DHCP Relay in VXLAN BGP EVPN

This chapter contains these sections:

DHCP relay agents in VXLAN BGP EVPN fabrics

A DHCP relay agent in a VXLAN BGP EVPN fabric is a network component that

- forwards DHCP packets between hosts and DHCP servers across VXLAN overlays,
- provides relay functionality in a multi-tenant environment to support multiple virtual networks, and
- uses VXLAN VTEP capabilities along with specialized sub-options for accurate address assignment and scope selection.

In VXLAN BGP EVPN networks, DHCP relay agents (often implemented in VTEPs) facilitate communication between local DHCP clients and remote DHCP servers. The relay ensures DHCP messages traverse the VXLAN fabric, maintaining tenant isolation and supporting distributed gateway models.

You may face challenges when using distributed anycast gateway addresses. DHCP messages forwarded by a relay agent might be returned to any switch hosting the same gateway IP (GiAddr). Use a unique loopback interface as the GiAddr for each switch to ensure correct DHCP address assignment. This approach supports proper scope selection and ensures that responses are routed to the appropriate switch.

Option 82 carries additional information in DHCP messages to help identify sources and tenants. In VXLAN EVPN environments, the following sub-options are important:

Gateway IP Address (GiAddr):

The relay agent uses this field to indicate the relay's address; DHCP servers use it for scope selection and reply routing.

Virtual Tunnel Endpoint (VXLAN VTEP):

An endpoint device that encapsulates/decapsulates VXLAN traffic, often acting as a DHCP relay agent.

Relevant Option 82 sub-options

In a multi-tenant EVPN environment, DHCP relay uses these sub-options of Option 82:

- **Sub-option 151 (0x97) – Virtual Subnet Selection (RFC 6607):**

  Conveys VRF-related information to the DHCP server in an MPLS-VPN or VXLAN EVPN multi-tenant network. Helps the DHCP server select the correct IP address pool based on the virtual subnet or tenant.

- **Sub-option 11 (0xb) – Server ID Override (RFC 5107):**

  Allows the relay agent to specify a new server ID, making renewal requests return to the relay agent rather than directly to the DHCP server. The proprietary enhancement uses sub-option 152 (0x98). Use the **ip dhcp relay sub-option type cisco** command to manage the function.

- **Sub-option 5 (0x5) – Link Selection (RFC 3527):**

  Separates the DHCP client's subnet from the relay's GiAddr, enabling the DHCP server to assign an address based on the correct subscriber subnet. The proprietary enhancement uses sub-option 152 (0x98). Use the **ip dhcp relay sub-option type cisco** command to manage the function.

In a multi-tenant data center network using VXLAN BGP EVPN, each switch (VTEP) employs a unique loopback interface as its GiAddr. DHCP relay agents add Option 82 sub-options to DHCP messages:

- Sub-option 151 informs the DHCP server which tenant (VRF) the request originated from.
- Sub-option 11 (Server ID Override) ensures clients send DHCP renew requests to the appropriate relay.
- Sub-option 5 (Link Selection) helps in exact subnet assignment.

This model allows the network to correctly assign IP addresses and manage tenant isolation, even with distributed gateways.

Guidelines and limitations for DHCP relay in VXLAN BGP EVPN

DHCP Relay in VXLAN BGP EVPN has the following configuration guideline and limitation:

- DHCP Relay in VXLAN BGP EVPN feature is not supported on EoR switches.

DHCP relay in VXLAN BGP EVPN supported release and platform

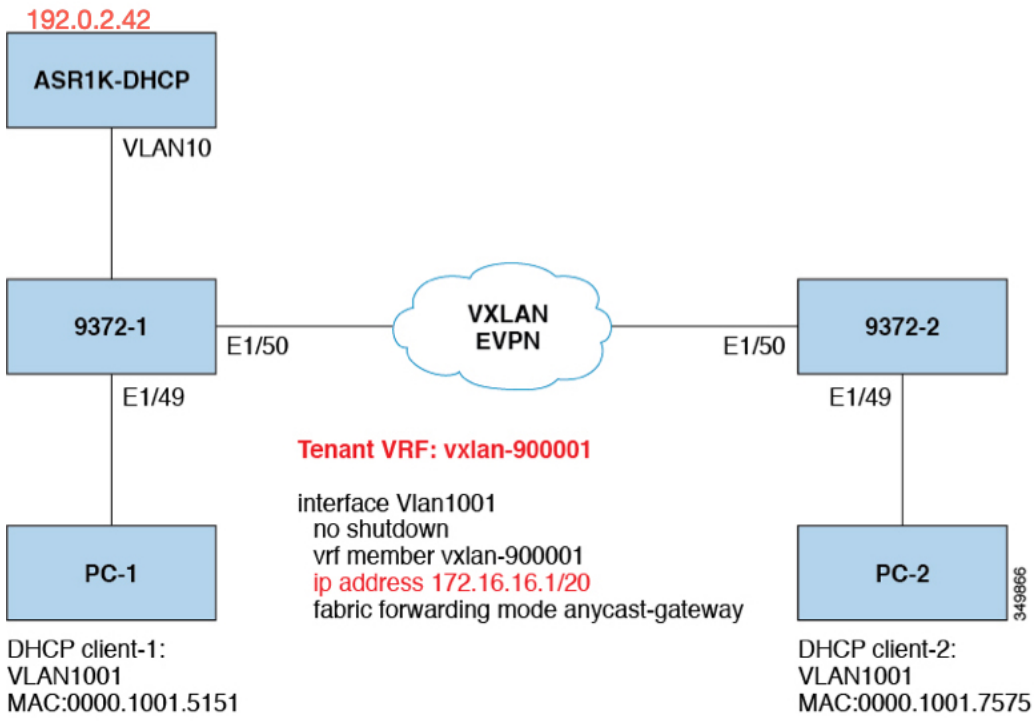
Table 1: Supported releases and platforms

Release	Platform
7.x and later	Cisco Nexus 9300-EX/FX/FX2 Series switches
9.2(x) and later	Cisco Nexus 9300-GX Series switches

Release	Platform
9.3(x) and later	Cisco Nexus 9300-FX3 Series switches
10.2(3)F and later	Cisco Nexus 9300-GX2 Series switches

DHCP Relay in VXLAN BGP EVPN Example

Figure 1: Example Topology



Topology characteristics:

- Switches 9372-1 and 9372-2 are VTEPs connected to the VXLAN fabric.
- Client1 and client2 are DHCP clients in vlan1001. They belong to tenant VRF vxlan-900001.
- The DHCP server is ASR1K, a router that sits in vlan10.
- DHCP server configuration

```
ip vrf vxlan900001
ip dhcp excluded-address vrf vxlan900001 172.16.16.1 172.16.16.9
ip dhcp pool one
 vrf vxlan900001
 network 172.16.16.0 255.240.0.0
 defaultrouter 172.16.16.1
```

DHCP Relay on VTEPs

The following are common deployment scenarios:

- Client on tenant VRF and server on Layer 3 default VRF.
- Client on tenant VRF (SVI X) and server on the same tenant VRF (SVI Y).
- Client on tenant VRF (VRF X) and server on different tenant VRF (VRF Y).
- Client on tenant VRF and server on non-default non-VXLAN VRF.

The following sections below move vlan10 to different VRFs to depict different scenarios.

Client on Tenant VRF and Server on Layer 3 Default VRF

Put DHCP server (192.0.2.42) into the default VRF and make sure it is reachable from both 9372-1 and 9372-2 through the default VRF.

```
9372-1# sh run int vl 10

!Command: show running-config interface Vlan10
!Time: Mon Aug 24 07:51:16 2018

version 7.0(3)I1(3)

interface Vlan10
  no shutdown
  ip address 192.0.2.25/24
  ip router ospf 1 area 0.0.0.0

9372-1# ping 192.0.2.42 cou 1

PING 192.0.2.42 (192.0.2.42): 56 data bytes
64 bytes from 192.0.2.42: icmp_seq=0 ttl=254 time=0.593 ms
- 192.0.2.42 ping statistics -
1 packets transmitted, 1 packets received, 0.00% packet loss
roundtrip min/avg/max = 0.593/0.592/0.593 ms

9372-2# ping 192.0.2.42 cou 1
PING 192.0.2.42 (192.0.2.42): 56 data bytes
64 bytes from 192.0.2.42: icmp_seq=0 ttl=252 time=0.609 ms
- 192.0.2.42 ping statistics -
1 packets transmitted, 1 packets received, 0.00% packet loss
round-trip min/avg/max = 0.609/0.608/0.609 ms
```

DHCP Relay Configuration

- 9372-1

```
9372—1# sh run dhcp

!Command: show running—config dhcp
!Time: Mon Aug 24 08:26:00 2018
```

```
version 7.0(3) I1(3)
feature dhcp

service dhcp
ip dhcp relay
ip dhcp relay information option
ip dhcp relay information option vpn
ipv6 dhcp relay

interface Vlanl001
  ip dhcp relay address 192.0.2.42 use—vrf default
```

- 9372-2

```
9372-2# sh run dhcp

!Command: show running—config dhcp
!Time: Mon Aug 24 08:26:16 2018

version 7.0(3)11(3)
feature dhcp

service dhcp
ip dhcp relay
ip dhcp relay information option
ip dhcp relay information option vpn
ipv6 dhcp relay

interfaoe Vlanl001
  ip dhcp relay address 192.0.2.42 use—vrf default
```

Debug Output

- The following is a packet dump for DHCP interact sequences.

```
9372-1# ethanalyzer local interface inband display-filter
"udp.srcport==67 or udp.dstport==67" limit-captured frames 0

Capturing on inband
20180824 08:35:25.066530 0.0.0.0 -> 255.255.255.0 DHCP DHCP Discover - Transaction ID
0x636a38fd
20180824 08:35:25.068141 192.0.2.25 -> 192.0.2.42 DHCP DHCP Discover - Transaction ID
0x636a38fd
20180824 08:35:27.069494 192.0.2.42 -> 192.0.2.25 DHCP DHCP Offer Transaction - ID
0x636a38fd
20180824 08:35:27.071029 172.16.16.1 -> 172.16.16.11 DHCP DHCP Offer Transaction - ID
0x636a38fd
20180824 08:35:27.071488 0.0.0.0 -> 255.255.255.0 DHCP DHCP Request Transaction - ID
0x636a38fd
20180824 08:35:27.072447 192.0.2.25 -> 192.0.2.42 DHCP DHCP Request Transaction - ID
0x636a38fd
20180824 08:35:27.073008 192.0.2.42 -> 192.0.2.25 DHCP DHCP ACK Transaction - ID
0x636a38fd
20180824 08:35:27.073692 172.16.16.1 -> 172.16.16.11 DHCP DHCP ACK Transaction - ID
0x636a38fd
```

Note Ethanalyzer might not capture all DHCP packets because of inband interpretation issues when you use the filter. You can avoid this by using SPAN.

- DHCP Discover packet 9372-1 sent to DHCP server.

  giaddr is set to 192.0.2.25 (ip address of vlan10) and suboptions 5/11/151 are set accordingly.

```
Bootp flags: 0x0000 (unicast)
client IP address: 0.0.0.0 (0.0.0.0)
Your (client) IP address: 0.0.0.0 (0.0.0.0)
Next server IP address: 0.0.0.0 (0.0.0.0)
Relay agent IP address: 192.0.2.25 (192.0.2.25)
client MAC address Hughes_01:51:51 (00:00:10:01:51:51)
client hardware address padding: 00000000000000000000
Server host name not given
Boot file name not given
Magic cookie: DHCP
Option: (53) DHCP Message Type
  Length: 1
  DHCP: Discover (1)
Option: (55) Parameter Request List
  Length: 4
  Parameter Request List Item: (1) Subnet Mask
  Parameter Request List Item: (3) Router
  Parameter Request List Item: (58) Renewal Time Value
  Parameter Request List Item: (59) Rebinding Time Value
Option: (61) client identifier
  Length: 7
  Hardware type: Ethernet (0x01)
  Client MAC address: Hughes_01:51:51 (00:00:10:01:51:51)
Option: (82) Agent Information Option
  Length: 47
Option 82 Suboption: (1) Agent Circuit ID
  Length: 10
  Agent Circuit ID: 01080006001e88690030
Option 82 Suboption: (2) Agent Remote ID
  Length: 6
  Agent Remote ID: f8c2882333a5
Option 82 Suboption: (151) VRF name/VPN ID
Option 82 Suboption: (11) Server ID Override
  Length: 4
  Server ID Override: 172.16.16.1 (172.16.16.1)
Option 82 Suboption: (5) Link selection
  Length: 4
  Link selection: 172.16.16.0 (172.16.16.0)
```

```
ASR1K-DHCP# sh ip dhcp bin
Bindings from all pools not associated with VRF:
IP address ClientID/ Lease expiration Type State Interface
         Hardware address/
         User name

Bindings from VRF pool vxlan900001:
IP address ClientID/ Lease expiration Type State Interface
         Hardware address/
         User name
```

```
172.16.16.10 0100.0010.0175.75 Aug 25 2018 09:21 AM Automatic Active GigabitEthernet2/1/0
172.16.16.11 0100.0010.0151.51 Aug 25 2018 08:54 AM Automatic Active GigabitEthernet2/1/0

9372-1# sh ip route vrf vxlan900001
IP Route Table for VRF "vxlan900001"
'*' denotes best ucast nexthop
'**' denotes best mcast nexthop
'[x/y]' denotes [preference/metric]
'%<string>' in via output denotes VRF <string>

10.11.11.11/8, ubest/mbest: 2/0, attached
  *via 10.11.11.11, Lo1, [0/0], 18:31:57, local
  *via 10.11.11.11, Lo1, [0/0], 18:31:57, direct
10.22.22.22/8, ubest/mbest: 1/0
  *via 1.2.2.2%default, [200/0], 18:31:57, bgp65535,internal, tag 65535 (evpn)segid:
900001 tunnelid: 0x2020202
encap: VXLAN

172.16.16.0/20, ubest/mbest: 1/0, attached
 *via 172.16.16.1, Vlan1001, [0/0], 18:31:57, direct
172.16.16.1/32, ubest/mbest: 1/0, attached
 *via 172.16.16.1, Vlan1001, [0/0], 18:31:57, local
172.16.16.10/32, ubest/mbest: 1/0
 *via 1.2.2.2%default, [200/0], 00:00:47, bgp65535,internal, tag 65535 (evpn)segid:
900001 tunnelid: 0x2020202
encap: VXLAN

172.16.16.11/32, ubest/mbest: 1/0, attached
 *via 172.16.16.11, Vlan1001, [190/0], 00:28:10, hmm

9372-1# ping 172.16.16.11 vrf vxlan900001 count 1
PING 172.16.16.11 (172.16.16.11): 56 data bytes
64 bytes from 172.16.16.11: icmp_seq=0 ttl=63 time=0.846 ms
- 172.16.16.11 ping statistics -
1 packets transmitted, 1 packets received, 0.00% packet loss
round-trip min/avg/max = 0.846/0.845/0.846 ms

9372-1# ping 172.16.16.10 vrf vxlan900001 count 1
PING 172.16.16.10 (172.16.16.10): 56 data bytes
64 bytes from 172.16.16.10: icmp_seq=0 ttl=62 time=0.874 ms
- 172.16.16.10 ping statistics -
1 packets transmitted, 1 packets received, 0.00% packet loss
round-trip min/avg/max = 0.874/0.873/0.874 ms
```

Client on Tenant VRF (SVI X) and Server on the Same Tenant VRF (SVI Y)

Put DHCP server (192.0.2.42) into VRF of vxlan-900001 and make sure it is reachable from both 9372-1 and 9372-2 through VRF of vxlan-900001.

```
9372-1# sh run int vl 10

!Command: show running-config interface Vlan10
!Time: Mon Aug 24 09:10:26 2018

version 7.0(3)I1(3)
```

```
interface Vlan10
  no shutdown
  vrf member vxlan-900001
  ip address 192.0.2.25/24
```

Because 172.16.16.1 is an anycast address for vlan1001 configured on all the VTEPs, we need to pick up a unique address as the DHCP relay packet's source address to make sure the DHCP server can deliver a response to the original DHCP Relay agent. In this scenario, we use loopback1 and we need to make sure loopback1 is reachable from everywhere of VRF vxlan-900001.

```
9372-1# sh run int lo1

!Command: show running-config interface loopback1
!Time: Mon Aug 24 09:18:53 2018

version 7.0(3)I1(3)

interface loopback1
  vrf member vxlan-900001
  ip address 10.11.11.11/8

9372-1# ping 192.0.2.42 vrf vxlan900001 source 10.11.11.11 cou 1
PING 192.0.2.42 (192.0.2.42) from 10.11.11.11: 56 data bytes
64 bytes from 192.0.2.42: icmp_seq=0 ttl=254 time=0.575 ms
- 192.0.2.42 ping statistics -
1 packets transmitted, 1 packets received, 0.00% packet loss
round-trip min/avg/max = 0.575/0.574/0.575 ms

9372-2# sh run int lo1

!Command: show running-config interface loopback1
!Time: Mon Aug 24 09:19:30 2018

version 7.0(3)I1(3)

interface loopback1
  vrf member vxlan900001
  ip address 10.22.22.22/8

9372-2# ping 192.0.2.42 vrf vxlan-900001 source 10.22.22.22 cou 1
PING 192.0.2.42 (192.0.2.42) from 10.22.22.22: 56 data bytes
64 bytes from 192.0.2.42: icmp_seq=0 ttl=253 time=0.662 ms
- 192.0.2.42 ping statistics -
1 packets transmitted, 1 packets received, 0.00% packet loss
round-trip min/avg/max = 0.662/0.662/0.662 ms
```

DHCP Relay Configuration

- 9372-1

```
9372—1# sh run dhcp

!Command: show running-config dhcp
!Time: Mon Aug 24 08:26:00 2018

version 7.0(3)11(3)
feature dhcp
```

```
service dhcp
ip dhcp relay
ip dhcp relay information option
I4ip dhcp relay information option vpn
ipv6 dhcp relay

interface Vlanl00l
  ip dhcp relay address 192.0.2.42
  ip dhcp relay source—interface loopback1
```

- 9372-2

```
9372—2# sh run dhcp

!Command: show running-config dhcp
!Time: Mon Aug 24 08:26:16 2018

version 7.0(3) 11(3)
feature dhcp

service dhcp
ip dhcp relay
ip dhcp relay information option
ip dhcp relay information option vpn
ipv6 dhcp relay

interface Vlanl00l
  ip dhcp relay address 192.0.2.42
  ip dhcp relay source—interface loopback1
```

Debug Output

- The following is a packet dump for DHCP interact sequences.

```
9372-1# ethanalyzer local interface inband display-filter
"udp.srcport==67 or udp.dstport==67" limit-captured frames 0

Capturing on inband
20180824 09:31:38.129393 0.0.0.0 -> 255.255.255.0 DHCP DHCP Discover - Transaction ID
0x860cd13
20180824 09:31:38.129952 10.11.11.11 -> 192.0.2.42 DHCP DHCP Discover - Transaction ID
 0x860cd13
20180824 09:31:40.130134 192.0.2.42 -> 10.11.11.11 DHCP DHCP Offer - Transaction ID
0x860cd13
20180824 09:31:40.130552 172.16.16.1 -> 172.16.16.11 DHCP DHCP Offer - Transaction ID
0x860cd13
20180824 09:31:40.130990 0.0.0.0 -> 255.255.255.0 DHCP DHCP Request - Transaction ID
0x860cd13
20180824 09:31:40.131457 10.11.11.11 -> 192.0.2.42 DHCP DHCP Request - Transaction ID
0x860cd13
20180824 09:31:40.132009 192.0.2.42 -> 10.11.11.11 DHCP DHCP ACK - Transaction ID
0x860cd13
20180824 09:31:40.132268 172.16.16.1 -> 172.16.16.11 DHCP DHCP ACK - TransactionID
0x860cd13
```

Note Ethanalyzer might not capture all DHCP packets because of inband interpretation issues when you use the filter. You can avoid this by using SPAN.

- DHCP Discover packet 9372-1 sent to DHCP server.

  giaddr is set to 10.11.11.11(loopback1) and suboptions 5/11/151 are set accordingly.

```
Bootstrap Protocol
  Message type: Boot Request (1)
  Hardware type: Ethernet (0x01)
  Hardware address length: 6
  Hops: 1
  Transaction ID: 0x0860cd13
  Seconds elapsed: O
  Bootp flags: 0x0000 (unicast)
  Client IP address: 0.0.0.0 (0.0.0.0)
  Your (client) IP address: 0.0.0.0 (0.0.0.0)
  Next server IP address: 0.0.0.0 (0.0.0.0)
  Relay agent iP address: 10.11.11.11 (10.11.11.11)
  Client MAC address: Hughes_01:51:51 (00:00:10:01:51:51)
  Client hardware address padding: 00000000000000000000
  Server host name not given
  Boot file name not given
  Magic cookie: DHCP
  Option: (53) DHCP Message Type
    Length: 1
    DHCP: Discover (1)
  Option: (55) Parameter Request List
  Option: (61) Client Identifier
  Option: (82) Agent Information Option
    Length: 47
  Option 82 suboption: (1) Aqent Circuit ID
  Option 82 suboption: (151) Agent Remote ID
  Option 82 suboption: (11) Server ID Override
    Length: 4
    Server ID override: 172.16.16.1 (172.16.16.1)
  Option 82 suboption: (5) Link selection
    Length: 4
    Link selection: 172.16.16.0 (172.16.16.0)
```

```
ASR1K-DHCP# sh ip dhcp bin
Bindings from all pools not associated with VRF:
IP address ClientID/Lease expiration Type State Interface
         Hardware address/
         User name

Bindings from VRF pool vxlan-900001:
IP address ClientID/Lease expiration Type State Interface
         Hardware address/
         User name

172.16.16.10 0100.0010.0175.75 Aug 25 2018 10:02 AM Automatic Active GigabitEthernet2/1/0
172.16.16.11 0100.0010.0151.51 Aug 25 2018 09:50 AM Automatic Active GigabitEthernet2/1/0

9372-1# sh ip route vrf vxlan-900001
IP Route Table for VRF "vxlan-900001"
```

```
'*' denotes best ucast nexthop
'**' denotes best mcast nexthop
'[x/y]' denotes [preference/metric]
'%<string>' in via output denotes VRF <string>

10.11.11.11/8, ubest/mbest: 2/0, attached
  *via 10.11.11.11, Lo1, [0/0], 19:13:56, local
  *via 10.11.11.11, Lo1, [0/0], 19:13:56, direct
10.22.22.22/8, ubest/mbest: 1/0
  *via 2.2.2.2%default, [200/0], 19:13:56, bgp65535,internal, tag 65535 (evpn)segid:
900001 tunnelid: 0x2020202
encap: VXLAN
172.16.16.0/20, ubest/mbest: 1/0, attached
  *via 172.16.16.1, Vlan1001, [0/0], 19:13:56, direct
172.16.16.1/32, ubest/mbest: 1/0, attached
  *via 172.16.16.1, Vlan1001, [0/0], 19:13:56, local
172.16.16.10/32, ubest/mbest: 1/0
  *via 2.2.2.2%default, [200/0], 00:01:27, bgp65535,
internal, tag 65535 (evpn)segid: 900001 tunnelid: 0x2020202
encap: VXLAN
172.16.16.11/32, ubest/mbest: 1/0, attached
  *via 172.16.16.11, Vlan1001, [190/0], 00:13:56, hmm
192.0.2.20/24, ubest/mbest: 1/0, attached
  *via 192.0.2.25, Vlan10, [0/0], 00:36:08, direct
192.0.2.25/24, ubest/mbest: 1/0, attached
  *via 192.0.2.25, Vlan10, [0/0], 00:36:08, local
9372-1# ping 172.16.16.10 vrf vxlan-900001 cou 1
PING 172.16.16.10 (172.16.16.10): 56 data bytes
64 bytes from 172.16.16.10: icmp_seq=0 ttl=62 time=0.808 ms
- 172.16.16.10 ping statistics -
1 packets transmitted, 1 packets received, 0.00% packet loss
round-trip min/avg/max = 0.808/0.808/0.808 ms

9372-1# ping 172.16.16.11 vrf vxlan-900001 cou 1
PING 172.16.16.11 (172.16.16.11): 56 data bytes
64 bytes from 172.16.16.11: icmp_seq=0 ttl=63 time=0.872 ms
- 172.16.16.11 ping statistics -
1 packets transmitted, 1 packets received, 0.00% packet loss
round-trip min/avg/max = 0.872/0.871/0.872 ms
```

Client on Tenant VRF (VRF X) and Server on Different Tenant VRF (VRF Y)

The DHCP server is placed into another tenant VRF vxlan-900002 so that DHCP response packets can access the original relay agent. We use loopback2 to avoid any anycast ip address that is used as the source address for the DHCP relay packets.

```
9372-1# sh run int vl 10
!Command: show runningconfig interface Vlan10
!Time: Tue Aug 25 08:48:22 2018

version 7.0(3)I1(3)
interface Vlan10
  no shutdown
  vrf member vxlan900002
  ip address 192.0.2.40/24
```

```
9372-1# sh run int lo2
!Command: show runningconfig interface loopback2
!Time: Tue Aug 25 08:48:57 2018
version 7.0(3)I1(3)
interface loopback2
  vrf member vxlan900002
  ip address 10.33.33.33/8

9372-2# sh run int lo2
!Command: show runningconfig interface loopback2
!Time: Tue Aug 25 08:48:44 2018
version 7.0(3)I1(3)
interface loopback2
  vrf member vxlan900002
  ip address 10.44.44.44/8

9372-1# ping 192.0.2.42 vrf vxlan-900002 source 10.33.33.33 cou 1
PING 192.0.2.42 (192.0.2.42) from 10.33.33.33: 56 data bytes
64 bytes from 192.0.2.42: icmp_seq=0 ttl=254 time=0.544 ms
- 192.0.2.42 ping statistics -
1 packets transmitted, 1 packets received, 0.00% packet loss
round-trip min/avg/max = 0.544/0.544/0.544 ms

9372-2# ping 192.0.2.42 vrf vxlan-900002 source 10.44.44.44 count 1
PING 192.0.2.42 (192.0.2.42) from 10.44.44.44: 56 data bytes
64 bytes from 192.0.2.42: icmp_seq=0 ttl=253 time=0.678 ms
- 192.0.2.42 ping statistics -
1 packets transmitted, 1 packets received, 0.00% packet loss
round-trip min/avg/max = 0.678/0.678/0.678 ms
```

DHCP Relay Configuration

- 9372-1

```
9372—1# sh run dhcp

!Command: show running—config dhcp
!Time: Mon Aug 24 08:26:00 2018

version 7.0(3) Ii (3)
feature dhcp

service dhcp
ip dhcp relay
ip dhcp relay information option
ip dhcp relay information option vpn
ipv6 dhcp relay

interface VlanlOOl
  ip dhcp relay address 192.0.2.42 use—vrf vxlan—900002
  ip dhcp relay source—interface loopback2
```

- 9372-2

```
!Command: show running-config dhcp
!Time: Mon Aug 24 08:26:16 2018

version 7.0(3)11(3)
```

```
feature dhcp

service dhcp
ip dhcp relay
ip dhcp relay information option
ip dhcp relay information option vpn
ipv6 dhcp relay

interface VlaniOOl
  ip dhcp relay address 192.0.2.42 use-vrf vxlan—900002
  ip dhcp relay source—interface loopback2
```

Debug Output

- The following is a packet dump for DHCP interact sequences.

```
9372-1# ethanalyzer local interface inband display-filter "udp.srcport==67 or
udp.dstport==67" limit-captured-frames 0
Capturing on inband
20180825 08:59:35.758314 0.0.0.0 -> 255.255.255.0 DHCP DHCP Discover - Transaction ID
0x3eebccae
20180825 08:59:35.758878 10.33.33.33 -> 192.0.2.42 DHCP DHCP Discover - Transaction ID
 0x3eebccae
20180825 08:59:37.759560 192.0.2.42 -> 10.33.33.33 DHCP DHCP Offer - Transaction ID
0x3eebccae
20180825 08:59:37.759905 172.16.16.1 -> 172.16.16.11 DHCP DHCP Offer - Transaction ID
0x3eebccae
20180825 08:59:37.760313 0.0.0.0 -> 255.255.255.0 DHCP DHCP Request - Transaction ID
0x3eebccae
20180825 08:59:37.760733 10.33.33.33 -> 192.0.2.42 DHCP DHCP Request - Transaction ID
0x3eebccae
20180825 08:59:37.761297 192.0.2.42 -> 10.33.33.33 DHCP DHCP ACK - Transaction ID
0x3eebccae
20180825 08:59:37.761554 172.16.16.1 -> 172.16.16.11 DHCP DHCP ACK - Transaction ID
0x3eebccae
```

- DHCP Discover packet 9372-1 sent to DHCP server.

  giaddr is set to 10.33.33.33 (loopback2) and suboptions 5/11/151 are set accordingly.

```
Bootstrap Protocol
  Message type: Boot Request (1)
  Hardware type: Ethernet (0x01)
  Hardware address length: 6
  Hops: 1
  Transaction ID: Ox3eebccae
  Seconds elapsed: O
  Bootp flags: 0x0000 (unicast)
  Client IP address: 0.0.0.0 (0.0.0.0)
  Your (client) IP address: 0.0.0.0 (0.0.0.0)
  Next server IP address: 0.0.0.0 (0.0.0.0)
  Relay agent IP address: 10.33.33.33 (10.33.33.33)
  Client MAC address: i-iughes_01:51:51 (00:00:10:01:51:51)
  Client hardware address padding: 00000000000000000000
  Server host name not given
  Boot file name not given
  Magic cookie: DHCP
  Option: (53) DHCP Message Type
    Length: 1
```

```
  DHCP: Discover (1)
Option: (55) Parameter Request List
Option: (61) client identifier
Option: (82) Agent Information option
  Length: 47
Option 82 Suboption: (1) Agent circuit W
Option 82 suboption: (2) Agent Remote 10
Option 82 suboption: (151) VRF name/VPN ID
Option 82 Suboption: (11) Server ID Override
  Length: 4
  Server ID Override: 172.16.16.1 (172.16.16.1)
Option 82 Suboption: (5) Link selection
  Length: 4
  Link selection: 172.16.16.0 (172.16.16.0)
```

Client on Tenant VRF and Server on Non-Default Non-VXLAN VRF

The DHCP server is placed into the management VRF and is reachable the through M0 interface. The IP address changes to 10.122.164.147 accordingly.

```
9372-1# sh run int m0
!Command: show running-config interface mgmt0
!Time: Tue Aug 25 09:17:04 2018
version 7.0(3)I1(3)
interface mgmt0
  vrf member management
  ip address 10.122.165.134/8

9372-1# ping 10.122.164.147 vrf management cou 1
PING 10.122.164.147 (10.122.164.147): 56 data bytes
64 bytes from 10.122.164.147: icmp_seq=0 ttl=251 time=1.024 ms
- 10.122.164.147 ping statistics -
1 packets transmitted, 1 packets received, 0.00% packet loss
round-trip min/avg/max = 1.024/1.024/1.024 ms

9372-2# sh run int m0
!Command: show running-config interface mgmt0
!Time: Tue Aug 25 09:17:47 2018
version 7.0(3)I1(3)
interface mgmt0
  vrf member management
  ip address 10.122.165.148/8

9372-2# ping 10.122.164.147 vrf management cou 1
PING 10.122.164.147 (10.122.164.147): 56 data bytes
64 bytes from 10.122.164.147: icmp_seq=0 ttl=251 time=1.03 ms
- 10.122.164.147 ping statistics -
1 packets transmitted, 1 packets received, 0.00% packet loss
round-trip min/avg/max = 1.03/1.03/1.03 ms
```

DHCP Relay Configuration

- 9372-1

```
9372—1# sh run dhcp 9372—2# sh run dhcp

!Command: show running-config dhcp
!Time: Mon Aug 24 08:26:00 2018

version 7.0(3)11(3)
feature dhcp

service dhcp
ip dhcp relay
ip dhcp relay information option
ip dhcp relay information option vpn
ipv6 dhcp relay

interface VlanlOOl
  ip dhcp relay address 10.122.164.147 use—vrf management
```

- 9372-2

```
9372-2# sh run dhcp
!Command: show running-config dhcp
!Time: Tue Aug 25 09:17:47 2018

version 7.0(3)11(3)
feature dhcp

service dhcp
ip dhcp relay
ip dhcp relay information option
ip dhcp relay information option vpn
ipv6 dhcp relay

interface VlanlOOl
ip dhcp relay address 10.122.164.147 use—vrf management
```

Debug Output

- The following is a packet dump for DHCP interact sequences.

```
9372-1# ethanalyzer local interface inband display-filter "udp.srcport==67 or
udp.dstport==67" limit-captured-frames 0
Capturing on inband
20180825 09:30:54.214998 0.0.0.0 -> 255.255.255.0 DHCP DHCP Discover - Transaction ID
0x28a8606d
20180825 09:30:56.216491 172.16.16.1 -> 172.16.16.11 DHCP DHCP Offer - Transaction ID
0x28a8606d
20180825 09:30:56.216931 0.0.0.0 -> 255.255.255.0 DHCP DHCP Request - Transaction ID
0x28a8606d
20180825 09:30:56.218426 172.16.16.1 -> 172.16.16.11 DHCP DHCP ACK - Transaction ID
0x28a8606d

9372-1# ethanalyzer local interface mgmt display-filter "ip.src==10.122.164.147 or
ip.dst==10.122.164.147" limit-captured-frames 0
Capturing on mgmt0
20180825 09:30:54.215499 10.122.165.134 -> 10.122.164.147 DHCP DHCP Discover - Transaction
 ID 0x28a8606d
20180825 09:30:56.216137 10.122.164.147 -> 10.122.165.134 DHCP DHCP Offer - Transaction
 ID 0x28a8606d
```

```
20180825 09:30:56.217444 10.122.165.134 -> 10.122.164.147 DHCP DHCP Request - Transaction
 ID 0x28a8606d
20180825 09:30:56.218207 10.122.164.147 -> 10.122.165.134 DHCP DHCP ACK - Transaction
ID 0x28a8606d
```

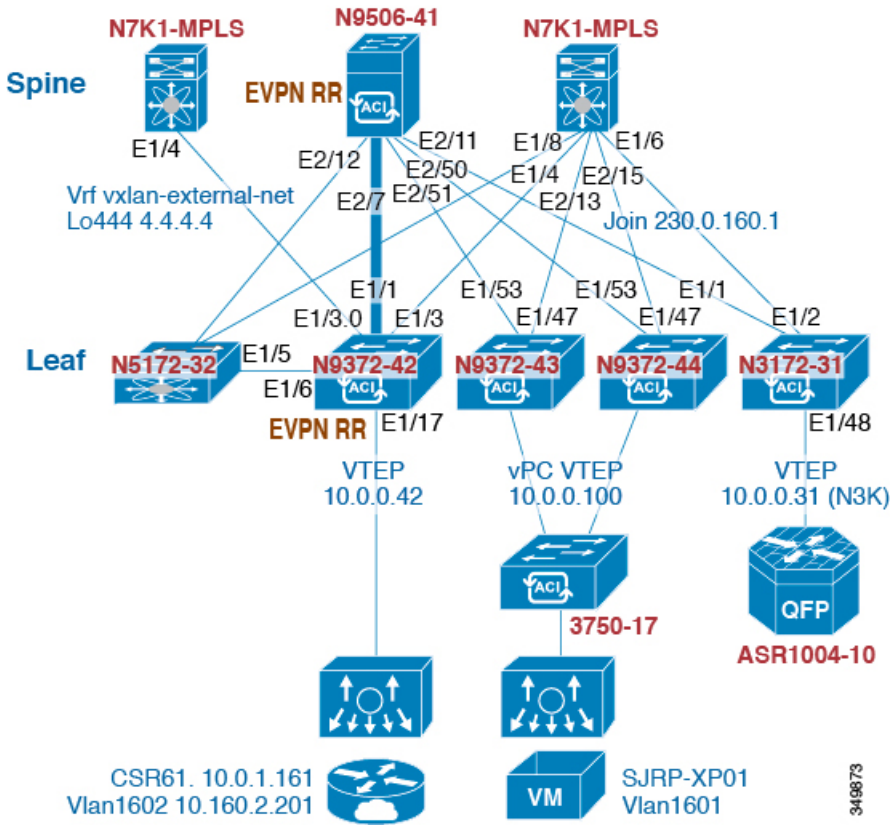
- DHCP Discover packet 9372-1 sent to DHCP server.

  giaddr is set to 10.122.165.134 (mgmt0) and suboptions 5/11/151 are set accordingly.

```
Bootstrap Protocol
  Message type: Boot Request (1)
  Hardware type: Ethernet (0x01)
  Hardware address length: 6
  Hops: 1
  Transaction ID: 0x28a8606d
  Seconds elapsed: O
  Bootp flags: 0x0000 (Unicast)
  Client IP address: 0.0.0.0 (0.0.0.0)
  Your (client) IP address: 0.0.0.0 (0.0.0.0)
  Next server IP address: 0.0.0.0 (0.0.0.0)
  Relay agent IP address: 10.122.165.134 (10.122.165.134)
  Client MAC address: Hughes_01:51:51 (00:00:10:01:51:51)
  Client hardware address padding: 00000000000000000000
  Server host name not given
  Boot file name not given
  Magic cookie: DHCP
  Option: (53) DHCP Message Type
    Length: 1
    DHCP: Discover (1)
  Option: (55) Parameter Request List
  Option: (61) Client identifier
  Option: (82) Agent Information Option
    Length: 47
    Option 82 Suboption: (1) Agent Circuit ID
    Option 82 Suboption: (2) Agent Remote ID
    Option 82 Suboption: (151) VRF name/VPN ID
    Option 82 Suboption: (11) Server ID Override
      Length: 4
      Server ID Override: 172.16.16.1 (172.16.16.1)
    Option 82 Suboption: (5) Link selection
      Length: 4
      Link selection: 172.16.16.0 (172.16.16.0)
```

Configuring vPC Peers Example

The following is an example of how to configure routing between vPC peers in the overlay VLAN for a DHCP relay configuration.



- Enable DHCP service.

```
service dhcp
```

- Configure DHCP relay.

```
ip dhcp relay
ip dhcp relay information option
ip dhcp relay sub-option type cisco
ip dhcp relay information option vpn
```

- Create loopback under VRF where you need DHCP relay service.

```
interface loopback601
  vrf member evpn-tenant-kk1
  ip address 192.0.2.36/24
  ip router ospf 1 area 0     /* Only required for vPC VTEP. */
```

- Advertise LoX into the Layer 3 VRF BGP.

```
Router bgp 2
vrf X
   network 10.1.1.42/8
```

- Configure DHCP relay on the SVI under the VRF.

```
interface Vlan1601
  vrf member evpn-tenant-kk1
  ip address 10.160.1.254/8
  fabric forwarding mode anycast-gateway
  ip dhcp relay address 10.160.2.201
  ip dhcp relay source-interface loopback601
```

- Configure Layer 3 VNI SVI with **ip forward**.

```
interface Vlan1600
  vrf member evpn-tenant-kk1
    ip forward
```

- Create the routing VLAN/SVI for the vPC VRF.

Note Only required for vPC VTEP

```
Vlan 1605
interface Vlan1605
  vrf member evpn-tenant-kk1
  ip address 10.160.5.43/8
  ip router ospf 1 area 10.10.10.41
```

- Create the VRF routing.

Note Only required for vPC VTEP.

```
router ospf 1
vrf evpn-tenant-kk1
    router-id 10.160.5.43
```

vPC VTEP DHCP Relay Configuration Example

To address a need to configure a VLAN that is allowed across the MCT/peer-link, such as a vPC VLAN, an SVI can be associated to the VLAN and is created within the tenant VRF. This becomes an underlay peering, with the underlay protocol, such as OSPF, that needs the tenant VRF instantiated under the routing process.

Alternatively, instead of placing the SVI within the routing protocol and instantiate the Tenant-VRF under the routing process, you can use the static routes between the vPC peers across the MCT. This approach ensures that the reply from the server returns to the correct place and each VTEP uses a different loopback interface for the GiAddr.

The following are examples of these configurations:

- Configuration of SVI within underlay routing:

```
/* vPC Peer-1 */

router ospf UNDERLAY
vrf tenant-vrf

interface Vlan2000
  no shutdown
  mtu 9216
  vrf member tenant-vrf
  ip address 192.168.1.1/16
  ip router ospf UNDERLAY area 0.0.0.0


/* vPC Peer-2 */

router ospf UNDERLAY
vrf tenant-vrf

interface Vlan2000
  no shutdown
  mtu 9216
  vrf member tenant-vrf
  ip address 192.168.1.2/16
  ip router ospf UNDERLAY area 0.0.0.0
```

- Configuration of SVI using static routes between vPC peers across the MCT:

```
/* vPC Peer-1 */

interface Vlan2000
  no shutdown
  mtu 9216
  vrf member tenant-vrf
  ip address 192.168.1.1/16

vrf context tenant-vrf
ip route 192.168.1.2/16 192.168.1.1


/* vPC Peer-2 */

interface Vlan2000
  no shutdown
  mtu 9216
  vrf member tenant-vrf
  ip address 192.168.1.2/16

vrf context tenant-vrf
ip route 192.168.1.1/16 192.168.1.2
```