Configue VXLAN BGP EVPN

This chapter contains these sections:

VXLAN BGP EVPN

VXLAN BGP EVPN

VXLAN BGP EVPN is a data center network overlay protocol suite that

- enables scalable Layer 2 and Layer 3 connectivity between distributed network endpoints,
- uses BGP EVPN as the control plane to advertise MAC/IP address bindings, and
- supports multi-tenant network virtualization with enhanced operational flexibility.

VXLAN encapsulates Layer 2 frames in Layer 3 UDP packets, enabling scalable network overlays. BGP EVPN provides a standards-based control plane that supports dynamic endpoint discovery and efficient traffic forwarding.

VXLAN BGP EVPN can be used to interconnect multiple data center sites, providing secure and isolated tenant networks across the infrastructure.

Auto-derived route distinguishers

An auto-derived route distinguisher (rd auto) is a VPN address-mapping mechanism that

- uses a Type 1 encoding format combining a 4-byte BGP Router ID and a 2-byte numbering field,
- distinguishes between IP-VRF and MAC-VRF through different numbering schemes, and
- enables unique identification across multiple VRFs.

In Cisco NX-OS, the auto-derived RD uses the IP address of the BGP Router ID (RID) for the 4-byte administrative field and the internal VRF identifier for the 2-byte numbering field (VRF ID). This format is specified in IETF RFC 4364 section 4.2.

The 2-byte numbering field is always derived from the VRF, but results in a different numbering scheme depending on its use for the IP-VRF or the MAC-VRF:

- The 2-byte numbering field for the IP-VRF uses the internal VRF ID, which starts at 1 and increases incrementally. VRF IDs 1 and 2 are reserved for the default VRF and the management VRF, respectively. The first custom-defined IP VRF uses VRF ID 3.
- The 2-byte numbering field for the MAC-VRF uses the VLAN ID + 32767, which results in 32768 for VLAN ID 1 and incrementing.

- IP-VRF with BGP Router ID 192.0.2.1 and VRF ID 6: RD 192.0.2.1:6
- MAC-VRF with BGP Router ID 192.0.2.1 and VLAN 20: RD 192.0.2.1:32787

Route-target autos

A route-target (RT) auto is a route-target assignment method that:

- derives route-target values automatically based on system parameters,
- uses the Type 0 extended community encoding as described in IETF RFC 4364, and
- constructs the route-target using the Autonomous System Number (ASN) and the Service Identifier (VNI).

The auto-derived route-target (using import/export/both auto) is based on the Type 0 encoding format as described in IETF RFC 4364 section 4.2. This encoding allows a 2-byte administrative field and a 4-byte numbering field.

Within Cisco NX-OS, the auto-derived route-target uses the ASN for the 2-byte administrative field. It uses the VNI for the 4-byte numbering field.

In multi-AS environments, route-targets must match the correct ASN portion. You may need to define or rewrite them to ensure compatibility. For more information, see rewrite-evpn-rt-asn.

Examples of an auto-derived Route-Target (RT)

- For 2-byte ASN:
  - IP-VRF within ASN 65001 and L3VNI 50001 - Route-Target 65001:50001
  - MAC-VRF within ASN 65001 and L2VNI 30001 - Route-Target 65001:30001
- For 4-byte ASN:
  - IP-VRF within ASN 65656 and L3VNI 50001 - Route-Target 23456:50001
  - MAC-VRF within ASN 65656 and L2VNI 30001 - Route-Target 23456:30001

When a 4-byte ASN is used, the 2-byte ASN field is set to 23456 (AS_TRANS) as specified in IETF RFC 6793 section 9; this value is registered by IANA as a special-purpose AS number to represent 4-byte ASNs in 2-byte fields.

Note Beginning with Cisco NX-OS Release 9.2(1), auto-derived Route-Target for 4-byte ASN is supported.

Supported features and configuration limits for VXLAN BGP EVPN

VXLAN BGP EVPN has the following supported features, platforms, and configuration limits for VXLAN BGP EVPN:

Configuration recommendations

- Switch and port limitations:
  - The VXLAN network identifier (VNID) 16777215 is reserved and should explicitly not be configured.
  - It is recommended to use the **vpc orphan-ports suspend** command for single attached and/or routed devices on a Cisco Nexus 9000 platform switch acting as vPC VTEP.
- Feature limitations:
  - Mobility Sequence number of a locally originated type-2 route (MAC/MAC-IP) can be mismatched between vPC peers, with one VTEP having a sequence number K while other VTEP in the same complex can have the same route with sequence number 0. This does not cause any functional impact and the traffic is not impacted even after the host moves.
  - For SVI-related triggers (such as shut/unshut or PIM enable/disable), a 30-second delay was added, allowing the Multicast FIB (MFIB) Distribution module (MFDM) to clear the hardware table before toggling between L2 and L3 modes or vice versa.
  - You can configure EVPN over segment routing or MPLS. See the Cisco Nexus 9000 Series NX-OS Label Switching Configuration Guide, Release 9.3(x) for more information.
  - You can use MPLS tunnel encapsulation using the new CLI encapsulation mpls command. You can configure the label allocation mode for the EVPN address family. See the Cisco Nexus 9000 Series NX-OS Label Switching Configuration Guide, Release 9.3(x) for more information.
  - Routing protocol adjacencies using Anycast Gateway SVIs is not supported.
  - When running VXLAN EVPN, any SVI for a VLAN extended over VXLAN must be configured with Anycast Gateway. Any other mode of operation is not supported.
- Command limitations:
  - In a VXLAN EVPN setup, border nodes must be configured with unique route distinguishers, preferably using the **auto rd** command. Not using unique route distinguishers across all border nodes is not supported. The use of unique route distinguishers is strongly recommended for all VTEPs of a fabric.
- Non-Disruptive In Service Software Upgrade (ND-ISSU) is supported on Nexus 9300 with VXLAN enabled. For more information, see Cisco Nexus 9000 and 3000 Upgrade and ISSU Matrix .

Supported platform and releases for VXLAN BGP EVPN

Table 1: VXLAN BGP EVPN support on Cloudscale switches

Release	Platforms
9.3(3)	Cisco Nexus 9300- EX/ FX/GX/FX2/FX3 platform switches. Cisco Nexus 9300-GX switch Cisco Nexus 9504 and 9508 with R-series line cards

- VXLAN BGP EVPN support on Smart Series switches

Unsupported features

- Switch limitations:
  - VXLAN is not supported on N9K-C92348GC-X switches.
- Feature limitations:
  - DHCP snooping (Dynamic Host Configuration Protocol snooping) is not supported on VXLAN VLANs.
  - RACLs are not supported on VXLAN uplink interfaces. VACLs are not supported on VXLAN de-capsulated traffic in egress direction; this applies for the inner traffic coming from network (VXLAN) towards the access (Ethernet).

    As a best practice, always use PACLs/VACLs for the access (Ethernet) to the network (VXLAN) direction. See the Cisco Nexus 9000 Series NX-OS Security Configuration Guide, Release 9.3(x) for other guidelines and limitations for the VXLAN ACL feature.
  - The Cisco Nexus 9000 QoS buffer-boost feature is not applicable for VXLAN traffic.

Scale

Note For information about VXLAN BGP EVPN scalability, see the Cisco Nexus 9000 Series NX-OS Verified Scalability Guide .

- In a VXLAN EVPN setup that has 2K VNI scale configuration, the control plane down time may take more than 200 seconds. To avoid potential BGP flap, extend the graceful restart time to 300 seconds.

ARP suppression

- ARP suppression is only supported for a VNI if the VTEP hosts the First-Hop Gateway (Distributed Anycast Gateway) for this VNI. The VTEP and the SVI for this VLAN have to be properly configured for the distributed Anycast Gateway operation, for example, global Anycast Gateway MAC address configured and Anycast Gateway feature with the virtual IP address on the SVI.

- The ARP suppression setting must match across the entire fabric. For a specific VNID, all VTEPs must be either configured or not configured.

VXLAN BGP EVPN fabrics with eBGP

- For VXLAN BGP EVPN fabrics with eBGP, the following recommendations are applicable:
  - It is recommended to use loopbacks for the eBGP EVPN peering sessions (overlay control-plane).
  - It is a best practice to use the physical interfaces for eBGP IPv4/IPv6 peering sessions (underlay).
- Only eBGP peering between a VTEP and external nodes (Edge Router, Core Router or VNF) is supported.
  - eBGP peering from the VTEP to the external node using a physical interface or subinterfaces is recommended and it is a best practice (external connectivity).
  - The eBGP peering from the VTEP to the external node can be in the default VRF or in a tenant VRF (external connectivity).
  - The eBGP peering from the VTEP to a external node over VXLAN must be in a tenant VRF and must use the update-source of a loopback interface (peering over VXLAN).
  - Using an SVI for eBGP peering from the VTEP to the External Node requires the VLAN to be local (not VXLAN extended).

NVE interface

- Bind the NVE source-interface to a dedicated loopback interface and do not share this loopback with any function or peerings of Layer-3 protocols. A best practice is to use a dedicated loopback address for the VXLAN VTEP function.
- You must bind NVE to a loopback address that is separate from other loopback addresses that are required by Layer 3 protocols. NVE and other Layer 3 protocols using the same loopback is not supported.
- The NVE source-interface loopback is required to be present in the default VRF.
- During the vPC Border Gateway boot up process the NVE source loopback interface undergoes the hold down timer twice instead of just once. This is a day-1 and expected behavior.

Supported Templates

- When configuring VXLAN BGP EVPN, only the "System Routing Mode: Default" is applicable for the following hardware platforms:
  - Cisco Nexus 9300 platform switches
  - Cisco Nexus 9300-EX platform switches
  - Cisco Nexus 9300-FX/FX2 /FX3 platform switches
  - Cisco Nexus 9300-GX platform switches
  - Cisco Nexus 9500 platform switches with X9700-EX, X9700-FX, and X9700-GX line cards
- Changing the “System Routing Mode” requires a reload of the switch.

VXLAN uplinks

- Starting from Cisco NX-OS Release 9.3(5), new VXLAN uplink capabilities are introduced:
  - A physical interface in default VRF is supported as VXLAN uplink.
  - A parent interface in default VRF, carrying subinterfaces with VRF and dot1q tags, is supported as VXLAN uplink.
  - A subinterface in any VRF and/or with dot1q tag remains not supported as VXLAN uplink.
  - An SVI in any VRF remains not supported as VXLAN uplink.
  - In vPC with physical peer-link, a SVI can be leveraged as backup underlay, default VRF only between the vPC members (infra-VLAN, system nve infra-vlans).
  - On a vPC pair, shutting down NVE or NVE loopback on one of the vPC nodes is not a supported configuration. This means that traffic failover on one-side NVE shut or one-side loopback shut is not supported.
  - FEX host interfaces remain not supported as VXLAN uplink and cannot have VTEPs connected (BUD node).
- You need to configure the VXLAN uplink with **ip unreachables** in order to enable Path maximum transmission unit (MTU) discovery (PMTUD) in a VXLAN set up. PMTUD prevents fragmentation in the path between two endpoints by dynamically determining the lowest MTU along the path from the packet's source to its destination.
- Cisco Nexus 9500 platform switches with 9700 -EX or -FX or -GX line cards support 1G, 10G, 25G, 40G, 100G and 400G for VXLAN uplinks.
- Cisco Nexus 9200 and 9300- EX/ FX/FX2/FX3 and -GX support 1G, 10G, 25G, 40G, 100G and 400G for VXLAN uplinks.

Table 2: Smart switches

UDP port

- The Cisco Nexus 9000 platform switches use standards conforming UDP port number 4789 for VXLAN encapsulation. This value is not configurable.
- The Cisco Nexus 9200 platform switches with Application Spine Engine (ASE2) have throughput constrains for packet sizes of 99-122 bytes; packet drops might be experienced.

SPAN

The following guidelines and limitations apply to VXLAN/VTEP using BGP EVPN:

- • SPAN source or destination is supported on any port.

  For more information, see the Cisco Nexus 9000 Series NX-OS System Management Configuration Guide, Release 9.3(x) .
- When SVI is enabled on a VTEP (flood and learn, or EVPN) regardless of ARP suppression, make sure that ARP-ETHER TCAM is carved using the **hardware access-list tcam region arp-ether 256 double-wide** command. This requirement does not apply to Cisco Nexus 9200, 9300-EX, and

9300-FX/FX2 /FX3 and 9300-GX platform switches and Cisco Nexus 9500 platform switches with 9700- EX/ FX line cards.

Gateway functionality

- Gateway functionality for VXLAN to MPLS (LDP), VXLAN to MPLS-SR (Segment Routing) and VXLAN to SRv6 can be operated on the same Cisco Nexus 9000 Series platform.
  - VXLAN to MPLS (LDP) Gateway is supported on the Cisco Nexus 3600-R and the Cisco Nexus 9500 with R-Series line cards.
  - VXLAN to MPLS-SR Gateway is supported on the Cisco Nexus 9300-FX2/FX3/GX and Cisco Nexus 9500 with R-Series line cards.
- VXLAN to SRv6 is supported on the Cisco Nexus 9300-GX platform.

VXLAN and GRE co-existence

ECMP resilient hashing

- Resilient hashing is supported on the following switch platform with a VXLAN VTEP configured:
  - Cisco Nexus 9300- EX/ FX/FX2/FX3/GX support ECMP resilient hashing.
  - Cisco Nexus 9300 with ALE uplink ports does not support resilient hashing.

Note Resilient hashing is disabled by default.

Static MAC support on BGP EVPN

Configure VXLAN BGP EVPN

Refer to these sections for configuring the VXLAN BGP EVPN features.

Enable VXLAN

Use this task when you need to configure VXLAN and EVPN fabric functionality on your device.

Follow these steps to enable VXLAN:

Before you begin

- Ensure you have administrative access to the device.
- Confirm that your device and software release support VXLAN and EVPN features.

Procedure

Step 1 Enter global configuration mode: **configure terminal**
Step 2 Enable VLAN-based VXLAN: **feature vn-segment**
Step 3 Enable NV overlay functionality: **feature nv overlay**
Step 4 Enable VN-Segment for VLANs: **feature vn-segment-vlan-based**
Step 5 Enable Switch Virtual Interface (SVI) support: **feature interface-vlan**
Step 6 Activate the EVPN control plane for VXLAN: **nv overlay evpn**

The device now supports VXLAN and EVPN functionality. To view a configuration example, see the example sections.

Configure VLAN and VXLAN VNI

Use this task to set up VLANs with associated VXLAN VNI mappings, typically required for Layer 2 network segmentation and virtualization on devices participating in EVPN fabrics.

Follow these steps to configure a VLAN and VXLAN VNI:

Note Steps 4 to 7 are optional for configuring the VLAN for VXLAN VNI. These steps are required only if you need a custom route distinguisher or route-target, rather than using auto derivation.

Before you begin

- Ensure you have administrative access to the network device.
- Identify the VLAN and VNI numbers to be used.

Procedure

Step 1 Enter global configuration mode: **configure terminal**
Step 2 Specify the VLAN: **vlan** *number*
Step 3 Map the VLAN to a VXLAN VNI: **vn-segment** *number*

This configures Layer 2 VNI under VXLAN VLAN.

Step 4 Enter EVPN configuration mode for the VLAN: **evpn**
Step 5 Specify the VNI for the EVPN instance: **vni** *number* **l2**
Step 6 (Optional) Specify the MAC-VRF's route distinguisher: **rd auto**
Step 7 (Optional) Configure the route target for import and export of MAC prefixes: **route-target both** {**auto** | *rt*}

Use auto for iBGP. For eBGP or asymmetric VNIs, manually specify the RT. Supported formats for RT include ASN2:NN, ASN4:NN, or IPV4:NN.

The VLAN and VXLAN VNI are configured with the appropriate EVPN settings. You can specify custom RD and RT if needed. For a configuration example, refer to the example sections.

Configure VRF for VXLAN routing

Use this task when setting up a VRF for VXLAN routing on your device. Steps 3–6 are optional unless you require custom route distinguisher or route-target values.

Follow these steps to configure the VRF for VXLAN routing:

Note Step 4 to step 7 are optional for configuring the VRF for VXLAN Routing and are only necessary in case of a custom route distinguisher or route-target requirement (not using auto derivation).

Procedure

Step 1 Enter configuration mode: **configure terminal**

Step 2 Create or select the VRF context: **vrf context** *vrf-name*

Step 3 Specify the VNI for the VRF: **vni** *number*

Step 4 Specify the IP-VRF's route distinguisher: **rd auto**

Step 5 Configure the IPv4 or IPv6 unicast address family: **address-family** {**ipv4** | **ipv6**} **unicast**

Step 6 Configure the route target for import and export of IPv4 or IPv6 prefixes: **route-target both** {**auto** | *rt*}

The RT is used for a per-IP-VRF prefix import/export policy. If you enter an RT, these formats are supported: ASN2:NN, ASN4:NN, or IPV4:NN.

Note
Specifying the **auto** option is applicable only for iBGP.

Manually configured route targets are required for eBGP and for asymmetric VNIs.

Step 7 Set RTs specifically for EVPN: **route-target both** {**auto** | *rt*} **evpn**

The RT is used for a per-VRF prefix import/export policy. If you enter an RT, these formats are supported: ASN2:NN, ASN4:NN, or IPV4:NN.

Note
Specifying the **auto** option is applicable only for iBGP.

Manually configured route targets are required for eBGP and for asymmetric VNIs.

Configuring SVI for Core-facing VXLAN Routing

Configure the core-facing SVI VRF.

SUMMARY STEPS

1. **vlan** *number*
2. **vn-segment** *number*
3. **interface** *vlan-number*
4. **mtu** *number*
5. **vrf member** *vrf-name*
6. **no** {**ip** |**ipv6**} **redirects**
7. **ip forward**
8. **ipv6 address use-link-local-only**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**vlan** *number*	Specify VLAN.
Step 2	**vn-segment** *number*	Map VLAN to VXLAN VNI to configure Layer 3 VNI under VXLAN VLAN.
Step 3	**interface** *vlan-number*	Specify VLAN interface.
Step 4	**mtu** *number*	MTU size in bytes <68-9216>.
Step 5	**vrf member** *vrf-name*	Assign to VRF.
Step 6	**no** {**ip** |**ipv6**} **redirects**	Disable sending IP redirect messages for IPv4 and IPv6.
Step 7	**ip forward**	Enable IPv4 based lookup even when the interface VLAN has no IP address defined.
Step 8	**ipv6 address use-link-local-only**	Enable IPv6 forwarding. **Note** The IPv6 address use-link-local-only serves the same purpose as ip forward for IPv4. It enables the switch to perform an IP based lookup even when the interface VLAN has no IP address defined under it.

Configuring SVI for Host-Facing VXLAN Routing

Configure the SVI for hosts, acting as Distributed Default Gateway.

SUMMARY STEPS

1. **fabric forwarding anycast-gateway-mac** *address*

2. **vlan** *number*
3. **vn-segment** *number*
4. **interface** *vlan-number*
5. **vrf member** *vrf-name*
6. **ip address** *address*
7. **fabric forwarding mode anycast-gateway**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**fabric forwarding anycast-gateway-mac** *address*	Configure distributed gateway virtual MAC address. **Note** One virtual MAC per VTEP. **Note** All VTEPs should have the same virtual MAC address.
Step 2	**vlan** *number*	Specify VLAN.
Step 3	**vn-segment** *number*	Specify vn-segment.
Step 4	**interface** *vlan-number*	Specify VLAN interface.
Step 5	**vrf member** *vrf-name*	Assign to VRF.
Step 6	**ip address** *address*	Specify IP address.
Step 7	**fabric forwarding mode anycast-gateway**	Associate SVI with anycast gateway under VLAN configuration mode.

Configuring the NVE Interface and VNIs Using Multicast

SUMMARY STEPS

1. **interface** *nve-interface*
2. **source-interface loopback1**
3. **host-reachability protocol bgp**
4. **global mcast-group** *ip-address* **{L2 | L3}**
5. **member vni** *vni*
6. **mcast-group** *ip address*
7. **member vni** *vni* **associate-vrf**
8. **mcast-group** *address*

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**interface** *nve-interface*	Configure the NVE interface.
Step 2	**source-interface loopback1**	Binds the NVE source-interface to a dedicated loopback interface.
Step 3	**host-reachability protocol bgp**	This defines BGP as the mechanism for host reachability advertisement
Step 4	**global mcast-group** *ip-address* **{L2 | L3}**	Configures the mcast group globally (for all VNI) on a per-NVE interface basis. This applies and gets inherited s to all Layer 2 or Layer 3 VNIs. **Note** Layer3 macst group is only used for Tenant Routed Multicast (TRM).
Step 5	**member vni** *vni*	Add Layer 2 VNIs to the tunnel interface.
Step 6	**mcast-group** *ip address*	Configure the mcast group on a per-VNI basis. Add Layer 2 VNI specific mcast group and override the global set configuration. **Note** Instead of a mcast group, ingress replication can be configured.
Step 7	**member vni** *vni* **associate-vrf**	Add Layer-3 VNIs, one per tenant VRF, to the overlay. **Note** Required for VXLAN routing only.
Step 8	**mcast-group** *address*	Configure the mcast group on a per-VNI basis. Add Layer 3 VNI specific mcast group and override the global set configuration.

Configuring VXLAN EVPN Ingress Replication

For VXLAN EVPN ingress replication, the VXLAN VTEP uses a list of IP addresses of other VTEPs in the network to send BUM (broadcast, unknown unicast and multicast) traffic. These IP addresses are exchanged between VTEPs through the BGP EVPN control plane.

Note VXLAN EVPN ingress replication is supported on:

- Cisco Nexus Series 9300 Series switches (7.0(3)I1(2) and later).
- Cisco Nexus Series 9500 Series switches (7.0(3)I2(1) and later).

Before you begin: The following are required before configuring VXLAN EVPN ingress replication (7.0(3)I1(2) and later):

- Enable VXLAN.
- Configure VLAN and VXLAN VNI.
- Configure BGP on the VTEP.
- Configure RD and Route Targets for VXLAN Bridging.

SUMMARY STEPS

1. **interface** *nve-interface*
2. **host-reachability protocol bgp**
3. **global ingress-replication protocol bgp**
4. **member vni** *vni* **associate-vrf**
5. **member vni** *vni*
6. **ingress-replication protocol bgp**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**interface** *nve-interface*	Configure the NVE interface.
Step 2	**host-reachability protocol bgp**	This defines BGP as the mechanism for host reachability advertisement.
Step 3	**global ingress-replication protocol bgp**	Enables globally (for all VNI) the VTEP to exchange local and remote VTEP IP addresses on the VNI in order to create the ingress replication list. This enables sending and receiving BUM traffic for the VNI. **Note** Using ingress-replication protocol bgp avoids the need for any multicast configurations that might have been required for configuring the underlay.
Step 4	**member vni** *vni* **associate-vrf**	Add Layer-3 VNIs, one per tenant VRF, to the overlay. **Note** Required for VXLAN routing only.

	Command or Action	Purpose
Step 5	**member vni** *vni*	Add Layer 2 VNIs to the tunnel interface.
Step 6	**ingress-replication protocol bgp**	Enables the VTEP to exchange local and remote VTEP IP addresses on a oer VNI basis in order to create the ingress replication list. This enables sending and receiving BUM traffic for the VNI and override the global configuration. **Note** Instead of a ingress replication, mcast group can be configured. **Note** Using **ingress-replication protocol bgp** avoids the need for any multicast configurations that might have been required for configuring the underlay.

Configuring BGP on the VTEP

SUMMARY STEPS

1. **router bgp** *number*
2. **router-id** *address*
3. **neighbor** *address* **remote-as** *number*
4. **address-family l2vpn evpn**
5. (Optional) **Allowas-in**
6. **send-community extended**
7. **vrf** *vrf-name*
8. **address-family ipv4 unicast**
9. **maximum-paths path** {**ibgp**}
10. **address-family ipv6 unicast**
11. **maximum-paths path** {**ibgp**}

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**router bgp** *number*	Configure BGP.
Step 2	**router-id** *address*	Specify router address.
Step 3	**neighbor** *address* **remote-as** *number*	Define MPBGP neighbors. Under each neighbor define L2VPN EVPN.
Step 4	**address-family l2vpn evpn**	Configure address family Layer 2 VPN EVPN under the BGP neighbor.

	Command or Action	Purpose
		Note Address-family IPv4 EVPN for VXLAN host-based routing
Step 5	(Optional) **Allowas-in**	Only for EBGP deployment cases: Allows duplicate autonomous system (AS) numbers in the AS path. Configure this parameter on the leaf for eBGP when all leafs are using the same AS, but the spines have a different AS than leafs.
Step 6	**send-community extended**	Configures community for BGP neighbors.
Step 7	**vrf** *vrf-name*	Specify VRF.
Step 8	**address-family ipv4 unicast**	Configure the address family for IPv4.
Step 9	**maximum-paths path** {**ibgp**}	Enable ECMP for EVPN transported IP Prefixes within the IPv4 address-family of the respective VRF.
Step 10	**address-family ipv6 unicast**	Configure the address family for IPv6.
Step 11	**maximum-paths path** {**ibgp**}	Enable ECMP for EVPN transported IP Prefixes within the IPv6 address-family of the respective VRF.

Configuring iBGP for EVPN on the Spine

SUMMARY STEPS

1. **router bgp** *autonomous system number*
2. **neighbor** *address* **remote-as** *number*
3. **address-family l2vpn evpn**
4. **send-community extended**
5. **route-reflector-client**
6. **retain route-target all**
7. **address-family l2vpn evpn**
8. **disable-peer-as-check**
9. **route-map permitall out**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**router bgp** *autonomous system number*	Specify BGP.
Step 2	**neighbor** *address* **remote-as** *number*	Define neighbor.

	Command or Action	Purpose
Step 3	**address-family l2vpn evpn**	Configure address family Layer 2 VPN EVPN under the BGP neighbor.
Step 4	**send-community extended**	Configures community for BGP neighbors.
Step 5	**route-reflector-client**	Enable Spine as Route Reflector.
Step 6	**retain route-target all**	Configure retain route-target all under address-family Layer 2 VPN EVPN [global]. **Note** Required for eBGP. Allows the spine to retain and advertise all EVPN routes when there are no local VNI configured with matching import route targets.
Step 7	**address-family l2vpn evpn**	Configure address family Layer 2 VPN EVPN under the BGP neighbor.
Step 8	**disable-peer-as-check**	Disables checking the peer AS number during route advertisement. Configure this parameter on the spine for eBGP when all leafs are using the same AS but the spines have a different AS than leafs. **Note** Required for eBGP.
Step 9	**route-map permitall out**	Applies route-map to keep the next-hop unchanged. **Note** Required for eBGP.

Configuring eBGP for EVPN on the Spine

SUMMARY STEPS

1. **route-map NEXT-HOP-UNCH permit 10**
2. **set ip next-hop unchanged**
3. **router bgp** *autonomous system number*
4. **address-family l2vpn evpn**
5. **retain route-target all**
6. **neighbor** *address* **remote-as** *number*
7. **address-family l2vpn evpn**
8. **disable-peer-as-check**
9. **send-community extended**
10. **route-map NEXT-HOP-UNCH out**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**route-map NEXT-HOP-UNCH permit 10**	Configure route-map to keepthe next-hop unchanged for EVPN routes.
Step 2	**set ip next-hop unchanged**	Set next-hop address. **Note** When two next hops are enabled, next hop ordering is not maintained. If one of the next hops is a VXLAN next hop and the other next hop is local reachable via FIB/AM/Hmm, the local next hop reachable via FIB/AM/Hmm is always taken irrespective of the order. Directly/locally connected next hops are always given priority over remotely connected next hops.
Step 3	**router bgp** *autonomous system number*	Specify BGP.
Step 4	**address-family l2vpn evpn**	Configure address family Layer 2 VPN EVPN under the BGP neighbor.
Step 5	**retain route-target all**	Configure retain route-target all under address-family Layer 2 VPN EVPN [global]. **Note** Required for eBGP. Allows the spine to retain and advertise all EVPN routes when there are no local VNI configured with matching import route targets.
Step 6	**neighbor** *address* **remote-as** *number*	Define neighbor.
Step 7	**address-family l2vpn evpn**	Configure address family Layer 2 VPN EVPN under the BGP neighbor.
Step 8	**disable-peer-as-check**	Disables checking the peer AS number during route advertisement. Configure this parameter on the spine for eBGP when all leafs are using the same AS but the spines have a different AS than leafs.
Step 9	**send-community extended**	Configures community for BGP neighbors.
Step 10	**route-map NEXT-HOP-UNCH out**	Applies route-map to keep the next-hop unchanged.

Suppressing ARP

The ARP request from a host is normally flooded in the VLAN. It is possible to optimize this flooding behavior by maintaining an ARP cache locally on an attached access switch and generating an ARP response from the information in the local cache. Thus, the ARP broadcast on the overlay or VLAN is prevented.

The cache of remote hosts is built by learning the IP-host or MAC-address information through BGP EVPN MAC route advertisement.

Upon receiving an ARP request, the local cache can be consulted to see if the response can be locally generated. If the cache lookup fails, then the ARP request can be flooded. This helps in the detection of silent hosts.

SUMMARY STEPS

1. **interface nve 1**
2. **global suppress-arp**
3. **member vni** *vni-id*
4. **suppress-arp**
5. **suppress-arp disable**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**interface nve 1**	Create the network virtualization endpoint (NVE) interface.
Step 2	**global suppress-arp**	Configure to suppress ARP globally for all Layer 2 VNI.within the NVE interface.
Step 3	**member vni** *vni-id*	Specify VNI ID.
Step 4	**suppress-arp**	Configure to suppress ARP under Layer 2 VNI and overrides the global set default.
Step 5	**suppress-arp disable**	Disables the global setting of the ARP suppression on a specific VNI.

Disabling VXLANs

SUMMARY STEPS

1. **configure terminal**
2. **no nv overlay evpn**
3. **no feature vn-segment-vlan-based**
4. **no feature nv overlay**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal**	Enters configuration mode.
Step 2	**no nv overlay evpn**	Disables EVPN control plane.
Step 3	**no feature vn-segment-vlan-based**	Disables the global mode for all VXLAN bridge domains
Step 4	**no feature nv overlay**	Disables the VXLAN feature.
Step 5	(Optional) **copy running-config startup-config**	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

Duplicate Detection for IP and MAC Addresses

For IP addresses:

Cisco NX-OS supports duplicate detection for IP addresses. This enables the detection of duplicate IP addresses based on the number of moves in a given time-interval (seconds), if host appears simultaneously under two VTEP's.

Simultaneous availability of host under two VTEP's is detected by host mobility logic with 600 msec refresh timeout for IPv4 hosts and default refresh time out logic for IPv6 addresses (default is 3 seconds).

The default is 5 moves in 180 seconds. (Default number of moves is 5 moves. Default time-interval is 180 seconds.)

After the 5th move within 180 seconds, the switch starts a 30 second lock (hold down timer) before checking to see if the duplication still exists (an effort to prevent an increment of the sequence bit). This 30 second lock can occur 5 times within 24 hours (this means 5 moves in 180 seconds for 5 times) before the switch permanently locks or freezes the duplicate entry. (**show fabric forwarding ip local-host-db vrf abc**)

Wherever a host IP address is permanently frozen, a syslog message is written by HMM.

```
2021 Aug 26 01:08:26 leaf hmm: (vrf-name) [IPv4] Freezing potential duplicate host
20.2.0.30/32, reached recover count (5) threshold
```

The following are example commands to help the configuration of the number of VM moves in a specific time interval (seconds) for duplicate IP-detection:

Command	Description

`switch(config)# fabric forwarding ?`
`anycast-gateway-mac`
`dup-host-ip-addr-detection`
	Available sub-commands:
	• Anycast gateway MAC of the switch.
	• To detect duplicate host addresses in n seconds.

Command	Description
`switch(config)# fabric forwarding dup-host-ip-addr-detection ?` `<1-1000>`	The number of host moves allowed in n seconds. The range is 1 to 1000 moves; default is 5 moves.
`switch(config)# fabric forwarding dup-host-ip-addr-detection 100 ?` `<2-36000>`	The duplicate detection timeout in seconds for the number of host moves. The range is 2 to 36000 seconds; default is 180 seconds.
`switch(config)# fabric forwarding dup-host-ip-addr-detection 100 10`	Detects duplicate host addresses (limited to 100 moves) in a period of 10 seconds.

For MAC addresses:

Cisco NX-OS supports duplicate detection for MAC addresses. This enables the detection of duplicate MAC addresses based on the number of moves in a given time-interval (seconds).

The default is 5 moves in 180 seconds. (Default number of moves is 5 moves. Default time-interval is 180 seconds.)

After the 5th move within 180 seconds, the switch starts a 30 second lock (hold down timer) before checking to see if the duplication still exists (an effort to prevent an increment of the sequence bit). This 30 second lock can occur 3 times within 24 hours (this means 5 moves in 180 seconds for 3 times) before the switch permanently locks or freezes the duplicate entry. (**show l2rib internal permanently-frozen-list**)

Wherever a MAC address is permanently frozen, a syslog message with written by L2RIB.

```
2017 Jul  5 10:27:34 leaf %$ VDC-1 %$  %USER-2-SYSTEM_MSG: Unfreeze limit (3) hit, MAC
0000.0033.3333in topo: 200 is permanently frozen - l2rib
2017 Jul  5 10:27:34 leaf %$ VDC-1 %$  %USER-2-SYSTEM_MSG: Detected duplicate host
0000.0033.3333, topology 200, during Local update, with host located at remote VTEP 1.2.3.4,
 VNI 2 - l2rib
2017 Jul  5 10:27:34 leaf %$ VDC-1 %$  %USER-2-SYSTEM_MSG: Unfreeze limit (3) hit, MAC
0000.0033.3334in topo: 200 is permanently frozen - l2rib
2017 Jul  5 10:27:34 leaf %$ VDC-1 %$  %USER-2-SYSTEM_MSG: Detected duplicate host
0000.0033.3334, topology 200, during Local update, with host l
```

MAC address remains in permanently frozen list until both local and remote entry exists.

Unconfiguring below commands will not disable permanently frozen functionality rather will change the parameters to default values.

- **l2rib dup-host-mac-detection**
- **l2rib dup-host-recovery**

The following are example commands to help the configuration of the number of VM moves in a specific time interval (seconds) for duplicate MAC-detection:

Command	Description

`switch(config)# l2rib dup-host-mac-detection ?`
`<1-1000>`
`default`
	Available sub-commands for L2RIB:
	• The number of host moves allowed in n seconds. The range is 1 to 1000 moves.
	• Default setting (5 moves in 180 in seconds).

`switch(config)# l2rib dup-host-mac-detection 100 ?` `<2-36000>`	The duplicate detection timeout in seconds for the number of host moves. The range is 2 to 36000 seconds; default is 180 seconds.
`switch(config)# l2rib dup-host-mac-detection 100 10`	Detects duplicate host addresses (limited to 100 moves) in a period of 10 seconds.

Configuring Event History Size for L2RIB

To set the event history size for the L2RIB component follow these steps:

SUMMARY STEPS

1. **configure terminal**
2. **l2rib event-history** { **mac** | **mac-ip** | **loop-detection** } **size** { **default** | **medium** | **high** | **very-high** }
3. **clear l2rib event-history** { **mac** | **mac-ip** | **loop-detection** } **size** { **default** | **medium** | **high** | **very-high** }

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter global configuration mode.
Step 2	**l2rib event-history** { **mac**	**mac-ip**	**loop-detection** } **size** { **default**	**medium**	**high**	**very-high** } **Example:** `switch(config)# l2rib event-history mac size low`	Sets the event history size for the L2RIB component.
Step 3	**clear l2rib event-history** { **mac**	**mac-ip**	**loop-detection** } **size** { **default**	**medium**	**high**	**very-high** } **Example:** `switch(config)# clear l2rib event-history mac size low`	Clears the set event history size for the L2RIB component.

Verifying the VXLAN BGP EVPN Configuration

To display the VXLAN BGP EVPN configuration information, enter one of the following commands:

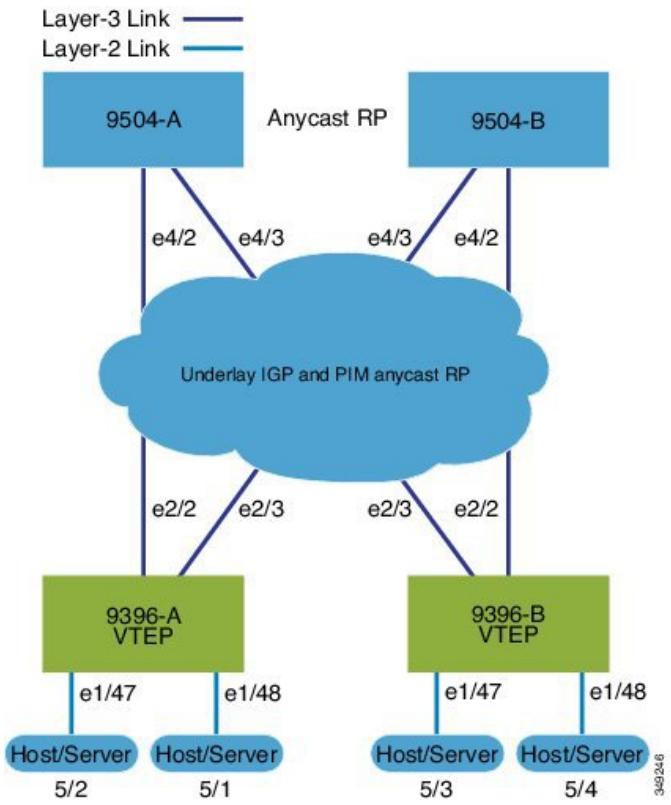
Command	Purpose
show nve vrf	Displays VRFs and associated VNIs
show bgp l2vpn evpn	Displays routing table information.
show ip arp suppression-cache [**detail** | **summary** | **vlan** *vlan* | **statistics**]	Displays ARP suppression information.
show vxlan interface	Displays VXLAN interface status.
show vxlan interface | count	Displays VXLAN VLAN logical port VP count. **Note** A VP is allocated on a per-port per-VLAN basis. The sum of all VPs across all VXLAN-enabled Layer 2 ports gives the total logical port VP count. For example, if there are 10 Layer 2 trunk interfaces, each with 10 VXLAN VLANs, then the total VXLAN VLAN logical port VP count is 10*10 = 100.
show l2route evpn mac [**all** | **evi** *evi* [**bgp** | **local** | **static** | **vxlan** | **arp**]]	Displays Layer 2 route information.
show l2route evpn fl all	Displays all fl routes.
show l2route evpn imet all	Displays all imet routes.
show l2route evpn mac-ip all **show l2route evpn mac-ip all detail**	Displays all MAC IP routes.
show l2route topology	Displays Layer 2 route topology.
show l2route evpn ethernet-segment all detail	Displays detailed information about all Ethernet Segment Identifiers (ESIs) in an EVPN (Ethernet VPN) environment.

Note Although the **show ip bgp** command is available for verifying a BGP configuration, as a best practice, it is preferable to use the **show bgp** command instead.

Example of VXLAN BGP EVPN (iBGP)

An example of a VXLAN BGP EVPN (iBGP):

Figure 1: VXLAN BGP EVPN Topology (iBGP)



iBGP between Spine and Leaf

- Spine (9504-A)
  - Enable the EVPN control plane

    ```
    nv overlay evpn
    ```

  - Enable the relevant protocols

    ```
    feature ospf
    feature bgp
    feature pim
    ```

  - Configure Loopback for local Router ID, PIM, and BGP

    ```
    interface loopback0
      ip address 10.1.1.1/32
      ip router ospf 1 area 0.0.0.0
      ip pim sparse-mode
    ```

  - Configure Loopback for Anycast RP

    ```
    interface loopback1
      ip address 100.1.1.1/32
      ip router ospf 1 area 0.0.0.0
      ip pim sparse-mode
    ```

- Configure Anycast RP

```
ip pim rp-address 100.1.1.1 group-list 224.0.0.0/4
ip pim anycast-rp 100.1.1.1 10.1.1.1
ip pim anycast-rp 100.1.1.1 20.1.1.1
```

- Enable OSPF for underlay routing

```
router ospf 1
```

- Configure interfaces for Spine-leaf interconnect

```
interface Ethernet4/2
  ip address 192.168.1.42/24
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
  no shutdown

interface Ethernet4/3
  ip address 192.168.2.43/24
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
  no shutdown
```

- Configure BGP

```
router bgp 65535
router-id 10.1.1.1
  neighbor 30.1.1.1 remote-as 65535
    update-source loopback0
    address-family l2vpn evpn
      send-community both
      route-reflector-client
  neighbor 40.1.1.1 remote-as 65535
    update-source loopback0
    address-family l2vpn evpn
      send-community both
      route-reflector-client
```

- Spine (9504-B)
  - Enable the EVPN control plane

```
nv overlay evpn
```

  - Enable the relevnt Protocols

```
feature ospf
feature bgp
feature pim
```

  - Configure Loopback for local Router ID, PIM, and BGP

```
interface loopback0
  ip address 20.1.1.1/32
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
```

- Configure Loopback for AnycastRP

```
interface loopback1
  ip address 100.1.1.1/32
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
```

- Configure Anycast RP

```
ip pim rp-address 100.1.1.1 group-list 224.0.0.0/4
ip pim anycast-rp 100.1.1.1 10.1.1.1
ip pim anycast-rp 100.1.1.1 20.1.1.1
```

- Enable OSPF for underlayrouting

```
router ospf 1
```

- Configure interfaces for Spine-leaf interconnect

```
interface Ethernet4/2
  ip address 192.168.3.42/24
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
  no shutdown

interface Ethernet4/3
  ip address 192.168.4.43/24
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
  no shutdown
```

- Configure BGP

```
router bgp 65535
  router-id 20.1.1.1
  neighbor 30.1.1.1 remote-as 65535
    update-source loopback0
    address-family l2vpn evpn
      send-community both
      route-reflector client
  neighbor 40.1.1.1 remote-as 65535
    update-source loopback0
    address-family l2vpn evpn
      send-community both
      route-reflector client
```

- Leaf (9396-A)
  - Enable the EVPN control plane

```
nv overlay evpn
```

  - Enable the relevant protocols

```
feature ospf
feature bgp
feature pim
feature interface-vlan
```

- Enable VXLAN with distributed anycast-gateway using BGP EVPN

```
feature vn-segment-vlan-based
feature nv overlay
fabric forwarding anycast-gateway-mac 0000.2222.3333
```

- Enabling OSPF for underlay routing

```
router ospf 1
```

- Configure Loopback for local Router ID, PIM, and BGP

```
interface loopback0
  ip address 30.1.1.1/32
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
```

- Configure Loopback for local VTEP IP

```
interface loopback1
  ip address 33.1.1.1/32
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
```

- Configure interfaces for Spine-leaf interconnect

```
interface Ethernet2/2
  no switchport
  ip address 192.168.1.22/24
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
  no shutdown

interface Ethernet2/3
  no switchport
  ip address 192.168.3.23/24
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
  shutdown
```

- Configure route-map to Redistribute Host-SVI (Silent Host)

```
route-map HOST-SVI permit 10
  match tag 54321
```

- Configure PIM RP

```
ip pim rp-address 100.1.1.1 group-list 224.0.0.0/4
```

- Create VLANs

```
vlan 1001-1002
```

- Create overlay VRF VLAN and configure vn-segment

```
vlan 101
  vn-segment 900001
```

- Create overlay VRF VLAN and configure vn-segment

```
vlan 101
  vn-segment 900001
```

- Configure Core-facing SVI for VXLAN routing

```
interface vlan101
 no shutdown
  vrf member vxlan-900001
  ip forward
  no ip redirects
  ipv6 address use-link-local-only
  no ipv6 redirects
```

- Create VLAN and provide mapping to VXLAN

```
vlan 1001
  vn-segment 2001001
vlan 1002
  vn-segment 2001002
```

- Create VRF and configure VNI

```
vrf context vxlan-900001
  vni 900001
  rd auto
```

Note The **rd auto** and **route-target** commands are automatically configured unless one or more are entered as overrides.

```
\
address-family ipv4 unicast
      route-target both auto
      route-target both auto evpn
    address-family ipv6 unicast
      route-target both auto
      route-target both auto evpn
```

- Create server facing SVI and enable distributed anycast-gateway.

```
interface vlan1001
  no shutdown
  vrf member vxlan-900001
  ip address 4.1.1.1/24 tag 54321
  ipv6 address 4:1:0:1::1/64 tag 54321
  fabric forwarding mode anycast-gateway

interface vlan1002
  no shutdown
  vrf member vxlan-900001
  ip address 4.2.2.1/24 tag 54321
  ipv6 address 4:2:0:1::1/64 tag 54321
```

```
  fabric forwarding mode anycast-gateway
```

- Configure ACL TCAM region for ARP suppression

Note The **hardware access-list tcam region arp-ether 256 double-wide** command is not needed for Cisco Nexus 9300-EX and 9300-FX/FX2/FX3 and 9300-GX platform switches.

```
hardware access-list tcam region arp-ether 256 double-wide
```

Note You can choose either of the following two options for creating the NVE interface. Use Option 1 for a small number of VNIs. Use Option 2 to leverage the simplified configuration mode.

Create the network virtualization endpoint (NVE) interface

Option 1

```
interface nve1
no shutdown
  source-interface loopback1
  host-reachability protocol bgp
  member vni 900001 associate-vrf
  member vni 2001001
    mcast-group 239.0.0.1
  member vni 2001002
    mcast-group 239.0.0.1
```

Option 2

```
interface nve1
  source-interface loopback1
  host-reachability protocol bgp
  global mcast-group 239.0.0.1 L2
  member vni 2001001
  member vni 2001002
  member vni 2001007-2001010
```

- Configure interfaces for hosts/servers

```
interface Ethernet1/47
  switchport
  switchport access vlan 1002

interface Ethernet1/48
  switchport
  switchport access vlan 1001
```

- Configure BGP

```
router bgp 65535
  router-id 30.1.1.1
  neighbor 10.1.1.1 remote-as 65535
    update-source loopback0
    address-family l2vpn evpn
      send-community both
  neighbor 20.1.1.1 remote-as 65535
    update-source loopback0
    address-family l2vpn evpn
      send-community both
  vrf vxlan-900001
    address-family ipv4 unicast
      redistribute direct route-map HOST-SVI
    address-family ipv6 unicast
      redistribute direct route-map HOST-SVI
```

Note The following commands in EVPN mode do not need to be entered.

```
evpn
  vni 2001001 l2
  vni 2001002 l2
```

Note The **rd auto** and **route-target auto** commands are automatically configured unless one or more are entered as overrides.

```
rd auto
    route-target import auto
    route-target export auto
```

Note The **rd auto** and **route-target** commands are automatically configured unless you want to use them to override the **import** or **export** options.

Note The following commands in EVPN mode do not need to be entered.

```
evpn
  vni 2001001 l2
    rd auto
    route-target import auto
    route-target export auto
  vni 2001002 l2
    rd auto
    route-target import auto
    route-target export auto
```

- Leaf (9396-B)

- Enable the EVPN control plane

```
nv overlay evpn
```

- Enable the relevant protocols

```
feature ospf
feature bgp
feature pim
feature interface-vlan
```

- Enable VxLAN with distributed anycast-gateway using BGP EVPN

```
feature vn-segment-vlan-based
feature nv overlay
fabric forwarding anycast-gateway-mac 0000.2222.3333
```

- Enabling OSPF for underlayrouting

```
router ospf 1
```

- Configure Loopback for local Router ID, PIM, and BGP

```
interface loopback0
  ip address 40.1.1.1/32
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
```

- Configure Loopback for local VTEP IP

```
interface loopback1
  ip address 44.1.1.1/32
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
```

- Configure interfaces for Spine-leaf interconnect

```
interface Ethernet2/2
  no switchport
  ip address 192.168.3.22/24
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
  no shutdown

interface Ethernet2/3
  no switchport
  ip address 192.168.4.23/24
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
  shutdown
```

- Configure route-map to Redistribute Host-SVI (Silent Host)

```
route-map HOST-SVI permit 10
  match tag 54321
```

- Configure PIM RP

```
ip pim rp-address 100.1.1.1 group-list 224.0.0.0/4
```

- Create VLANs

```
vlan 1001-1002
```

- Create overlay VRF VLAN and configure vn-segment

```
vlan 101
  vn-segment 900001
```

- Configure Core-facing SVI for VXLAN routing

```
interface vlan101
 no shutdown
  vrf member vxlan-900001
  ip forward
  no ip redirects
  ipv6 address use-link-local-only
  no ipv6 redirects
```

- Create VLAN and provide mapping to VXLAN

```
vlan 1001
  vn-segment 2001001
vlan 1002
  vn-segment 2001002
```

- Create VRF and configure VNI

```
vrf context vxlan-900001
  vni 900001
  rd auto
```

Note The **rd auto** and **route-target** commands are automatically configured unless one or more are entered as overrides.

```
  address-family ipv4 unicast
    route-target both auto
    route-target both auto evpn
  address-family ipv6 unicast
    route-target both auto
    route-target both auto evpn
```

- Create server facing SVI and enable distributed anycast-gateway

```
interface vlan1001
  no shutdown
  vrf member vxlan-900001
  ip address 4.1.1.1/24
  ipv6 address 4:1:0:1::1/64
  fabric forwarding mode anycast-gateway

interface vlan1002
  no shutdown
  vrf member vxlan-900001
```

```
  ip address 4.2.2.1/24
  ipv6 address 4:2:0:1::1/64
  fabric forwarding mode anycast-gateway
```

- Configure ACL TCAM region for ARP suppression

Note The **hardware access-list tcam region arp-ether 256 double-wide** command is not needed for Cisco Nexus 9300-EX and 9300-FX/FX2/FX3 and 9300-GX platform switches.

```
hardware access-list tcam region arp-ether 256 double-wide
```

Note You can choose either of the following two command procedures for creating the NVE interfaces. Use Option 1 for a small number of VNIs. Use Option 2 to leverage the simplified configuration mode.

Create the network virtualization endpoint (NVE) interface

Option 1

```
interface nve1
  no shutdown
  source-interface loopback1
  host-reachability protocol bgp
  member vni 900001 associate-vrf
  member vni 2001001
    mcast-group 239.0.0.1
  member vni 2001002
    mcast-group 239.0.0.1
```

Option 2

```
interface nve1
  interface nve1
  source-interface loopback1
  host-reachability protocol bgp
  global mcast-group 239.0.0.1 L2
  member vni 2001001
  member vni 2001002
  member vni 2001007-2001010
```

- Configure interfaces for hosts/servers

```
interface Ethernet1/47
  switchport
  switchport access vlan 1002
```

```
interface Ethernet1/48
  switchport
  switchport access vlan 1001
```

- Configure BGP

```
router bgp 65535
  router-id 40.1.1.1
  neighbor 10.1.1.1 remote-as 65535
    update-source loopback0
    address-family l2vpn evpn
      send-community both
  neighbor 20.1.1.1 remote-as 65535
    update-source loopback0
    address-family l2vpn evpn
      send-community both
  vrf vxlan-900001
  vrf vxlan-900001
    address-family ipv4 unicast
      redistribute direct route-map HOST-SVI
    address-family ipv6 unicast
      redistribute direct route-map HOST-SVI
```

Note The following commands in EVPN mode do not need to be entered.

```
evpn
  vni 2001001 l2
  vni 2001002 l2
```

Note The **rd auto** and **route-target** commands are automatically configured unless one or more are entered as overrides.

```
rd auto
    route-target import auto
    route-target export auto
```

Note The following commands in EVPN mode do not need to be entered.

```
evpn
  vni 2001001 l2
    rd auto
    route-target import auto
    route-target export auto
  vni 2001002 l2
    rd auto
    route-target import auto
    route-target export auto
```

- Configure interface vlan on Border Gateway (BGW)

```
interface vlan101
  no shutdown
```

```
  vrf member evpn-tenant-3103101
  no ip redirects
  ip address 101.1.0.1/16
  ipv6 address cafe:101:1::1/48
  no ipv6 redirects
  fabric forwarding mode anycast-gateway
```

Note When you have iBGP session between BGWs and EBGP fabric is used, you need to configure the route-map to make VIP or VIP_R route advertisement with higher AS-PATH when local VIP or VIP_R is down (due to reload or fabric link flap). A sample route-map configuration is provided below. In this example 192.0.2.1 is VIP address and 198.51.100.1 is BGP VIP route's nexthop learned from same BGW site.

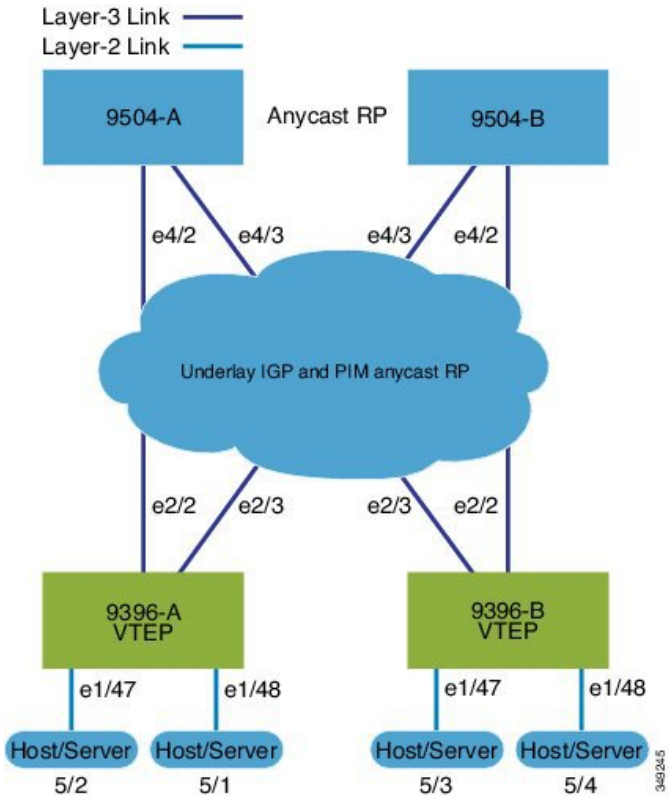
```
ip prefix-list vip_ip seq 5 permit 192.0.2.1/32
ip prefix-list vip_route_nh seq 5 permit 198.51.100.1/32

route-map vip_ip permit 5
  match ip address prefix-list vip_ip
  match ip next-hop prefix-list vip_route_nh
  set as-path prepend 5001 5001 5001
route-map vip_ip permit 10
```

Example of VXLAN BGP EVPN (eBGP)

An example of a VXLAN BGP EVPN (eBGP):

Figure 2: VXLAN BGP EVPN Topology (eBGP)



eBGP between Spine and Leaf

- Spine (9504-A)
  - Enable the EVPN control plane

```
nv overlay evpn
```

  - Enable the relevant protocols

```
feature bgp
feature pim
```

  - Configure Loopback for local Router ID, PIM, and BGP

```
interface loopback0
  ip address 10.1.1.1/32 tag 12345
  ip pim sparse-mode
```

  - Configure Loopback for Anycast RP

```
interface loopback1
  ip address 100.1.1.1/32 tag 12345
  ip pim sparse-mode
```

  - Configure Anycast RP

```
ip pim rp-address 100.1.1.1 group-list 224.0.0.0/4
ip pim anycast-rp 100.1.1.1 10.1.1.1
ip pim anycast-rp 100.1.1.1 20.1.1.1
```

  - Configure route-map used by eBGP for Spine

```
route-map NEXT-HOP-UNCH permit 10
  set ip next-hop unchanged
```

  - Configure route-map to Redistribute Loopback

```
route-map LOOPBACK permit 10
  match tag 12345
```

  - Configure interfaces for Spine-leaf interconnect

```
interface Ethernet4/2
  ip address 192.168.1.42/24
  ip pim sparse-mode
  no shutdown

interface Ethernet4/3
  ip address 192.168.2.43/24
  ip pim sparse-mode
  no shutdown
```

  - Configure the BGP overlay for the EVPN address family.

```
router bgp 100
  router-id 10.1.1.1
  address-family l2vpn evpn
```

```
    nexthop route-map NEXT-HOP-UNCH
    retain route-target all
  neighbor 30.1.1.1 remote-as 200
    update-source loopback0
    ebgp-multihop 3
    address-family l2vpn evpn
      send-community both
      disable-peer-as-check
      route-map NEXT-HOP-UNCH out
  neighbor 40.1.1.1 remote-as 200
    update-source loopback0
    ebgp-multihop 3
    address-family l2vpn evpn
      send-community both
      disable-peer-as-check
      route-map NEXT-HOP-UNCH out
```

- Configure BGP underlay for the IPv4 unicast address family.

```
 address-family ipv4 unicast
    redistribute direct route-map LOOPBACK
  neighbor 192.168.1.22 remote-as 200
    update-source ethernet4/2
    address-family ipv4 unicast
      allowas-in
      disable-peer-as-check
  neighbor 192.168.2.23 remote-as 200
    update-source ethernet4/3
    address-family ipv4 unicast
      allowas-in
      disable-peer-as-check
```

- Spine (9504-B)
  - Enable the EVPN control plane

```
nv overlay evpn
```

  - Enable the relevant protocols

```
feature bgp
feature pim
```

  - Configure Loopback for local Router ID, PIM, and BGP

```
interface loopback0
  ip address 20.1.1.1/32 tag 12345
  ip pim sparse-mode
```

  - Configure Loopback for AnycastRP

```
interface loopback1
  ip address 100.1.1.1/32 tag 12345
  ip pim sparse-mode
```

  - Configure Anycast RP

```
ip pim rp-address 100.1.1.1 group-list 224.0.0.0/4
ip pim anycast-rp 100.1.1.1 10.1.1.1
ip pim anycast-rp 100.1.1.1 20.1.1.1
```

- Configure route-map used by eBGP for Spine

```
route-map NEXT-HOP-UNCH permit 10
  set ip next-hop unchanged
```

- Configure route-map to Redistribute Loopback

```
route-map LOOPBACK permit 10
  match tag 12345
```

- Configure interfaces for Spine-leaf interconnect

```
interface Ethernet4/2
  no switchport
  ip address 192.168.3.42/24
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
  no shutdown

interface Ethernet4/3
  no switchport
  ip address 192.168.4.43/24
  ip router ospf 1 area 0.0.0.0
  ip pim sparse-mode
  shutdown
```

- Configure BGP overlay for the EVPN address family

```
router bgp 100
  router-id 20.1.1.1
  address-family l2vpn evpn
    nexthop route-map NEXT-HOP-UNCH
    retain route-target all
  neighbor 30.1.1.1 remote-as 200
    update-source loopback0
    ebgp-multihop 3
    address-family l2vpn evpn
      send-community both
      disable-peer-as-check
      route-map NEXT-HOP-UNCH out
  neighbor 40.1.1.1 remote-as 200
    update-source loopback0
    ebgp-multihop 3
    address-family l2vpn evpn
      send-community both
      disable-peer-as-check
      route-map NEXT-HOP-UNCH out
```

- Configure the BGP underlay for the IPv4 unicast address family.

```
  address-family ipv4 unicast
    redistribute direct route-map LOOPBACK
  neighbor 192.168.3.22 remote-as 200
```

```
    update-source ethernet4/2
    address-family ipv4 unicast
      allowas-in
      disable-peer-as-check
  neighbor 192.168.4.43 remote-as 200
    update-source ethernet4/3
    address-family ipv4 unicast
      allowas-in
      disable-peer-as-check
```

- Leaf (9396-A)
  - Enable the EVPN control plane.

    ```
    nv overlay evpn
    ```

  - Enable the relevant protocols.

    ```
    feature bgp
    feature pim
    feature interface-vlan
    ```

  - Enable VXLAN with distributed anycast-gateway using BGP EVPN.

    ```
    feature vn-segment-vlan-based
    feature nv overlay
    fabric forwarding anycast-gateway-mac 0000.2222.3333
    ```

  - Enabling OSPF for underlay routing.

    ```
    router ospf 1
    ```

  - Configure Loopback for local Router ID, PIM, and BGP.

    ```
    interface loopback0
      ip address 30.1.1.1/32
      ip pim sparse-mode
    ```

  - Configure Loopback for VTEP.

    ```
    interface loopback1
      ip address 33.1.1.1/32
      ip pim sparse-mode
    ```

  - Configure interfaces for Spine-leaf interconnect.

    ```
    interface Ethernet2/2
      no switchport
      ip address 192.168.1.22/24
      ip pim sparse-mode
      no shutdown

    interface Ethernet2/3
      no switchport
      ip address 192.168.4.23/24
      ip pim sparse-mode
      shutdown
    ```

  - Configure route-map to Redistribute Host-SVI (Silent Host).

```
route-map HOST-SVI permit 10
  match tag 54321
```

- Enable PIM RP.

```
ip pim rp-address 100.1.1.1 group-list 224.0.0.0/4
```

- Create VLANs.

```
vlan 1001-1002
```

- Create overlay VRF VLAN and configure vn-segment.

```
vlan 101
  vn-segment 900001
```

- Configure core-facing SVI for VXLAN routing.

```
interface vlan101
 no shutdown
  vrf member vxlan-900001
  ip forward
  no ip redirects
  ipv6 address use-link-local-only
  no ipv6 redirects
```

- Create VLAN and provide mapping toVXLAN.

```
vlan 1001
  vn-segment 2001001
vlan 1002
  vn-segment 2001002
```

- Create VRF and configure VNI

```
vrf context vxlan-900001
  vni 900001
  rd auto
```

Note The **rd auto** and **route-target** commands are automatically configured unless one or more are entered as overrides.

```
    address-family ipv4 unicast
      route-target both auto
      route-target both auto evpn
    address-family ipv6 unicast
      route-target both auto
      route-target both auto evpn
```

- Create server facing SVI and enable distributed anycast-gateway

```
interface vlan1001
```

```
  no shutdown
  vrf member vxlan-900001
  ip address 4.1.1.1/24 tag 54321
  ipv6 address 4:1:0:1::1/64 tag 54321
  fabric forwarding mode anycast-gateway

interface vlan1002
  no shutdown
  vrf member vxlan-900001
  ip address 4.2.2.1/24 tag 54321
  ipv6 address 4:2:0:1::1/64 tag 54321
  fabric forwarding mode anycast-gateway
```

- Configure ACL TCAM region for ARP suppression

Note The **hardware access-list tcam region arp-ether 256 double-wide** command is not needed for Cisco Nexus 9300-EX and 9300-FX/FX2/FX3 and 9300-GX platform switches.

```
hardware access-list tcam region arp-ether 256 double-wide
```

Note You can choose either of the following two options for creating the NVE interface. Use Option 1 for a small number of VNIs. Use Option 2 to leverage the simplified configuration mode.

Create the network virtualization endpoint (NVE) interface

Option 1

```
interface nve1
  no shutdown
  source-interface loopback1
  host-reachability protocol bgp
  member vni 900001 associate-vrf
  member vni 2001001
    mcast-group 239.0.0.1
  member vni 2001002
    mcast-group 239.0.0.1
```

Option 2

```
interface nve1
  source-interface loopback1
  host-reachability protocol bgp
  global mcast-group 239.0.0.1 L2
  member vni 2001001
  member vni 2001002
```

```
  member vni 2001007-2001010
```

- Configure interfaces for hosts/servers.

```
interface Ethernet1/47
  switchport
  switchport access vlan 1002

interface Ethernet1/48
  switchport
  switchport access vlan 1001
```

- Configure BGP underlay for the IPv4 unicast address family.

```
router bgp 200
  router-id 30.1.1.1
  address-family ipv4 unicast
    redistribute direct route-map LOOPBACK
  neighbor 192.168.1.42 remote-as 100
    update-source ethernet2/2
    address-family ipv4 unicast
      allowas-in
      disable-peer-as-check
  neighbor 192.168.4.43 remote-as 100
    update-source ethernet2/3
    address-family ipv4 unicast
      allowas-in
      disable-peer-as-check
```

- Configure BGP overlay for the EVPN address family.

```
  address-family l2vpn evpn
    nexthop route-map NEXT-HOP-UNCH
    retain route-target all
  neighbor 10.1.1.1 remote-as 100
    update-source loopback0
    ebgp-multihop 3
    address-family l2vpn evpn
      send-community both
      disable-peer-as-check
      route-map NEXT-HOP-UNCH out
  neighbor 20.1.1.1 remote-as 100
    update-source loopback0
    ebgp-multihop 3
    address-family l2vpn evpn
      send-community both
      disable-peer-as-check
      route-map NEXT-HOP-UNCH out
  vrf vxlan-900001
```

Note The following commands in EVPN mode do not need to be entered.

```
evpn
  vni 2001001 l2
  vni 2001002 l2
```

Note The **rd auto** and **route-target auto** commands are automatically configured unless one or more are entered as overrides.

```
rd auto
route-target import auto
route-target export auto
```

Note The following commands in EVPN mode do not need to be entered.

```
evpn
  vni 2001001 l2
    rd auto
    route-target import auto
    route-target export auto
  vni 2001002 l2
    rd auto
    route-target import auto
    route-target export auto
```

- Leaf (9396-B)
  - Enable the EVPN control plane.

    ```
    nv overlay evpn
    ```

  - Enable the relevant protocols.

    ```
    feature bgp
    feature pim
    feature interface-vlan
    ```

  - Enable VXLAN with distributed anycast-gateway using BGP EVPN.

    ```
    feature vn-segment-vlan-based
    feature nv overlay
    fabric forwarding anycast-gateway-mac 0000.2222.3333
    ```

  - Enabling OSPF for underlay routing.

    ```
    router ospf 1
    ```

  - Configure Loopback for local Router ID, PIM, and BGP.

    ```
    interface loopback0
      ip address 40.1.1.1/32
      ip pim sparse-mode
    ```

  - Configure Loopback for VTEP.

    ```
    interface loopback1
      ip address 44.1.1.1/32
      ip pim sparse-mode
    ```

  - Configure interfaces for Spine-leaf interconnect.

```
interface Ethernet2/2
  no switchport
  ip address 192.168.3.22/24
  ip pim sparse-mode
  no shutdown

interface Ethernet2/3
  no switchport
  ip address 192.168.2.23/24
  ip pim sparse-mode
  shutdown
```

- Configure route-map to Redistribute Host-SVI (Silent Host).

```
route-map HOST-SVI permit 10
  match tag 54321
```

- Enable PIM RP

```
ip pim rp-address 100.1.1.1 group-list 224.0.0.0/4
```

- Create VLANs

```
vlan 1001-1002
```

- Create overlay VRF VLAN and configure vn-segment.

```
vlan 101
  vn-segment 900001
```

- Configure core-facing SVI for VXLAN routing.

```
interface vlan101
 no shutdown
  vrf member vxlan-900001
  ip forward
  no ip redirects
  ipv6 address use-link-local-only
  no ipv6 redirects
```

- Create VLAN and provide mapping to VXLAN.

```
vlan 1001
  vn-segment 2001001
vlan 1002
  vn-segment 2001002
```

- Create VRF and configure VNI

```
vrf context vxlan-900001
  vni 900001
  rd auto
```

Note The following commands are automatically configured unless one or more are entered as overrides.

```
    address-family ipv4 unicast
      route-target both auto
      route-target both auto evpn
    address-family ipv6 unicast
      route-target both auto
      route-target both auto evpn
```

- Create server facing SVI and enable distributed anycast-gateway.

```
interface vlan1001
  no shutdown
  vrf member vxlan-900001
  ip address 4.1.1.1/24 tag 54321
  ipv6 address 4:1:0:1::1/64 tag 54321
  fabric forwarding mode anycast-gateway

interface vlan1002
  no shutdown
  vrf member vxlan-900001
  ip address 4.2.2.1/24 tag 54321
  ipv6 address 4:2:0:1::1/64 tag 54321
  fabric forwarding mode anycast-gateway
```

- Configure ACL TCAM region for ARP suppression

Note The **hardware access-list tcam region arp-ether 256 double-wide** command is not needed for Cisco Nexus 9300-EX and 9300-FX/FX2/FX3 and 9300-GX platform switches.

```
hardware access-list tcam region arp-ether 256 double-wide
```

Note You can choose either of the following two procedures for creating the NVE interface. Use Option 1 for a small number of VNIs. Use Option 2 to leverage the simplified configuration mode.

Create the network virtualization endpoint (NVE) interface.

Option 1

```
interface nve1
  no shutdown
  source-interface loopback1
  host-reachability protocol bgp
  member vni 900001 associate-vrf
  member vni 2001001
    mcast-group 239.0.0.1
  member vni 2001002
    mcast-group 239.0.0.1
```

Option 2

```
interface nve1
  source-interface loopback1
  host-reachability protocol bgp
  global mcast-group 239.0.0.1 L2
  member vni 2001001
  member vni 2001002
  member vni 2001007-2001010
```

- Configure interfaces for hosts/servers

```
interface Ethernet1/47
  switchport
  switchport access vlan 1002

interface Ethernet1/48
  switchport
  switchport access vlan 1001
```

- Configure BGP underlay for the IPv4 unicast address family.

```
router bgp 200
  router-id 40.1.1.1
  address-family ipv4 unicast
    redistribute direct route-map LOOPBACK
  neighbor 192.168.3.42 remote-as 100
    update-source ethernet2/2
    address-family ipv4 unicast
      allowas-in
      disable-peer-as-check
  neighbor 192.168.2.43 remote-as 100
    update-source ethernet2/3
    address-family ipv4 unicast
      allowas-in
      disable-peer-as-check
```

- Configure BGP overlay for the EVPN address family.

```
  address-family l2vpn evpn
    nexthop route-map NEXT-HOP-UNCH
    retain route-target all
  neighbor 10.1.1.1 remote-as 100
    update-source loopback0
    ebgp-multihop 3
    address-family l2vpn evpn
      send-community both
      disable-peer-as-check
      route-map NEXT-HOP-UNCH out
  neighbor 20.1.1.1 remote-as 100
    update-source loopback0
    ebgp-multihop 3
    address-family l2vpn evpn
      send-community both
      disable-peer-as-check
      route-map NEXT-HOP-UNCH out
  vrf vxlan-900001
```

Note The following commands in EVPN mode do not need to be entered.

```
evpn
  vni 2001001 l2
  vni 2001002 l2
```

Note The **rd auto** and **route-target auto** commands are automatically configured unless one or more are entered as overrides.

```
rd auto
route-target import auto
route-target export auto
```

Note The following commands in EVPN mode do not need to be entered.

```
evpn
  vni 2001001 l2
    rd auto
    route-target import auto
    route-target export auto
  vni 2001002 l2
    rd auto
    route-target import auto
    route-target export auto
```

Example Show Commands

- **show nve peers**

```
9396-B# show nve peers
Interface Peer-IP          State LearnType Uptime   Router-Mac
--------- ---------------  ----- --------- -------- -----------------
nve1      30.1.1.1         Up    CP        00:00:38 6412.2574.9f27
```

- **show nve vni**

```
9396-B# show nve vni
Codes: CP - Control Plane        DP - Data Plane
       UC - Unconfigured

Interface VNI      Multicast-group   State Mode Type [BD/VRF]      Flags
--------- -------- ----------------- ----- ---- ------------------ -----
nve1      900001   n/a               Up    CP   L3 [vxlan-900001]
nve1      2001001  225.4.0.1         Up    CP   L2 [1001]
nve1      2001002  225.4.0.1         Up    CP   L2 [1002]
```

- **show ip arp suppression-cache detail**

```
9396-B# show ip arp suppression-cache detail

Flags: + - Adjacencies synced via CFSoE
       L - Local Adjacency
       R - Remote Adjacency
       L2 - Learnt over L2 interface

Ip Address      Age      Mac Address    Vlan Physical-ifindex    Flags

4.1.1.54        00:06:41 0054.0000.0000 1001 Ethernet1/48        L
4.1.1.51        00:20:33 0051.0000.0000 1001 (null)              R
4.2.2.53        00:06:41 0053.0000.0000 1002 Ethernet1/47        L
4.2.2.52        00:20:33 0052.0000.0000 1002 (null)              R
```

Note The **show vxlan interface** command is not supported for the Cisco Nexus 9300-EX, 9300-FX/FX2/FX3, and 9300-GX platform switches.

- **show vxlan interface**

```
9396-B# show vxlan interface
Interface       Vlan    VPL Ifindex     LTL             HW VP
=========       ====    ===========     ===             =====
Eth1/47         1002    0x4c07d22e      0x10000         5697
Eth1/48         1001    0x4c07d02f      0x10001         5698
```

- **show bgp l2vpn evpn summary**

```
leaf3# show bgp l2vpn evpn summary
BGP summary information for VRF default, address family L2VPN EVPN
BGP router identifier 40.0.0.4, local AS number 10
BGP table version is 60, L2VPN EVPN config peers 1, capable peers 1
21 network entries and 21 paths using 2088 bytes of memory
BGP attribute entries [8/1152], BGP AS path entries [0/0]
BGP community entries [0/0], BGP clusterlist entries [1/4]

Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down
State/PfxRcd
40.0.0.1        4    10    8570    8565       60    0    0    5d22h 6
leaf3#
```

- **show bgp l2vpn evpn**

```
leaf3# show bgp l2vpn evpn
BGP routing table information for VRF default, address family L2VPN EVPN
BGP table version is 60, local router ID is 40.0.0.4
Status: s-suppressed, x-deleted, S-stale, d-dampened, h-history, *-valid,
>-best
Path type: i-internal, e-external, c-confed, l-local, a-aggregate, r-redist,
I-injected
Origin codes: i - IGP, e - EGP, ? - incomplete, | - multipath, & - backup

   Network            Next Hop            Metric     LocPrf     Weight Path
Route Distinguisher: 40.0.0.2:32868
*>i[2]:[0]:[10001]:[48]:[0000.8816.b645]:[0]:[0.0.0.0]/216
                      40.0.0.2                           100          0 i
*>i[2]:[0]:[10001]:[48]:[0011.0000.0034]:[0]:[0.0.0.0]/216
                      40.0.0.2                           100          0 i
```

- **show l2route evpn mac all**

```
leaf3# show l2route evpn mac all
Topology    Mac Address    Prod   Next Hop (s)
----------- -------------- ------ ---------------
101         0000.8816.b645 BGP    40.0.0.2
101         0001.0000.0033 Local  Ifindex 4362086
101         0001.0000.0035 Local  Ifindex 4362086
101         0011.0000.0034 BGP    40.0.0.2
```

- **show l2route evpn mac-ip all**

```
leaf3# show l2route evpn mac-ip all
Topology ID Mac Address    Prod Host IP                 Next Hop (s)
----------- -------------- ---- ------------------------------------------------------
101         0011.0000.0034 BGP  5.1.3.2                      40.0.0.2
102         0011.0000.0034 BGP  5.1.3.2                      40.0.0.2
```

VXLAN EVPN with Downstream VNI

About VXLAN EVPN with Downstream VNI

Cisco NX-OS Release 9.3(5) introduces VXLAN EVPN with downstream VNI. In earlier releases, the VNI configuration must be consistent across all nodes in the VXLAN EVPN network in order to enable communication between them.

VXLAN EVPN with downstream VNI provides the following solutions:

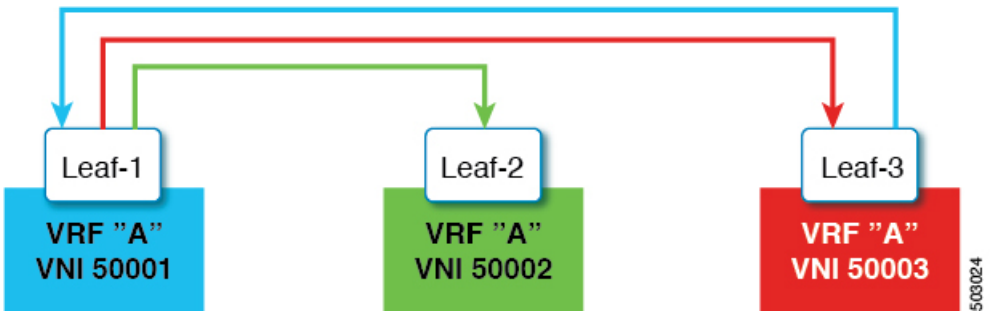
- Enables asymmetric VNI communication across nodes in a VXLAN EVPN network
- Provides customers access to a common shared service outside of their domain (tenant VRF)
- Supports communication between isolated VXLAN EVPN sites that have different sets of VNIs

Asymmetric VNIs

VXLAN EVPN with downstream VNI supports asymmetric VNI allocation.

The following figure shows an example of asymmetric VNIs. All three VTEPs have different VNIs configured for the same IP VRF or MAC VRF.

Figure 3: Asymmetric VNIs



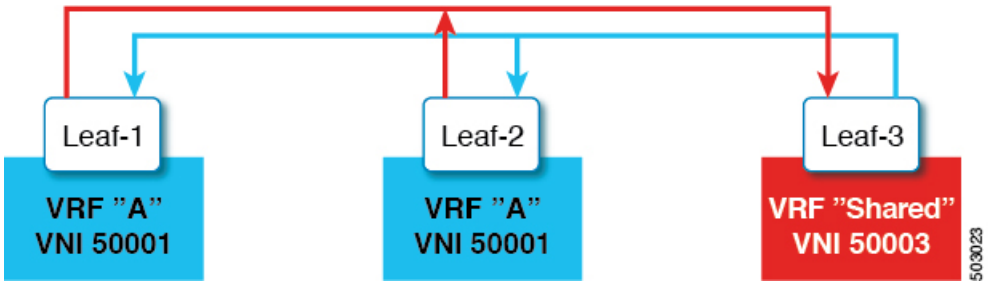
Shared Services VRFs

VXLAN EVPN with downstream VNI supports shared services VRFs. It does so by importing multiple L3VRFs into a single local L3VRF and supporting disparate values of downstream L3VNIs on a per-peer basis.

For example, a DNS server needs to serve multiple hosts in a data center regardless of the tenant VRFs on which the hosts sit. The DNS server is attached to a shared services VRF, which is attached to an L3VNI. To access this server from any of the tenant VRFs, the switches must import the routes from the shared services VRF to the tenant VRF, even though the L3VNI associated to the shared services VRF is different from the L3VNI associated to the tenant VRF.

In the following figure, Tenant VRF A in Leaf-1 can communicate with Tenant VRF A in Leaf-2. However, Tenant VRF A requires access to a shared service sitting behind Leaf-3.

Figure 4: Shared Services VRFs

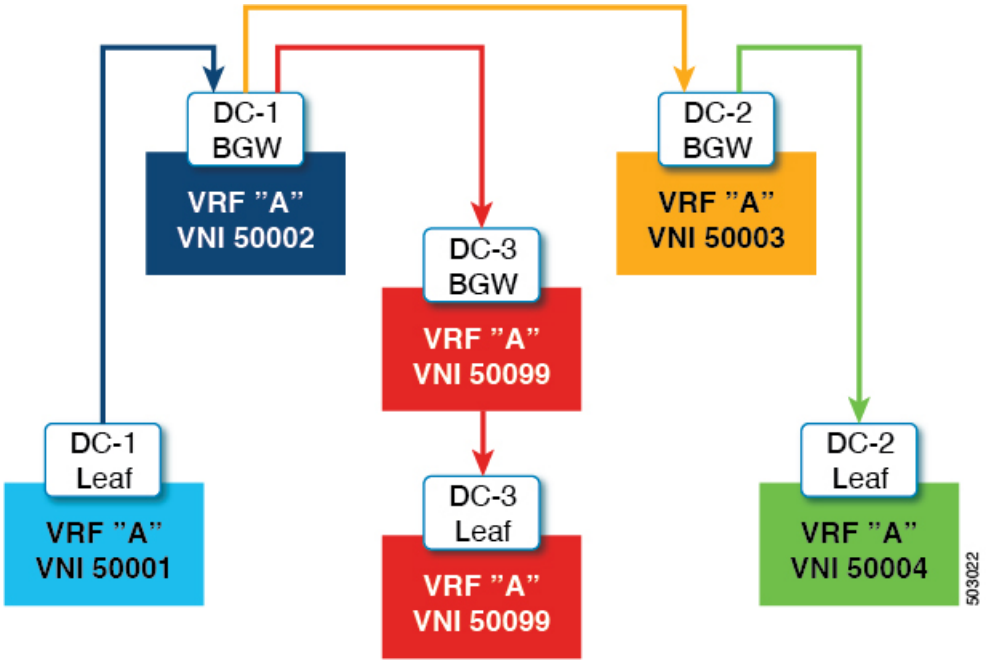


Multi-Site with Asymmetric VNIs

VXLAN EVPN with downstream VNI allows communication between sites that have different sets of VNIs. It does so by stitching the asymmetric VNIs at the border gateways.

In the following figure, DC-1 and DC-2 are asymmetric sites, and DC-3 is a symmetric site. Each site uses different VNIs within its site to communicate.

Figure 5: Multi-Site with Asymmetric VNIs



Guidelines and Limitations for VXLAN EVPN with Downstream VNI

VXLAN EVPN with downstream VNI has the following guidelines and limitations:

- Cisco Nexus 9332C, 9364C, 9300-EX, and 9300-FX/FX2/FXP platform switches and Cisco Nexus 9500 platform switches with -EX/FX line cards support VXLAN EVPN with downstream VNI.
- Beginning with Cisco NX-OS Release 9.3(7), Cisco Nexus 9300-GX platform switches support VXLAN EVPN with downstream VNI.
- VXLAN EVPN with downstream VNI is supported only on the IPv4 underlay.
- Downstream VNI is configured based on route-target export and import. The following conditions must be met to leverage Downstream VNI:
  - Downstream VNI requires the usage of different VRF (MAC-VRF or IP-VRF), each VRF must have a different VNI (Asymmetric VNI).
  - To import routes of a foreign VRF (MAC-VRF or IP-VRF) the appropriate route-target for the import into the local VRF must be configured.
  - The configuration of only auto-derived route-targets will not result in downstream VNI.
  - The export of VRF prefixes can be done by static or auto-derived route-target configuration.
  - The import of a foreign VRF's auto-derived route-target is supported.
  - The import of a foreign VRFs statically configured route-target is supported.
- Downstream VNI is supported for the following underlay constellations:
  - For downstream VNI with Layer-3 VNI, the underlay can be ingress replication or multicast based.

    - For downstream VNI with Layer-2 VNI, the underlay must be in ingress replication. Multicast based underlay is not supported with downstream VNI of Layer-2 VNIs.

- Downstream VNI requires to have consistent configuration:
    - All multi-site Border Gateway (BGW) in a site must have a consistent configuration.
    - All vPC members in a vPC domain must have consistent configuration.
- The usage of downstream VNI with multi-site requires all BGW across all sites to run at least Cisco NX-OS Release 9.3(5).
- For existing centralized VRF route leaking deployments, a brief traffic loss might occur during ISSU to Cisco NX-OS Release 9.3(5) or later.
- For successful downgrade from Cisco NX-OS Release 9.3(5) to a prior release, ensure that the asymmetric VNI configuration has been removed. Downstream VNI is not supported before Cisco NX-OS Release 9.3(5) and hence traffic forwarding would be impacted.
- Layer-3 VNIs (IP-VRF) can flexibly mapped between VNIs per peer.
    - VNI 50001 on VTEP1 can perform symmetric VNI with VNI 50001 and asymmetric VNI with VNI 50002 on VTEP2 at the same time.
    - VNI 50001 on VTEP1 can perform asymmetric VNI with VNI 50002 on VTEP2 and VNI 50003 on VTEP3.
    - VNI 50001 on VTEP1 can perform asymmetric VNI with VNI 50002 and VNI5003 on VTEP2 at the same time.
- Layer-2 VNIs (MAC-VRF) can only be mapped to one VNI per peer.
    - VNI 30001 on VTEP1 can perform asymmetric VNI with VNI 30002 on VTEP2 and VNI 30003 on VTEP3.
    - VNI 30001 on VTEP1 cannot perform asymmetric VNI with VNI 30002 and VNI 3003 on VTEP2 at the same time.
- iBGP sessions between vPC peer nodes in a VRF are not supported.
- BGP peering across VXLAN and Downstream VNI support the following constellations:
    - BGP peering between symmetric VNI is supported by using loopbacks.
    - BGP peering between asymmetric VNI is supported if the VNIs are in a direct message relationship. A loopback from VNI 50001 (on VTEP1) can peer with a loopback in VNI 50002 (on VTEP2).
    - BGP peering between asymmetric VNI is supported if the VNIs are in a direct message relationship but on different VTEPs. A loopback from VNI 50001 (on VTEP1) can peer with a loopback in VNI 50002 (on VTEP2 and VTEP3).
    - BGP peering between asymmetric VNI is not supported if the VNIs are in a 1:N relationship. A loopback in VNI 50001 (VTEP1) can’t peer with a loopback in VNI 50002 (VTEP2) and VNI 50003 (VTEP3) at the same time.
- VXLAN consistency checker is not supported for VXLAN EVPN with downstream VNI.

- VXLAN EVPN with downstream VNI is currently not supported with the following feature combinations:
  - VXLAN static tunnels
  - TRM and TRM with Multi-Site
  - CloudSec VXLAN EVPN Tunnel Encryption
  - ESI-based multihoming
  - Seamless integration of EVPN with L3VPN (MPLS SR)
  - VXLAN policy-based routing (PBR)
  - IPv6 Underlay
  - DSVNI with IPv6 Underlay
- Make sure that you configure L2VNI SVI on Anycast BGW to enable DSVNI MAC-IP Layer 3 label translation in a multisite environment. The functionality of DSVNI is limited for reoriginated routes, which requires as association between L2VNI and VRF. You can associate using the VRF member command in L2VNI SVI.

Verifying the VXLAN EVPN with Downstream VNI Configuration

To display the VXLAN EVPN with downstream VNI configuration information, enter one of the following commands:

Command	Purpose
show bgp evi *l2-evi*	Displays the VRF associated with an L2VNI.
show forwarding adjacency nve platform	Displays both symmetric and asymmetric NVE adjacencies with the corresponding DestInfoIndex.
show forwarding route vrf *vrf*	Displays the egress VNI or downstream VNI for each next-hop.
show ip route detail vrf *vrf*	Displays the egress VNI or downstream VNI for each next-hop.
show l2route evpn mac-ip all detail	Displays labeled next-hops that are present in the remote MAC routes.
show l2route evpn imet all detail	Displays the egress VNI associated with the remote peer.
show nve peers control-plane-vni peer-ip *ip-address*	Displays the egress VNI or downstream VNI for each NVE adjacency.

The following example shows sample output for the **show bgp evi** *l2-evi* command:

```
switch# show bgp evi 100
------------------------------------------------
  L2VNI ID                      : 100 (L2-100)
  RD                            : 3.3.3.3:32867
```

```
  Secondary RD                : 1:100
  Prefixes (local/total)      : 1/6
  Created                     : Jun 23 22:35:13.368170
  Last Oper Up/Down           : Jun 23 22:35:13.369005 / never
  Enabled                     : Yes
  Associated IP-VRF           : vni100
  Active Export RT list       :
        100:100
  Active Import RT list       :
        100:100
```

The following example shows sample output for the **show forwarding adjacency nve platform** command:

```
switch# show forwarding adjacency nve platform
slot  1
=======
IPv4 NVE adjacency information

next_hop:12.12.12.12   interface:nve1 (0x49000001)  table_id:1
  Peer_id:0x49080002  dst_addr:12.12.12.12  src_addr:13.13.13.13  RefCt:1  PBRCt:0
Flags:0x440800
cp : TRUE, DCI peer: FALSE is_anycast_ip FALSE dsvni peer: FALSE
  HH:0x7a13f  DstInfoIndex:0x3002
    tunnel init: unit-0:0x3 unit-1:0x0

next_hop:12.12.12.12   interface:nve1 (0x49000001)  table_id:1
  Peer_id:0x49080002  dst_addr:12.12.12.12  src_addr:13.13.13.13  RefCt:1  PBRCt:0
Flags:0x10440800
cp : TRUE, DCI peer: FALSE is_anycast_ip FALSE dsvni peer: TRUE
  HH:0x7a142  DstInfoIndex:0x3ffd
    tunnel init: unit-0:0x6 unit-1:0x0
...
```

The following example shows sample output for the **show forwarding route vrf** *vrf* command:

```
switch# show forwarding route vrf vrf1000

slot  1
=======

IPv4 routes for table vrf1000/base

--------------+-------------------+--------------+-----------------+-----------------
Prefix        | Next-hop          | Interface    | Labels          | Partial Install
--------------+-------------------+--------------+-----------------+-----------------
…..
10.1.1.11/32    12.12.12.12         nve1        dsvni: 301000
10.1.1.20/32    123.123.123.123     nve1        dsvni: 301000
10.1.1.21/32    30.30.30.30         nve1        dsvni: 301000
10.1.1.30/32    10.1.1.30           Vlan10
```

The following example shows sample output for the **show ip route detail vrf** *vrf* command:

```
switch# show ip route detail vrf default
IP Route Table for VRF "default"
  '*' denotes best ucast next-hop
  '**' denotes best mcast next-hop
  '[x/y]' denotes [preference/metric]
  '%<string>' in via output denotes VRF <string>

193.0.1.0/24, ubest/mbest: 4/0
      *via 30.1.0.2, Eth1/1, [100/0], 00:00:05, urib_dt6-client1 segid: 6544, tunnelid:
0x7b9 encap: VXLAN
```

```
     *via 30.1.1.2, Eth1/1, [100/0], 00:00:05, urib_dt6-client1 segid: 6545, (Asymmetric)
 tunnelid: 0x7ba encap: VXLAN

     *via 30.1.2.2, Eth1/1, [100/0], 00:00:05, urib_dt6-client1 segid: 6546, (Asymmetric)
 tunnelid: 0x7bb encap: VXLAN
```

The following example shows sample output for the **show l2route evpn mac-ip all detail** command:

```
switch# show l2route evpn mac-ip all
Flags -(Rmac):Router MAC (Stt):Static (L):Local (R):Remote (V):vPC link
(Dup):Duplicate (Spl):Split (Rcv):Recv(D):Del Pending (S):Stale (C):Clear
(Ps):Peer Sync (Ro):Re-Originated (Orp):Orphan
Topology Mac Address    Host IP   Prod   Flags Seq No  Next-Hops
-------- -------------- --------  ------ ----- ------- ----------------------------
5        0000.0005.1301 1.3.13.1  BGP    --     0      102.1.13.1 (Label: 2000005)
5        0000.0005.1401 1.3.14.1  BGP    --     0      102.1.145.1 (Label: 2000005)
```

The following example shows sample output for the **show l2route evpn imet all detail** command:

```
switch# show l2route evpn imet all

Flags- (F): Originated From Fabric, (W): Originated from WAN

Topology ID VNI         Prod  IP Addr     Flags
----------- ----------- ----- ----------- ---------
3           2000003     BGP   102.1.13.1    -
3           2000003     BGP   102.1.31.1    -
3           2000003     BGP   102.1.32.1    -
3           2000003     BGP   102.1.145.1   -
```

The following example shows sample output for the **show nve peers control-plane-vni** command. In this example, 3000003 is the downstream VNI.

```
switch# show nve peers control-plane-vni peer-ip 203.1.1.1
Peer       VNI     Learn-Source Gateway-MAC     Peer-type  Egress-VNI SW-BD  State

---------  -----   ------------ --------------- ---------- ---------- -----
----------------------
203.1.1.1  2000003 BGP          f40f.1b6f.f8db   FAB        3000003      3005
peer-vni-add-complete
```

EVPN Centralized Gateway

Guidelines and Limitations for EVPN Centralized Gateway

- EVPN CGW feature is only supported with control plane host MAC/IP learning from L2 VTEPs.
- ARP/ND Suppression to be configured on L2 VTEPs.
- Only single anycast IP is supported per SVI. Secondary IPs are not supported either in same subnet or from different subnets.
- L2 VTEP interworking with symmetric IRB and hybrid mode VTEPs without any centralize GW VTEP is not supported.