IP地址和隧道IP地址），以便Spoke1能夠使用該資料包將該資訊增加到其資料庫中。

根據顯示的所有調試，從Spoke2傳送的NHRP解析應答未到達Spoke1。HUB可以按照預期接收和轉發NHRP解析請求資料包而從問題中丟棄。因此，下一步是獲取Spoke1和Spoke2之間的捕獲資訊，以獲取有關此問題的更多詳細資訊。

內嵌式封包擷取

內嵌封包擷取功能可讓您分析透過裝置的流量。配置它的第一步是建立一個訪問清單，其中包括要在兩個通訊流（入站和出站）上捕獲的通訊。

對於此情況，使用NBMA IP地址：

```
ip access-list extended filter
10 permit ip host 172.21.100.1 host 172.22.200.2
20 permit ip host 172.22.200.2 host 172.21.100.1
```

然後，使用命令monitor capture <CAPTURE_NAME> access-list <ACL_NAME> buffer size 10 interface <WAN_INTERFACE> both配置捕獲，並使用monitor capture <CAPTURE_NAME> start命令開始捕獲。

捕獲Spoke1和Spoke2上的配置：

```
monitor capture CAP access-list filter buffer size 10 interface GigabitEthernet1 both
monitor capture CAP start
```

要顯示捕獲的輸出，請使用命令show monitor capture <CAPTURE_NAME> buffer brief。

捕獲輸出Spoke1：

<#root>

```
SPOKE1#show monitor capture CAP buffer brief
------------------------------------------------------------------------------
#   size   timestamp     source             destination      dscp    protocol
------------------------------------------------------------------------------
   0  210    0.000000   172.22.200.2    ->  172.21.100.1     48 CS6  UDP
   1  150    0.014999   172.21.100.1    ->  172.22.200.2     48 CS6  UDP
   2  478    0.028990   172.22.200.2    ->  172.21.100.1     48 CS6  UDP
   3  498    0.049985   172.21.100.1    ->  172.22.200.2     48 CS6  UDP
   4  150    0.069988   172.22.200.2    ->  172.21.100.1     48 CS6  UDP
   5  134    0.072994   172.21.100.1    ->  172.22.200.2     48 CS6  UDP
   6  230    0.074993   172.22.200.2    ->  172.21.100.1     48 CS6  UDP
   7  230    0.089992   172.21.100.1    ->  172.22.200.2     48 CS6  UDP
   8  118    0.100993   172.22.200.2    ->  172.21.100.1     48 CS6  UDP
   9  218    0.108988   172.22.200.2    ->  172.21.100.1     48 CS6  ESP
  10   70    0.108988   172.21.100.1    ->  172.22.200.2     0  BE   ICMP
  11  218    1.907994   172.22.200.2    ->  172.21.100.1     48 CS6  ESP
  12   70    1.907994   172.21.100.1    ->  172.22.200.2     0  BE   ICMP
  13  218    5.818003   172.22.200.2    ->  172.21.100.1     48 CS6  ESP
  14   70    5.818003   172.21.100.1    ->  172.22.200.2     0  BE   ICMP
  15  218   12.559969   172.22.200.2    ->  172.21.100.1    48 CS6  ESP
  16   70   12.559969   172.21.100.1    ->  172.22.200.2     0  BE   ICMP
  17  218   26.859001   172.22.200.2    ->  172.21.100.1     48 CS6  ESP
```

**18 70 26.859001 172.21.100.1 -> 172.22.200.2 0 BE ICMP**

**19 218 54.378978 172.22.200.2 -> 172.21.100.1 48 CS6 ESP**

**20 70 54.378978 172.21.100.1 -> 172.22.200.2 0 BE ICMP**

捕獲輸出Spoke2：

<#root>

```
SPOKE2#show monitor capture CAP buffer brief
------------------------------------------------------------------------------
#   size   timestamp     source              destination      dscp    protocol
------------------------------------------------------------------------------
   0  210    0.000000   172.22.200.2    ->  172.21.100.1     48 CS6  UDP
   1  150    0.015990   172.21.100.1    ->  172.22.200.2     48 CS6  UDP
   2  478    0.027998   172.22.200.2    ->  172.21.100.1     48 CS6  UDP
   3  498    0.050992   172.21.100.1    ->  172.22.200.2     48 CS6  UDP
   4  150    0.069988   172.22.200.2    ->  172.21.100.1     48 CS6  UDP
   5  134    0.072994   172.21.100.1    ->  172.22.200.2     48 CS6  UDP
   6  230    0.074993   172.22.200.2    ->  172.21.100.1     48 CS6  UDP
   7  230    0.089992   172.21.100.1    ->  172.22.200.2     48 CS6  UDP
   8  118    0.099986   172.22.200.2    ->  172.21.100.1     48 CS6  UDP
```

**9 218 0.108988 172.22.200.2 -> 172.21.100.1 48 CS6 ESP**

**10 70 0.108988 172.21.100.1 -> 172.22.200.2 0 BE ICMP**

**11 218 1.907994 172.22.200.2 -> 172.21.100.1 48 CS6 ESP**

**12 70 1.909001 172.21.100.1 -> 172.22.200.2 0 BE ICMP**

**13 218 5.817011 172.22.200.2 -> 172.21.100.1 48 CS6 ESP**

**14 70 5.818002 172.21.100.1 -> 172.22.200.2 0 BE ICMP**

**15 218 12.559968 172.22.200.2 -> 172.21.100.1 48 CS6 ESP**

**16 70 12.560960 172.21.100.1 -> 172.22.200.2 0 BE ICMP**

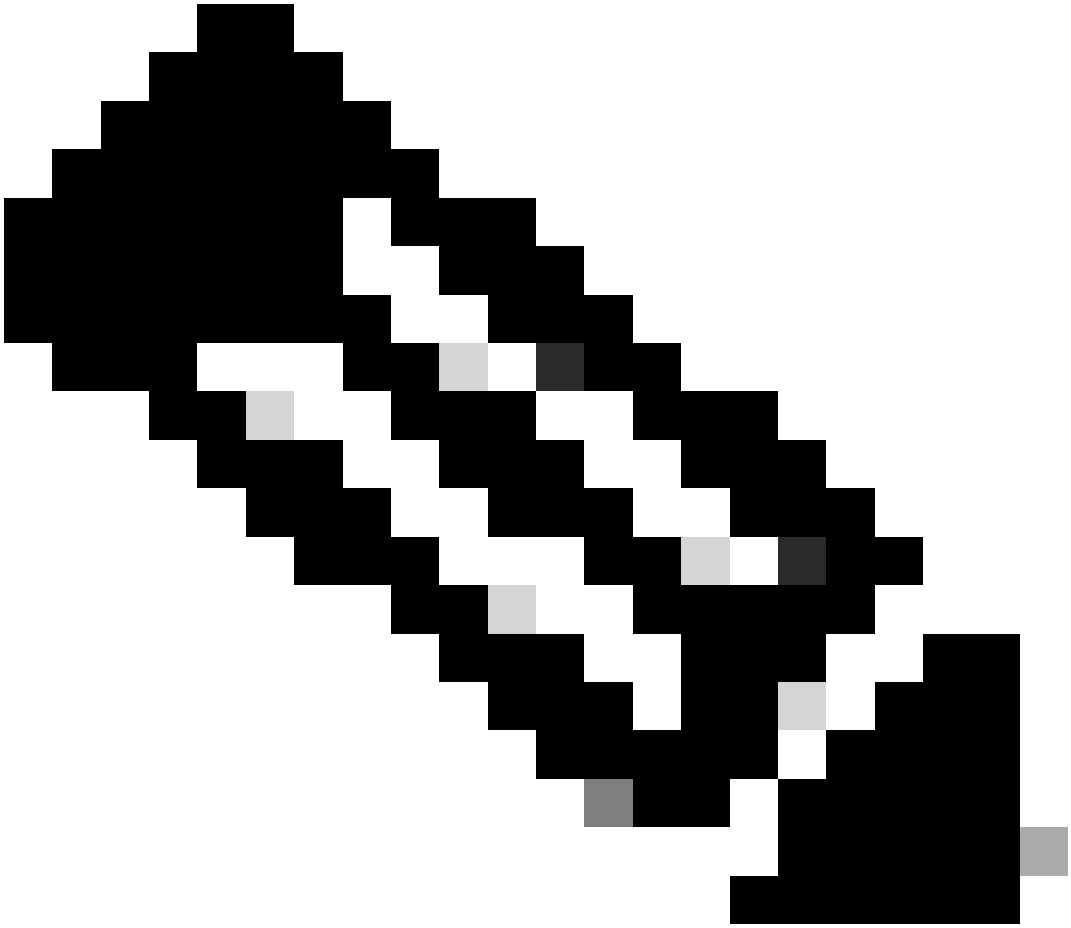
**17 218 26.858009 172.22.200.2 -> 172.21.100.1 48 CS6 ESP**

```
18   70   26.859001   172.21.100.1    ->  172.22.200.2     0  BE   ICMP

19  218   54.378978   172.22.200.2    ->  172.21.100.1     48 CS6  ESP

20   70   54.379970   172.21.100.1    ->  172.22.200.2     0  BE   ICMP
```

捕獲的輸出顯示初始資料包是UDP流量，指示IKE/IPSEC協商。然後，Spoke2向Spoke1傳送解析應答，該應答被視為ESP流量（資料包9）。在此之後，預期流量為ESP，但下一個顯示的資料包是來自Spoke1到Spoke2的ICMP流量。

要更深入地分析資料包，可以運行命令show monitor capture <CAPTURE_NAME> buffer dump從裝置導出pcap檔案。然後使用解碼器工具將轉儲輸出轉換為pcap檔案，以便使用Wireshark打開該檔案。

---



---

注意：思科有一個資料包分析器，您可以在其中找到捕獲配置、示例和解碼器：思科TAC工具-資料包捕獲配置生成器和分析器

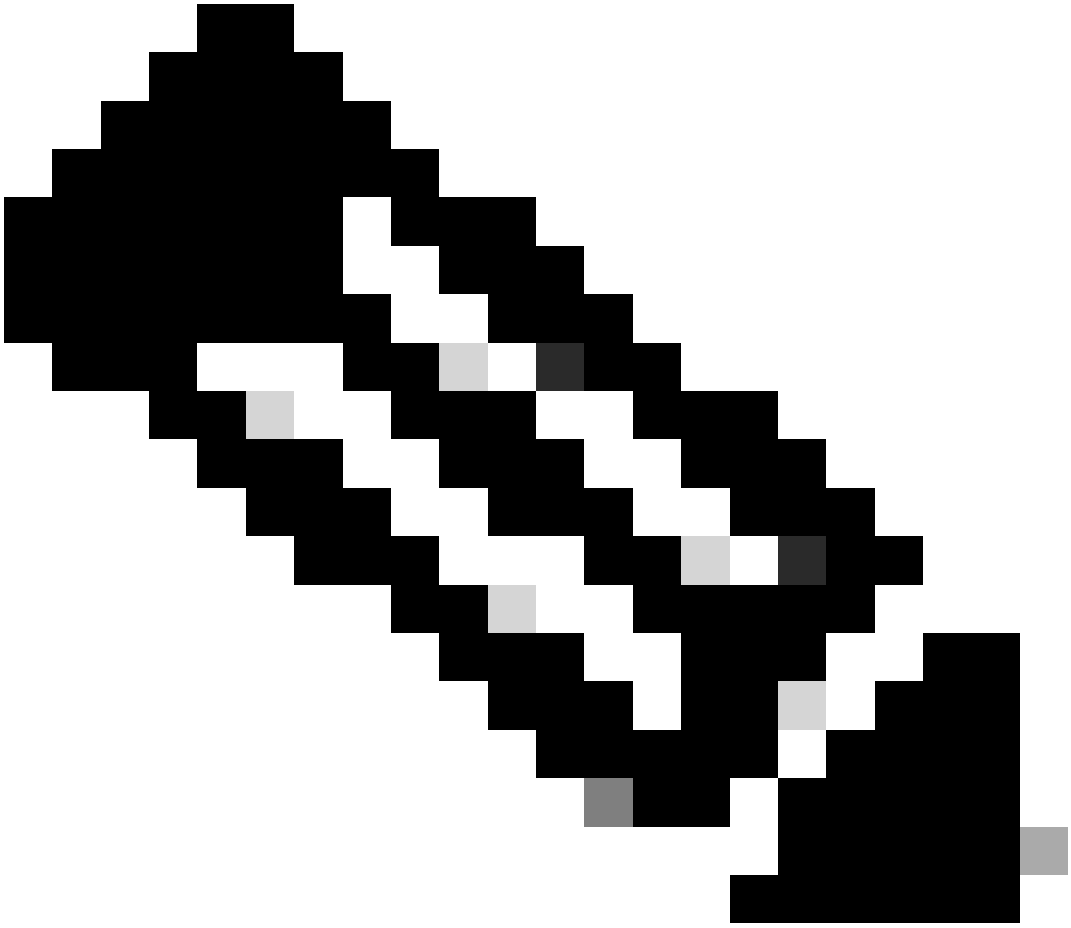
Wireshark輸出：

| | Time | Source | Destination | Protocol | Length | Info |
|---|---|---|---|---|---|---|
| 1 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ISAKMP | 210 | Identity Protection (Main Mode) |
| 2 | 1969-12-31 18:00:00.000000 | 172.21.100.1 | 172.22.200.2 | ISAKMP | 150 | Identity Protection (Main Mode) |
| 3 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ISAKMP | 478 | Identity Protection (Main Mode) |
| 4 | 1969-12-31 18:00:00.000000 | 172.21.100.1 | 172.22.200.2 | ISAKMP | 498 | Identity Protection (Main Mode) |
| 5 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ISAKMP | 150 | Identity Protection (Main Mode) |
| 6 | 1969-12-31 18:00:00.000000 | 172.21.100.1 | 172.22.200.2 | ISAKMP | 134 | Identity Protection (Main Mode) |
| 7 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ISAKMP | 230 | Quick Mode |
| 8 | 1969-12-31 18:00:00.000000 | 172.21.100.1 | 172.22.200.2 | ISAKMP | 230 | Quick Mode |
| 9 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ISAKMP | 118 | Quick Mode |
| 10 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ESP | 218 | ESP (SPI=0x33a95845) |
| 11 | 1969-12-31 18:00:00.000000 | 172.21.100.1 | 172.22.200.2 | ICMP | 70 | Destination unreachable (Communication administratively filtered) |
| 12 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ESP | 218 | ESP (SPI=0x33a95845) |
| 13 | 1969-12-31 18:00:00.000000 | 172.21.100.1 | 172.22.200.2 | ICMP | 70 | Destination unreachable (Communication administratively filtered) |
| 14 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ESP | 186 | ESP (SPI=0x33a95845) |
| 15 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ESP | 186 | ESP (SPI=0x33a95845) |
| 16 | 1969-12-31 18:00:00.000000 | 172.21.100.1 | 172.22.200.2 | ICMP | 70 | Destination unreachable (Communication administratively filtered) |
| 17 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ESP | 218 | ESP (SPI=0x33a95845) |
| 18 | 1969-12-31 18:00:00.000000 | 172.21.100.1 | 172.22.200.2 | ICMP | 70 | Destination unreachable (Communication administratively filtered) |
| 19 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ESP | 186 | ESP (SPI=0x33a95845) |
| 20 | 1969-12-31 18:00:00.000000 | 172.21.100.1 | 172.22.200.2 | ICMP | 70 | Destination unreachable (Communication administratively filtered) |
| 21 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ESP | 186 | ESP (SPI=0x33a95845) |
| 22 | 1969-12-31 18:00:00.000000 | 172.21.100.1 | 172.22.200.2 | ICMP | 70 | Destination unreachable (Communication administratively filtered) |
| 23 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ESP | 218 | ESP (SPI=0x33a95845) |
| 24 | 1969-12-31 18:00:00.000000 | 172.21.100.1 | 172.22.200.2 | ICMP | 70 | Destination unreachable (Communication administratively filtered) |
| 25 | 1969-12-31 18:00:00.000000 | 172.22.200.2 | 172.21.100.1 | ESP | 218 | ESP (SPI=0x33a95845) |
| 26 | 1969-12-31 18:00:00.000000 | 172.21.100.1 | 172.22.200.2 | ICMP | 70 | Destination unreachable (Communication administratively filtered) |

Scan Again

在Wireshark上捕獲輸出

ICMP資料包的內容包含錯誤消息Destination unreachable (Communication administratively filtered)。這表示存在某種過濾器，例如影響路徑中流量的路由器ACL或防火牆。大多數情況下，過濾器是在傳送資料包的裝置上配置的（在本例中為Spoke1），但中間裝置也可以傳送該資料包。



注意：兩個分支上的Wireshark輸出相同。

Cisco IOS® XE資料路徑資料包跟蹤功能

Cisco IOS XE資料路徑資料包跟蹤功能用於分析裝置如何處理流量。若要設定該清單，您需要建立包含要在兩個流量流（傳入和傳出）上擷取的流量的存取清單。

在本場景中，使用NBMA IP地址。

```
ip access-list extended filter
10 permit ip host 172.21.100.1 host 172.22.200.2
20 permit ip host 172.22.200.2 host 172.21.100.1
```

然後，配置fia-trace功能並設定調試條件以使用訪問清單。最後，啟動條件。

```
debug platform packet-trace packet 1024 fia-trace
debug platform condition ipv4 access-list filter both
debug platform condition start
```

- debug platform packet-trace packet <count> fia-trace：啟用詳細的fia跟蹤，並在捕獲配置的資料包數量後停止跟蹤
- debug platform condition ipv4 access-list <ACL-NAME> both：使用之前配置的訪問清單在裝置上設定條件
- debug platform condition start：啟動條件

要檢視fia-trace的輸出，請使用以下命令。

```
show platform packet-trace statistics
show platform packet-trace summary
show platform packet-trace packet <number>
```

Spoke1 show platform packet-trace statistics輸出：

<#root>

```
SPOKE1#show platform packet-trace statistics
Packets Summary
  Matched  18
  Traced   18
Packets Received
  Ingress  11
  Inject   7
    Count       Code  Cause
    4           2     QFP destination lookup
    3           9     QFP ICMP generated packet
Packets Processed
  Forward  7
  Punt     8
    Count       Code  Cause
    5           11    For-us data
    3           26    QFP ICMP generated packet
  Drop     3
    Count       Code  Cause
    3           8     Ipv4Acl
  Consume  0
          PKT_DIR_IN
             Dropped       Consumed       Forwarded
INFRA            0              0              0
TCP              0              0              0
```

```
UDP                 0                   0                   5
IP                  0                   0                   5
IPV6                0                   0                   0
ARP                 0                   0                   0

          PKT_DIR_OUT
              Dropped         Consumed        Forwarded
INFRA               0                   0                   0
TCP                 0                   0                   0
UDP                 0                   0                   0
IP                  0                   0                   0
IPV6                0                   0                   0
ARP                 0                   0                   0
```

在show platform packet-trace statistics輸出中，可以看到裝置所處理的資料包的計數器。這允許您檢視入站和出站資料包，並檢查裝置是否丟棄任何資料包以及丟棄原因。

在圖中所示的輸出中，Spoke1正在丟棄部分描述為Ipv4Acl的資料包。為進一步分析這些資料包，可以使用show platform packet-trace summary命令。

Spoke1 show platform packet-trace summary 輸出：

<#root>

```
SPOKE1#show platform packet-trace summary
Pkt    Input                     Output                    State  Reason
0      Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
1      INJ.2                     Gi1                       FWD
2      Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
3      INJ.2                     Gi1                       FWD
4      Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
5      INJ.2                     Gi1                       FWD
6      Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
7      INJ.2                     Gi1                       FWD
8      Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
9      Gi1                       Gi1                       DROP   8   (Ipv4Acl)
10     Gi1                       internal0/0/recycle:0     PUNT   26  (QFP ICMP generated packet)
11     INJ.9                     Gi1                       FWD
12     Gi1                       Gi1                       DROP   8   (Ipv4Acl)
13     Gi1                       internal0/0/recycle:0     PUNT   26  (QFP ICMP generated packet)
14     INJ.9                     Gi1                       FWD
15     Gi1                       Gi1                       DROP   8   (Ipv4Acl)
16     Gi1                       internal0/0/recycle:0     PUNT   26  (QFP ICMP generated packet)
17     INJ.9                     Gi1                       FWD
18     Gi1                       Gi1                       DROP   8   (Ipv4Acl)
19     Gi1                       internal0/0/recycle:0     PUNT   26  (QFP ICMP generated packet)
20     INJ.9                     Gi1                       FWD
```

```
21    Gi1                       Gi1                       DROP    8    (Ipv4Acl)


22    Gi1                       internal0/0/recycle:0     PUNT    26   (QFP ICMP generated packet)
23    INJ.9                     Gi1                       FWD
24    Gi1                       Gi1                       DROP    8    (Ipv4Acl)


25    Gi1                       internal0/0/recycle:0     PUNT    26   (QFP ICMP generated packet)
26    INJ.9                     Gi1                       FWD
```

透過此輸出，您可以看到每個封包到達和離開裝置，以及輸入和輸出介面。此外，還會顯示資料包的狀態，指示它是被轉發、丟棄還是被內部處理（傳送）。

在本示例中，此輸出有助於辨識裝置丟棄的資料包。使用命令show platform packet-trace packet <PACKET_NUMBER>，您可以看到裝置如何處理該特定資料包。

Spoke1 show platform packet-trace packet <PACKET_NUMBER>輸出：

<#root>

```
SPOKE1#show platform packet-trace packet 9
Packet: 9 CBUG ID: 9
Summary
Input : GigabitEthernet1


Output : GigabitEthernet1


State : DROP 8 (Ipv4Acl)


Timestamp
Start : 366032715676920 ns (02/01/2024 04:30:15.708990 UTC)
Stop : 366032715714128 ns (02/01/2024 04:30:15.709027 UTC)
Path Trace
  Feature: IPV4(Input)


Input : GigabitEthernet1


     Output : <unknown>


Source : 172.22.200.2


     Destination : 172.21.100.1


     Protocol : 50 (ESP)
```

```
  Feature: DEBUG_COND_INPUT_PKT
     Entry : Input - 0x812707d0

 Input : GigabitEthernet1


     Output : <unknown>


     Lapsed time : 194 ns
  Feature: IPV4_INPUT_DST_LOOKUP_ISSUE
     Entry : Input - 0x8129bf74

 Input : GigabitEthernet1


     Output : <unknown>


     Lapsed time : 769 ns
  Feature: IPV4_INPUT_ARL_SANITY
     Entry : Input - 0x812725cc

 Input : GigabitEthernet1


     Output : <unknown>


     Lapsed time : 307 ns
  Feature: EPC_INGRESS_FEATURE_ENABLE
     Entry : Input - 0x812782d0

Input : GigabitEthernet1


     Output : <unknown>


     Lapsed time : 6613 ns
  Feature: IPV4_INPUT_DST_LOOKUP_CONSUME
     Entry : Input - 0x8129bf70

Input : GigabitEthernet1


     Output : <unknown>


     Lapsed time : 272 ns
  Feature: STILE_LEGACY_DROP
     Entry : Input - 0x812a7650

 Input : GigabitEthernet1
```

**Output : <unknown>**

Lapsed time : 278 ns
Feature: INGRESS_MMA_LOOKUP_DROP
Entry : Input - 0x812a1278

**Input : GigabitEthernet1**

**Output : <unknown>**

Lapsed time : 697 ns
Feature: INPUT_DROP_FNF_AOR
Entry : Input - 0x81297278

**Input : GigabitEthernet1**

**Output : <unknown>**

Lapsed time : 676 ns
Feature: INPUT_FNF_DROP
Entry : Input - 0x81280f24

**Input : GigabitEthernet1**

**Output : <unknown>**

Lapsed time : 1018 ns
Feature: INPUT_DROP_FNF_AOR_RELEASE
Entry : Input - 0x81297274

**Input : GigabitEthernet1**

**Output : <unknown>**

Lapsed time : 174 ns
**Feature: INPUT_DROP**

Entry : Input - 0x8126e568

**Input : GigabitEthernet1**

**Output : <unknown>**

Lapsed time : 116 ns

**Feature: IPV4_INPUT_ACL**

Entry : Input - 0x81271f70

**Input : GigabitEthernet1**

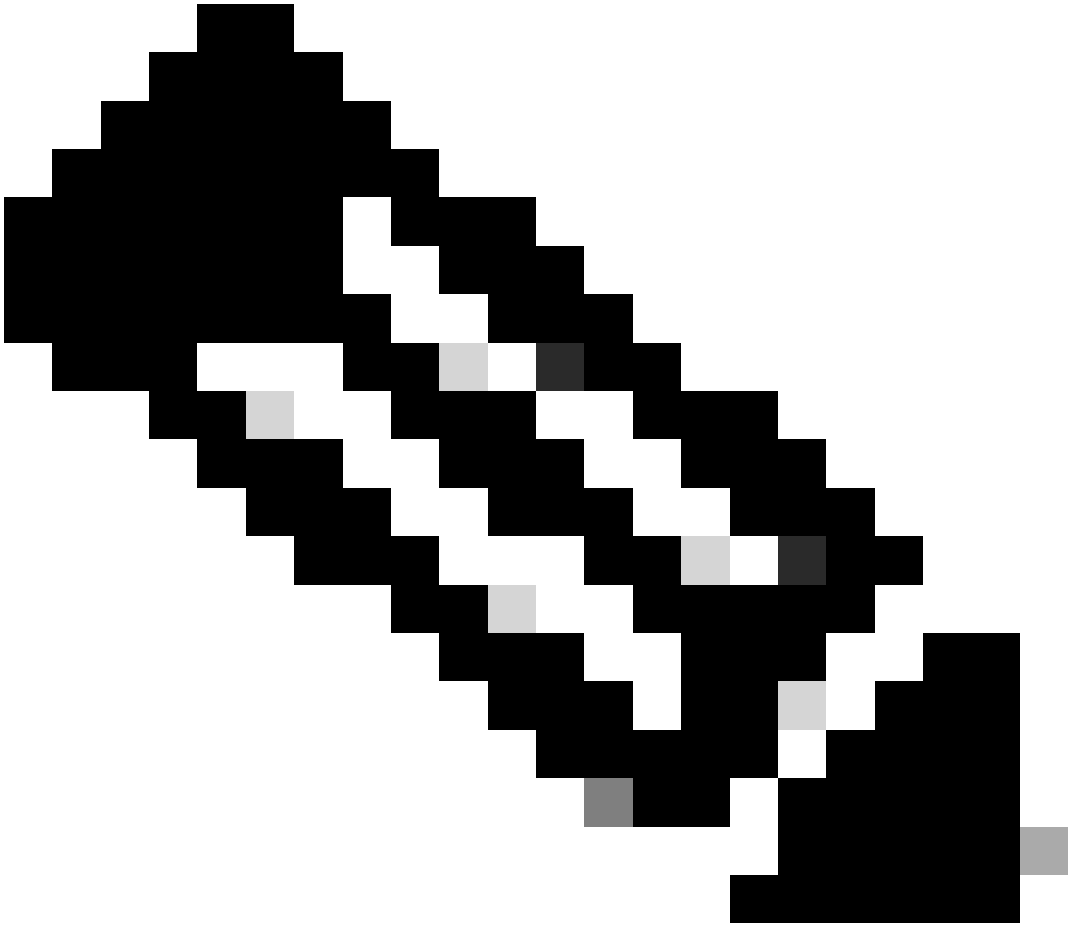
**Output : <unknown>**

Lapsed time : 12915 ns

在第一部分，您可以看到入口和出口介面以及資料包的狀態。然後是輸出的第二部分，您可以在其中找到源IP地址和目的IP地址以及協定。

每個後續階段都會顯示裝置如何處理此特定資料包。 這樣可以深入瞭解網路地址轉換(NAT)或訪問清單等任何配置或可能影響該配置的其它因素。

在這種情況下，可以確定資料包的協定是ESP，源IP是Spoke2的NBMA IP地址，目標IP是Spoke1的NBMA IP地址。這表示這是NHRP協商中缺少的資料包。此外，可以觀察到，任何階段都沒有指定輸出介面，這表明在轉發流量之前，流量受到了某種影響。在倒數第二階段，您可以看到裝置正在丟棄指定介面(GigabitEthernet1)上的入站流量。最後一個階段顯示輸入存取清單，表示介面上可能有某些組態造成捨棄。



注意：使用本文檔中列出的所有故障排除工具後，如果協商中涉及的輻條未顯示任何丟棄或影響資料流的跡象，則這些裝置的故障排除到此結束。

下一步必須檢查它們之間的中間裝置，例如防火牆、交換機和ISP。

## 解決方案

如果出現這種情況，下一步就是檢查前面輸出中顯示的介面。 這涉及檢查配置以驗證是否存在影響流量的任何內容。

WAN介面配置：

<#root>

```
SPOKE1#show running-configuration interface gigabitEthernet1
Building configuration...

Current configuration : 150 bytes
```

```
!
interface GigabitEthernet1
ip address 172.21.100.1 255.255.255.0
```

**ip access-group ESP_TRAFFIC in**

```
negotiation auto
no mop enabled
no mop sysid
end
```

作為配置的一部分，介面應用了access-group。務必確認訪問清單上配置的主機不會干擾用於NHRP協商的流量。

<#root>

```
SPOKE1#show access-lists ESP_TRAFFIC
Extended IP access list ESP_TRAFFIC
10 deny esp host 172.21.100.1 host 172.22.200.2
```

**20 deny esp host 172.22.200.2 host 172.21.100.1 (114 matches)**

```
30 permit ip any any (22748 matches)
```

訪問清單的第二個語句拒絕Spoke2的NBMA IP地址與Spoke1的NBMA IP地址之間的通訊，導致之前看到的丟棄。從介面刪除訪問組後，兩個分支之間的通訊成功：

```
SPOKE1#ping 192.168.2.2 source loopback1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.2.2, timeout is 2 seconds:
Packet sent with a source address of 192.168.1.1
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 1/2/3 ms
```

IPSEC通道已開啟，現在它顯示兩個裝置上的封裝和解除封裝：

分支1：

<#root>

```
SPOKE1#show crypto IPSEC sa peer 172.22.200.2

interface: Tunnel10
    Crypto map tag: Tunnel10-head-0, local addr 172.21.100.1

   protected vrf: (none)
   local  ident (addr/mask/prot/port): (172.21.100.1/255.255.255.255/47/0)
   remote ident (addr/mask/prot/port): (172.22.200.2/255.255.255.255/47/0)
```

```
   current_peer 172.22.200.2 port 500
     PERMIT, flags={origin_is_acl,}


#pkts encaps: 6, #pkts encrypt: 6, #pkts digest: 6



    #pkts decaps: 7, #pkts decrypt: 7, #pkts verify: 7


    #pkts compressed: 0, #pkts decompressed: 0
    #pkts not compressed: 0, #pkts compr. failed: 0
    #pkts not decompressed: 0, #pkts decompress failed: 0
    #send errors 0, #recv errors 0

     local crypto endpt.: 172.21.100.1, remote crypto endpt.: 172.22.200.2
     plaintext mtu 1458, path mtu 1500, ip mtu 1500, ip mtu idb GigabitEthernet1
     current outbound spi: 0x9392DA81(2475874945)
     PFS (Y/N): N, DH group: none

     inbound esp sas:
      spi: 0xBF8F523D(3213840957)
        transform: esp-256-aes esp-sha256-hmac ,
        in use settings ={Transport, }
        conn id: 2073, flow_id: CSR:73, sibling_flags FFFFFFFF80000008, crypto map: Tunnel10-head-0
         sa timing: remaining key lifetime (k/sec): (4607998/28783)
        IV size: 16 bytes
        replay detection support: Y
        Status: ACTIVE(ACTIVE)

     inbound ah sas:

     inbound pcp sas:

     outbound esp sas:
      spi: 0x9392DA81(2475874945)
        transform: esp-256-aes esp-sha256-hmac ,
        in use settings ={Transport, }
        conn id: 2074, flow_id: CSR:74, sibling_flags FFFFFFFF80000008, crypto map: Tunnel10-head-0
         sa timing: remaining key lifetime (k/sec): (4607999/28783)
        IV size: 16 bytes
        replay detection support: Y
        Status: ACTIVE(ACTIVE)

     outbound ah sas:

     outbound pcp sas:
```

分支2：

<#root>

```
SPOKE2#show crypto IPSEC sa peer 172.21.100.1

interface: Tunnel10
    Crypto map tag: Tunnel10-head-0, local addr 172.22.200.2

   protected vrf: (none)
```

```
   local  ident (addr/mask/prot/port): (172.22.200.2/255.255.255.255/47/0)
   remote ident (addr/mask/prot/port): (172.21.100.1/255.255.255.255/47/0)
   current_peer 172.21.100.1 port 500
     PERMIT, flags={origin_is_acl,}


#pkts encaps: 7, #pkts encrypt: 7, #pkts digest: 7



    #pkts decaps: 6, #pkts decrypt: 6, #pkts verify: 6


    #pkts compressed: 0, #pkts decompressed: 0
    #pkts not compressed: 0, #pkts compr. failed: 0
    #pkts not decompressed: 0, #pkts decompress failed: 0
    #send errors 0, #recv errors 0

     local crypto endpt.: 172.22.200.2, remote crypto endpt.: 172.21.100.1
     plaintext mtu 1458, path mtu 1500, ip mtu 1500, ip mtu idb GigabitEthernet1
     current outbound spi: 0xBF8F523D(3213840957)
     PFS (Y/N): N, DH group: none

     inbound esp sas:
      spi: 0x9392DA81(2475874945)
        transform: esp-256-aes esp-sha256-hmac ,
        in use settings ={Transport, }
        conn id: 2073, flow_id: CSR:73, sibling_flags FFFFFFFF80000008, crypto map: Tunnel10-head-0
         sa timing: remaining key lifetime (k/sec): (4607998/28783)
        IV size: 16 bytes
        replay detection support: Y
        Status: ACTIVE(ACTIVE)

     inbound ah sas:

     inbound pcp sas:

     outbound esp sas:
      spi: 0xBF8F523D(3213840957)
        transform: esp-256-aes esp-sha256-hmac ,
        in use settings ={Transport, }
        conn id: 2074, flow_id: CSR:74, sibling_flags FFFFFFFF80000008, crypto map: Tunnel10-head-0
         sa timing: remaining key lifetime (k/sec): (4607999/28783)
        IV size: 16 bytes
        replay detection support: Y
        Status: ACTIVE(ACTIVE)

     outbound ah sas:

     outbound pcp sas:
```

現在，Spoke1的DMVPN表在兩個條目上顯示正確的對映：

<#root>

```
SPOKE1#show dmvpn

Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
        N - NATed, L - Local, X - No Socket
```

```
        T1 - Route Installed, T2 - Nexthop-override, B - BGP
        C - CTS Capable, I2 - Temporary
        # Ent --> Number of NHRP entries with same NBMA peer
        NHS Status: E --> Expecting Replies, R --> Responding, W --> Waiting
        UpDn Time --> Up or Down Time for a Tunnel
==============================================================================

Interface: Tunnel10, IPv4 NHRP Details
Type:Spoke, NHRP Peers:2,

# Ent  Peer NBMA Addr Peer Tunnel Add State  UpDn Tm Attrb
----- --------------- --------------- ----- -------- -----

1 172.22.200.2     10.10.10.2    UP   00:01:31   D

     1 172.20.10.10     10.10.10.10    UP    1d05h     S
```

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）。