



Configuring DHCP Relay in a BGP EVPN VXLAN Fabric

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Restrictions for DHCP Relay in a BGP EVPN VXLAN Fabric

- DHCP relay in a BGP EVPN VXLAN fabric is supported in the following scenarios only when VRF-Lite is configured on the border VTEP and the border VTEP is connected to the DHCP server through an external router.
 - DHCP client in the tenant VRF and DHCP server in the Layer 3 default VRF
 - DHCP client in the tenant VRF and DHCP server in a different tenant VRF
 - DHCP client in the tenant VRF and DHCP server in a non-default non-VXLAN VRF
- DHCPv6 relay is not supported.

Information About DHCP Relay in a BGP EVPN VXLAN Fabric

Networks use DHCP relay to forward DHCP packets between host devices and a DHCP server. In a BGP EVPN VXLAN fabric, you can configure a VTEP as a relay agent to provide DHCP relay services in a multi-tenant VXLAN environment.

When a network uses DHCP relay, DHCP messages move through the same switch in both directions. DHCP relay generally uses the gateway IP address (GiAddr) for scope selection and DHCP response messages. In a BGP EVPN VXLAN fabric that has distributed IP anycast gateway enabled, DHCP messages can return to any switch that hosts the respective GiAddr.

Deploying DHCP relay in an EVPN VXLAN network requires a different method for scope selection and a unique IP address for each switch in the network. The unique Loopback interface for a switch becomes the GiAddr that a switch uses to respond to the correct switch. DHCP option 82, also referred to as DHCP option VPN, is used for scope selection based on the Layer 2 VNI.

In a multi-tenant EVPN environment, DHCP relay uses the following sub-options of option 82:

- **Sub-Option 151(0x97)—Virtual Subnet Selection:**

The virtual subnet selection sub-option is used to convey VRF-related information to the DHCP server in an MPLS VPN and a VXLAN EVPN multi-tenant environment.

[RFC 6607](#) provides the definition for this sub-option.

- **Sub-Option 11(0xb)—Server ID Override**

The server identifier or server ID override sub-option allows the DHCP relay agent to specify a new value for the server ID option. The DHCP server inserts this new value in the reply packet. This sub-option allows the DHCP relay agent to act as the actual DHCP server. The DHCP relay agent begins to receive all the renew requests instead of the DHCP server. The server ID override sub-option contains the incoming interface IP address. The DHCP client accesses the DHCP relay agent using the incoming interface IP address. The DHCP client uses this information to send all the renew and release request packets to the DHCP relay agent. The DHCP relay agent adds all the appropriate sub-options and then forwards the renew and release request packets to the original DHCP server.

For this function, Cisco's proprietary implementation is sub-option 152(0x98). To implement the suboption and manage the function, run the **ip dhcp relay sub-option type cisco** command in global configuration mode on the VTEP that acts as the DHCP relay agent.

[RFC 5107](#) provides the definition for this sub-option.

- **Sub-Option 5(0x5)—Link Selection:**

The link selection sub-option provides a mechanism to separate the subnet or link, on which the DHCP client resides, from the GiAddr. The DHCP server uses this mechanism to communicate with the DHCP relay agent. The DHCP relay agent sets the sub-option to the correct subscriber subnet. The DHCP server then uses this value to assign an IP address different from the GiAddr. The DHCP relay agent sets the GiAddr to its own IP address to ensure that it is possible to forward the DHCP messages over the network.

For this function, Cisco's proprietary implementation is sub-option 150(0x96). To manage the function, run the **ip dhcp relay sub-option type cisco** command in global configuration mode on the VTEP that acts as the DHCP relay agent.

[RFC 3527](#) provides the definition for this sub-option.

DHCP Relay on VTEPs

DHCP relay is generally configured on the default gateway that faces the DHCP client. You can configure a VTEP as a DHCP relay agent in different ways to automate IP addressing. The configuration depends on whether the DHCP server is present in the same network, the same VRF, or a different VRF compared to the DHCP client. When the DHCP server and DHCP client are in different VRFs, traffic is forwarded across the tenant or VRF boundaries.

The following are the common DHCP relay deployment scenarios for a BGP EVPN VXLAN fabric:

1. DHCP server is in the Layer 3 default VRF and DHCP client is in the tenant VRF.

See [Example: DHCP Server is in the Layer 3 Default VRF and the DHCP Client is in the Tenant VRF](#) for a configuration example.

2. DHCP server and DHCP client are in the same tenant VRF.

See [Example: DHCP Server and DHCP Client are in the Same Tenant VRF](#), on page 7 for a configuration example.

3. DHCP server and DHCP client are in different tenant VRFs.
See [Example: DHCP Client and DHCP Server are in Different Tenant VRFs](#) for a configuration example.
4. DHCP server is in a non-default non-VXLAN VRF and DHCP client is in the tenant VRF.
See [Example: DHCP Server is in a non-Default, non-VXLAN VRF and DHCP Client is in the Tenant VRF](#) for a configuration example.

How to Configure DHCP Relay in a BGP EVPN VXLAN Fabric

You must configure EVPN VXLAN Layer 2 and Layer 3 overlay networks before configuring BGP EVPN VXLAN interworking with DHCP relay. See [How to Configure EVPN VXLAN Integrated Routing and Bridging](#) for detailed steps.

Perform the following set of procedures to configure BGP EVPN VLAN interworking with DHCP relay:

Configuring DHCP Relay on a VTEP

To configure DHCP relay on a VTEP, perform the following steps:

Procedure

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	ip dhcp relay information option vpn Example: Device(config)# ip dhcp relay information option vpn	Adds option VPN suboption to DHCP option 82. Enables the device to insert VPN suboptions into the DHCP relay agent information option in the messages forwarded to the DHCP server and sets the GiAddr on the outgoing interface towards the DHCP server.
Step 4	ip dhcp relay information option Example: Device(config)# ip dhcp relay information option	Enables DHCP option 82. Enables the system to insert a DHCP relay agent information option in the messages forwarded to the DHCP server.

	Command or Action	Purpose
Step 5	ip dhcp relay override gateway-ip-address link-selection Example: Device(config)# ip dhcp relay override giaddr link-selection	Sets the gateway IP address as the IP address of the DHCP relay agent and configures the server to assign an IP address that is different from the GiAddr to the DHCP clients.
Step 6	ip dhcp compatibility suboption {link-selection server-override} standard Example: Device(config)# ip dhcp compatibility suboption link-selection standard Device(config)# ip dhcp compatibility suboption server-override standard	Configures the DHCP client to use the Internet Assigned Numbers Authority (IANA) standard relay agent server ID override suboption. Use the link-selection standard keyword to switch to standard DHCP option 82[5]. Use the server-override standard keyword to switch to standard DHCP option 82[11].
Step 7	ip dhcp snooping vlan vlan-id-list Example: Device(config)# ip dhcp snooping vlan 201-202	Enables DHCP snooping on the specified list of VLANs.
Step 8	ip dhcp snooping Example: Device(config)# ip dhcp snooping	Enables DHCP snooping globally on the VTEP.
Step 9	end Example: Device(config)# end	Returns to privileged EXEC mode.

Configuring DHCP Relay on the Access SVI of a VTEP

Perform this procedure on all the VTEPs for each VLAN that is associated with the Layer 2 VNI configured in the EVPN VXLAN network.

To configure DHCP relay on the access SVI of a VTEP, perform the following steps:

Procedure

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	interface vlan <i>vlan-id</i> Example: Device(config)# interface Vlan 201	Enters interface configuration mode for the specified VLAN interface. This VLAN interface acts as the GiAddr.
Step 4	vrf forwarding <i>vrf-name</i> Example: Device(config-if)# vrf forwarding green	Associates the VRF with the interface. The interface must be associated with the same VRF for which the Layer 3 VNI has been configured for the EVPN VXLAN network.
Step 5	ip dhcp relay information option vpn-id Example: Device(config-if)# ip dhcp relay information option vpn-id	Enables the device to insert VPN suboptions into the DHCP relay agent information option in the messages forwarded to the DHCP server and sets the GiAddr on the outgoing interface towards the DHCP server.
Step 6	ip dhcp relay source-interface Loopback <i>loopback-interface-id</i> Example: Device(config-if)# ip dhcp relay source-interface Loopback13	Configures the specified Loopback interface as the source interface for DHCP relay messages. The DHCP relay agent uses the IP address of the source interface as the source IP address to relay messages. Note The IP address configured on the Loopback interface must be unique per VTEP per VRF.
Step 7	ip address <i>ip-address</i> Example: Device(config-if)# ip address 192.168.1.201 255.255.255.0	Sets the IP address for the VLAN interface.
Step 8	ip helper-address [global vrf <i>vrf-name</i>] <i>ip-address</i> Example: Device(config-if)# ip helper-address global 192.168.3.100 Device(config-if)# ip helper-address vrf green 192.168.20.20	Sets the DHCP IP helper address for the VLAN interface. Use the global keyword if the DHCP server is reachable over the global routing table (GRT). Use the vrf <i>vrf-name</i> keyword if the DHCP server is reachable over the tenant VRF.
Step 9	exit Example: Device(config-if)# exit	Exits interface configuration mode and returns to global configuration mode.
Step 10	end Example: Device(config)# end	Returns to privileged EXEC mode.

Configuring the Layer 3 or Routed Interface on the Border VTEP for DHCP Server Reachability

DHCP server reachability can be achieved through a physical Layer 3 interface (or subinterface), a dot1Q interface, an SVI, or a Layer 3 Portchannel interface (or subinterface).



Note This task is optional if you implement plain IP address forwarding in the respective VRF.

To configure the Layer 3 or routed interface on the border VTEP for external connectivity, perform the following steps:

Procedure

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	interface vlan <i>vlan-id</i> Example: Device (config)# interface vlan 203	Enters interface configuration mode for the specified VLAN interface.
Step 4	vrf forwarding <i>vrf-name</i> Example: Device (config-if)# vrf forwarding green	Configures the SVI for the VLAN and associates the specified VRF with the interface.
Step 5	ip address <i>ip-address</i> Example: Device (config-if)# ip address 192.168.3.203 255.255.255.0	Configures the IP address for the VLAN.
Step 6	ipv6 address <i>ipv6-address</i> Example: Device (config-if)# ipv6 address 2001:203::203/64	Configures the IPv6 address for the VLAN.
Step 7	ipv6 enable Example: Device (config-if)# ipv6 enable	Enables IPv6 processing on the VLAN interface.

	Command or Action	Purpose
Step 8	exit Example: Device(config-if)# exit	Exits interface configuration mode and returns to global configuration mode.
Step 9	interface interface-id Example: Device(config)# interface GigabitEthernet1/0/30	Enters interface configuration mode for the specified interface.
Step 10	switchport access vlan vlan-id Example: Device(config-if)# switchport access vlan 203	Specifies the VLAN to be used as access VLAN when the interface is in access mode.
Step 11	switchport mode access Example: Device(config-if)# switchport mode access	Configures the interface as an access interface.
Step 12	exit Example: Device(config-if)# exit	Exits interface configuration mode and returns to global configuration mode.
Step 13	end Example: Device(config)# end	Returns to privileged EXEC mode.

Example: DHCP Server and DHCP Client are in the Same Tenant VRF

This example shows how to configure DHCP relay deployment in a BGP EVPN VXLAN fabric for the topology in [this figure](#) when the DHCP server and the DHCP client are in the same tenant VRF. The DHCP server is reachable over this common tenant VRF.

The following tables provide sample configurations for the DHCP server and VTEP 1:

Table 1: Configuring DHCP when DHCP Server and DHCP Client are in the Same Tenant VRF

DHCP Configuration Snippet

<snip: only the relevant configuration is shown>

```
ip dhcp relay information option vpn
ip dhcp relay information option
ip dhcp compatibility suboption link-selection standard
ip dhcp compatibility suboption server-override standard
ip dhcp snooping vlan 101-102,201-202
ip dhcp snooping
!
interface Loopback101
  vrf forwarding green
  ip address 10.1.251.1 255.255.255.255
!
interface Vlan101
  vrf forwarding green
  ip dhcp relay source-interface Loopback101
  ip address 10.1.101.1 255.255.255.0
  ip helper-address 192.168.20.20
!
interface Vlan102
  vrf forwarding green
  ip dhcp relay source-interface Loopback101
  ip address 10.1.102.1 255.255.255.0
  ip helper-address 192.168.20.20
```

<snip: only the relevant configuration is shown>

Table 2: Configuring VTEP 1 when DHCP Server and DHCP Client are in the Same Tenant VRF

VTEP 1
<pre> Leaf-01# show running-config ! hostname Leaf-01 ! vrf definition green rd 1:1 ! address-family ipv4 route-target export 1:1 route-target import 1:1 route-target export 1:1 stitching route-target import 1:1 stitching exit-address-family ! ip routing ! ip multicast-routing ! ip dhcp relay information option vpn ip dhcp relay information option ip dhcp compatibility suboption link-selection standard ip dhcp compatibility suboption server-override standard ! ip dhcp snooping vlan 101-102,201-202 ip dhcp snooping ! l2vpn evpn replication-type static router-id Loopback1 default-gateway advertise ! l2vpn evpn instance 101 vlan-based encapsulation vxlan ! l2vpn evpn instance 102 vlan-based encapsulation vxlan ! l2vpn evpn instance 201 vlan-based encapsulation vxlan ! l2vpn evpn instance 202 vlan-based encapsulation vxlan ! system mtu 9198 ! vlan configuration 101 member evpn-instance 101 vni 10101 vlan configuration 102 member evpn-instance 102 vni 10102 vlan configuration 201 member evpn-instance 201 vni 10201 vlan configuration 202 member evpn-instance 202 vni 10202 vlan configuration 901 member vni 50901 vlan configuration 902 member vni 50902 ! </pre>

VTEP 1

```
interface Loopback0
ip address 172.16.255.3 255.255.255.255
ip ospf 1 area 0
!
interface Loopback1
ip address 172.16.254.3 255.255.255.255
ip pim sparse-mode
ip ospf 1 area 0
!
interface Loopback101
vrf forwarding green
ip address 10.1.251.1 255.255.255.255
!
interface GigabitEthernet1/0/1
no switchport
ip address 172.16.13.3 255.255.255.0
ip pim sparse-mode
ip ospf network point-to-point
ip ospf 1 area 0
!
interface GigabitEthernet1/0/2
no switchport
ip address 172.16.23.3 255.255.255.0
ip pim sparse-mode
ip ospf network point-to-point
ip ospf 1 area 0
!
interface GigabitEthernet1/0/10
switchport mode trunk
!
interface Vlan101
vrf forwarding green
ip dhcp relay source-interface Loopback101
ip address 10.1.101.1 255.255.255.0
ip helper-address 192.168.20.20
!
interface Vlan102
vrf forwarding green
ip dhcp relay source-interface Loopback101
ip address 10.1.102.1 255.255.255.0
ip helper-address 192.168.20.20
!
interface Vlan901
vrf forwarding green
ip unnumbered Loopback0
no autostate
!
```

VTEP 1

```
interface nve1
no ip address
source-interface Loopback1
host-reachability protocol bgp
member vni 10101 mcast-group 225.0.0.101
member vni 10102 mcast-group 225.0.0.102
member vni 50901 vrf green
!
router ospf 1
router-id 172.16.255.3
!
router bgp 65001
bgp router-id interface Loopback0
bgp log-neighbor-changes
no bgp default ipv4-unicast
neighbor 172.16.255.1 remote-as 65001
neighbor 172.16.255.1 update-source Loopback0
neighbor 172.16.255.2 remote-as 65001
neighbor 172.16.255.2 update-source Loopback0
!
address-family ipv4
exit-address-family
!
address-family l2vpn evpn
neighbor 172.16.255.1 activate
neighbor 172.16.255.1 send-community both
neighbor 172.16.255.2 activate
neighbor 172.16.255.2 send-community both
exit-address-family
!
address-family ipv4 vrf green
advertise l2vpn evpn
redistribute connected
redistribute static
exit-address-family
!
ip pim rp-address 172.16.255.255
!
end
!
Leaf-01#
```

Return to [Configuration Examples for DHCP Relay in a BGP EVPN VXLAN Fabric](#).

Example: DHCP Server and DHCP Client are in the Same Tenant VRF