Configuring Multi-Site

This chapter contains these sections:

About VXLAN EVPN Multi-Site

The VXLAN EVPN Multi-Site solution interconnects two or more BGP-based Ethernet VPN (EVPN) sites/fabrics (overlay domains) in a scalable fashion over an IP-only network. This solution uses border gateways (BGWs) in anycast or vPC mode to terminate and interconnect two sites. The BGWs provide the network control boundary that is necessary for traffic enforcement and failure containment functionality.

In the BGP control plane for releases prior to Cisco NX-OS Release 9.3(5), BGP sessions between the BGWs rewrite the next hop information of EVPN routes and reoriginate them. Beginning with Cisco NX-OS Release 9.3(5), reorigination is always enabled (with either single or dual route distinguishers), and rewrite is not performed. For more information, see Dual RD Support for Multi-Site, on page 2.

VXLAN Tunnel Endpoints (VTEPs) are only aware of their overlay domain internal neighbors, including the BGWs. All routes external to the fabric have a next hop on the BGWs for Layer 2 and Layer 3 traffic.

The BGW is the node that interacts with nodes within a site and with nodes that are external to the site. For example, in a leaf-spine data center fabric, it can be a leaf, a spine, or a separate device acting as a gateway to interconnect the sites.

The VXLAN EVPN Multi-Site feature can be conceptualized as multiple site-local EVPN control planes and IP forwarding domains interconnected via a single common EVPN control and IP forwarding domain. Every

EVPN node is identified with a unique site-scope identifier. A site-local EVPN domain consists of EVPN nodes with the same site identifier. BGWs on one hand are also part of the site-specific EVPN domain and on the other hand a part of a common EVPN domain to interconnect with BGWs from other sites. For a given site, these BGWs facilitate site-specific nodes to visualize all other sites to be reachable only via them. This means:

- Site-local bridging domains are interconnected only via BGWs with bridging domains from other sites.
- Site-local routing domains are interconnected only via BGWs with routing domains from other sites.
- Site-local flood domains are interconnected only via BGWs with flood domains from other sites.

Selective Advertisement is defined as the configuration of the per-tenant information on the BGW. Specifically, this means IP VRF or MAC VRF (EVPN instance). In cases where external connectivity (VRF-lite) and EVPN Multi-Site coexist on the same BGW, the advertisements are always enabled.

Dual RD Support for Multi-Site

Beginning with Cisco NX-OS Release 9.3(5), VXLAN EVPN Multi-Site supports route reorigination with dual route distinguishers (RDs). This behavior is enabled automatically.

Each VRF or L2VNI tracks two RDs: a primary RD (which is unique) and a secondary RD (which is the same across BGWs). Reoriginated routes are advertised with the secondary type-0 RD (site-id:VNI). All other routes are advertised with the primary RD. The secondary RD is allocated automatically once the router is in Multi-Site BGW mode.

If the site ID is greater than 2 bytes, the secondary RD can't be generated automatically on the Multi-Site BGW, and the following message appears:

```
%BGP-4-DUAL_RD_GENERATION_FAILED: bgp- [12564] Unable to generate dual RD on EVPN multisite
 border gateway. This may increase memory consumption on other BGP routers receiving
re-originated EVPN routes. Configure router bgp <asn> ; rd dual id <id> to avoid it.
```

In this case, you can either manually configure the secondary RD value or disable dual RDs. For more information, see Configuring Dual RD Support for Multi-Site, on page 7.

Guidelines and Limitations for VXLAN EVPN Multi-Site

VXLAN EVPN Multi-Site has the following configuration guidelines and limitations:

- The following switches support VXLAN EVPN Multi-Site:
  - Cisco Nexus 9300-EX and 9300-FX platform switches (except Cisco Nexus 9348GC-FXP platform switches)
  - Cisco Nexus 9300-FX2 platform switches
  - Cisco Nexus 9300-FX3 platform switches
  - Cisco Nexus 9300-GX platform switches
  - Cisco Nexus 9500 platform switches with -EX or -FX or -GX line cards

Note Cisco Nexus 9500 platform switches with -R/RX line cards don't support VXLAN EVPN Multi-Site.

Switch or Port restrictions

- The **evpn multisite fabric-tracking** is mandatory only for anycast BGWs. For vPC based BGWs, this command is not mandatory. The NVE Interface will be brought up with just the dci tracked link in the up state.
- Cisco Nexus 9332C and 9364C platform switches can be BGWs.

Deployment restrictions

- In a VXLAN EVPN Multi-Site deployment, when you use the ttag feature, make sure that the ttag is stripped (**ttag-strip**) on BGW's DCI interfaces attached to Non-NXOS gear.
- VXLAN EVPN Multi-Site and Tenant Routed Multicast (TRM) are supported between sources and receivers deployed across different sites.
- The Multi-Site BGW allows the coexistence of Multi-Site extensions (Layer 2 unicast/multicast and Layer 3 unicast) as well as Layer 3 unicast and multicast external connectivity.
- In TRM with multi-site deployments, all BGWs receive traffic from fabric. However, only the designated forwarder (DF) BGW forwards the traffic. All other BGWs drop the traffic through a default drop ACL. This ACL is programmed in all DCI tracking ports. Don't remove the **evpn multisite dci-tracking** configuration from the DCI uplink ports. If you do, you remove the ACL, which creates a nondeterministic traffic flow in which packets can be dropped or duplicated instead of deterministically forwarded by only one BGW, the DF.
- Bind NVE to a loopback address that is separate from loopback addresses that are required by Layer 3 protocols. A best practice is to use a dedicated loopback address for the NVE source interface (PIP VTEP) and multi-site source interface (anycast and virtual IP VTEP).
- Beginning with Cisco NX-OS Release 9.3(5), if you disable the **host-reachability protocol bgp** command under the NVE interface in a VXLAN EVPN Multi-Site topology, the NVE interface stays operationally down.
- Beginning with Cisco NX-OS Release 9.3(5), Multi-Site Border Gateways re-originate incoming remote routes when advertising to the site's local spine/leaf switches. These re-originated routes modify the following fields:
  - RD value changes to [Multisite Site ID:L3 VNID].
  - It is mandatory that Route-Targets are defined on all VTEP that are participating in a given VRF, this includes and is explicitly required for the BGW to extend the given VRF. Prior to Cisco NX-OS Release 9.3(5), Route-Targets from intra-site VTEPs were inadvertently kept across the site boundary, even if not defined on the BGW. Starting from Cisco NX-OS Release 9.3(5) the mandatory behavior is enforced. By adding the necessary Route-Targets to the BGW, the change from inadvertent Route-Target advertisement to explicit Route-Target advertisement can be performed.
  - Path type changes from external to local.

    - 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.

- Ensure that the **ip pim sparse-mode** is enabled on the Multi-Site VIP loopback interface.
- To improve the convergence in case of fabric link failure and avoid issues in case of fabric link flapping, ensure to configure multi-hop BFD between loopbacks of spines and BGWs.

  In the specific scenario where a BGW node becomes completely isolated from the fabric due to all its fabric links failing, the use of multi-hop BFD ensures that the BGP sessions between the spines and the isolated BGW can be immediately brought down, without relying on the configured BGP hold-time value.
- In a VXLAN Multi-Site environment, a border gateway device that uses ECMP for routing through both a VXLAN overlay and an L3 prefix to access remote site subnets might encounter adjacency resolution failure for one of these routes. If the switch attempts to use this unresolved prefix, it will result in traffic being dropped.
- Following guidelines and limitations are applied when a multisite Border Gateway is put into Maintenance Mode:
    - BUM Traffic from remote Fabrics will still be attracted to the Border gateway that is in maintenance mode
    - Border Gateway in maintenance mode still participates in Designated Forwarder Election
    - Default Maintenance mode profile applies the command "ip pim isolate" and so the Border gateway is isolated from S,G tree towards the fabric direction. This leads to BUM traffic loss and hence an appropriate maintenance mode profile should be used for Border Gateways than the default.

vPC BGW restrictions

- BGWs in a vPC topology are supported.
- vPC mode can support only two BGWs.
- vPC mode can support both Layer 2 hosts and Layer 3 services on local interfaces.
- In vPC mode, BUM is replicated to either of the BGWs for traffic coming from the external site. Hence, both BGWs are forwarders for site external to site internal (DCI to fabric) direction.
- In vPC mode, BUM is replicated to either of the BGWs for traffic coming from the local site leaf for a VLAN using Ingress Replication (IR) underlay. Both BGWs are forwarders for site internal to site external (fabric to DCI) direction for VLANs using the IR underlay.
- In vPC mode, BUM is replicated to both BGWs for traffic coming from the local site leaf for a VLAN using the multicast underlay. Therefore, a decapper/forwarder election happens, and the decapsulation winner/forwarder only forwards the site-local traffic to external site BGWs for VLANs using the multicast underlay.
- In vPC mode, all Layer 3 services/attachments are advertised in BGP via EVPN Type-5 routes with their virtual IP as next hop. If the VIP/PIP feature is configured, they are advertised with PIP as the next hop.

Unsupported features

- Multicast Flood Domain between inter-site/fabric BGWs isn't supported.
- iBGP EVPN Peering between BGWs of different fabrics/sites isn't supported.
- PIM BiDir is not supported for fabric underlay multicast replication with VXLAN Multi-Site.
- FEX is not supported on a vPC BGW and Anycast BGW.

Anycast BGW restrictions

- Anycast mode can support up to six BGWs per site.
- Anycast mode can support only Layer 3 services that are attached to local interfaces.
- In Anycast mode, BUM is replicated to each border leaf. DF election between the border leafs for a particular site determines which border leaf forwards the inter-site traffic (fabric to DCI and conversely) for that site.
- In Anycast mode, all Layer 3 services are advertised in BGP via EVPN Type-5 routes with their physical IP as the next hop.
- If different Anycast Gateway MAC addresses are configured across sites, enable ARP suppression for all VLANs that have been extended.

Supported features

- Beginning with Cisco NX-OS Release 9.3(5), VTEPs support VXLAN-encapsulated traffic over parent interfaces if subinterfaces are configured. This feature is supported for VXLAN EVPN Multi-Site and DCI. DCI tracking can be enabled only on the parent interface.
- Beginning with Cisco NX-OS Release 9.3(5), VXLAN EVPN Multi-Site supports asymmetric VNIs. For more information, see Multi-Site with Asymmetric VNIs and Configuration Example for Multi-Site with Asymmetric VNIs, on page 18.
- **Dual RD**

  The following guidelines and limitations apply to dual RD support for Multi-Site:

  - Dual RD are supported beginning with Cisco NX-OS Release 9.3(5).
  - Dual RD is enabled automatically for Cisco Nexus 9332C, 9364C, 9300-EX, and 9300-FX/FX2 platform switches and Cisco Nexus 9500 platform switches with -EX/FX line cards that have VXLAN EVPN Multi-Site enabled.
  - To use CloudSec or other features that require PIP advertisement for multi-site reoriginated routes, configure BGP additional paths on the route server if dual RD are enabled on the BGW, or disable dual RD.
  - Sending secondary RD additional paths at the BGW node isn't supported.
  - During an ISSU, the number of paths for the leaf nodes might double temporarily while all BGWs are being upgraded.

Guidelines and Limitations for VXLAN Multi-Site Anycast BGW Support on Cisco Nexus 9800 Series Switches

Enabling VXLAN EVPN Multi-Site

This procedure enables the VXLAN EVPN Multi-Site feature. Multi-Site is enabled on the BGWs only. The site-id must be the same on all BGWs in the fabric/site.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enters global configuration mode.
Step 2	**evpn multisite border-gateway** *ms-id* **Example:** `switch(config)# evpn multisite border-gateway 100`	Configures the site ID for a site/fabric. The range of values for *ms-id* is 1 to 2,814,749,767,110,655. The *ms-id* must be the same in all BGWs within the same fabric/site.
Step 3	**interface nve 1** **Example:** `switch(config-evpn-msite-bgw)# interface nve 1`	Creates a VXLAN overlay interface that terminates VXLAN tunnels. **Note** Only one NVE interface is allowed on the switch.
Step 4	**source-interface loopback** *src-if* **Example:** `switch(config-if-nve)# source-interface loopback 0`	The source interface must be a loopback interface that is configured on the switch with a valid /32 IP address. This /32 IP address must be known by the transient devices in the transport network and the remote VTEPs. This requirement is accomplished by advertising it through a dynamic routing protocol in the transport network.
Step 5	**host-reachability protocol bgp** **Example:** `switch(config-if-nve)# host-reachability protocol bgp`	Defines BGP as the mechanism for host reachability advertisement.
Step 6	**multisite border-gateway interface loopback** *vi-num* **Example:** `switch(config-if-nve)# multisite border-gateway interface loopback 100`	Defines the loopback interface used for the BGW virtual IP address (VIP). The border-gateway interface must be a loopback interface that is configured on the switch with a valid /32 IP address. This /32 IP address must be known by the transient devices in the transport network and the remote VTEPs. This requirement is accomplished by advertising it through a dynamic routing protocol in the transport network. This loopback must be different than the source interface loopback. The range of *vi-num* is from 0 to 1023.

	Command or Action	Purpose
Step 7	**no shutdown** **Example:** `switch(config-if-nve)# no shutdown`	Negates the **shutdown** command.
Step 8	**exit** **Example:** `switch(config-if-nve)# exit`	Exits the NVE configuration mode.
Step 9	**interface loopback** *loopback-number* **Example:** `switch(config)# interface loopback 0`	Configures the loopback interface.
Step 10	**ip address** *ip-address* **Example:** `switch(config-if)# ip address 198.0.2.0/32`	Configures the IP address for the loopback interface.

Configuring Dual RD Support for Multi-Site

Follow these steps if you need to manually configure the secondary RD value or disable dual RDs.

Before you begin

Enable VXLAN EVPN Multi-Site.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**router bgp** *as-num*
	Example:
	`switch(config)# router bgp 100`
	`switch(config-router)#`
		Configures the autonomous system number. The range for *as-num* is from 1 to 4,294,967,295.

Step 3	[**no**] **rd dual id** [*2-bytes*] **Example:** `switch(config-router)# rd dual id 1`	Defines the first 2 bytes of the secondary RD. The ID must be the same across the Multi-Site BGWs. The range is from 1 to 65535. **Note** If necessary, you can use the **no rd dual** command to disable dual RDs and fall back to a single RD.

	Command or Action	Purpose
Step 4	(Optional) **show bgp evi** *evi-id* **Example:** `switch(config-router)# show bgp evi 100`	Displays the secondary RD configured as part of the **rd dual id** [*2-bytes*] command for the specified EVI.

Example

The following example shows sample output for the **show bgp evi** *evi-id* 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

  Active Export RT list         :
        100:100
  Active Import RT list         :
        100:100
```

Configuring VNI Dual Mode

This procedure describes the configuration of the BUM traffic domain for a given VLAN. Support exists for using multicast or ingress replication inside the fabric/site and ingress replication across different fabrics/sites.

Note If you have multiple VRFs and only one is extended to ALL leaf switches, you can add a dummy loopback to that one extended VRF and advertise through BGP. Otherwise, you'll need to check how many VRFs are extended and to which switches, and then add a dummy loopback to the respective VRFs and advertise them as well. Therefore, use the **advertise-pip** command to prevent potential user errors in the future.

For more information about configuring multicast or ingress replication for a large number of VNIs, see Example of VXLAN BGP EVPN (eBGP).

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 2	**interface nve 1** **Example:** `switch(config)# interface nve 1`	Creates a VXLAN overlay interface that terminates VXLAN tunnels. **Note** Only one NVE interface is allowed on the switch.
Step 3	**member vni** *vni-range* **Example:** `switch(config-if-nve)# member vni 200`	Configures the virtual network identifier (VNI). The range for *vni-range* is from 1 to 16,777,214. The value of *vni-range* can be a single value like 5000 or a range like 5001-5008. **Note** Enter one of the Step 4 or Step 5 commands.
Step 4	**mcast-group** *ip-addr* **Example:** `switch(config-if-nve-vni)# mcast-group 255.0.4.1`	Configures the NVE Multicast group IP prefix within the fabric.
Step 5	**ingress-replication protocol bgp** **Example:** `switch(config-if-nve-vni)# ingress-replication protocol bgp`	Enables BGP EVPN with ingress replication for the VNI within the fabric.
Step 6	**multisite ingress-replication** **Example:** `switch(config-if-nve-vni)# multisite ingress-replication`	Defines the Multi-Site BUM replication method for extending the Layer 2 VNI.

Configuring Fabric/DCI Link Tracking

This procedure describes the configuration to track all DCI-facing interfaces and site internal/fabric facing interfaces. Tracking is mandatory and is used to disable reorigination of EVPN routes either from or to a site if all the DCI/fabric links go down.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enters global configuration mode.
Step 2	**interface ethernet** *port* **Example:** `switch(config)# interface ethernet1/1`	Enters interface configuration mode for the DCI or fabric interface. **Note** Enter one of the following commands in Step 3 or Step 4.

	Command or Action	Purpose
Step 3	**evpn multisite dci-tracking** **Example:** `switch(config-if)# evpn multisite dci-tracking`	Configures DCI interface tracking.
Step 4	(Optional) **evpn multisite fabric-tracking** **Example:** `switch(config-if)# evpn multisite fabric-tracking`	Configures EVPN Multi-Site fabric tracking. The **evpn multisite fabric-tracking** is mandatory for anycast BGWs and vPC BGW fabric links.
Step 5	**ip address** *ip-addr* **Example:** `switch(config-if)# ip address 192.1.1.1`	Configures the IP address.
Step 6	**no shutdown** **Example:** `switch(config-if)# no shutdown`	Negates the **shutdown** command.

Configuring Fabric External Neighbors

This procedure describes the configuration of fabric external/DCI neighbors for communication to other site/fabric BGWs.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enters global configuration mode.
Step 2	**router bgp** *as-num* **Example:** `switch(config)# router bgp 100`	Configures the autonomous system number. The range for *as-num* is from 1 to 4,294,967,295.
Step 3	**neighbor** *ip-addr* **Example:** `switch(config-router)# neighbor 100.0.0.1`	Configures a BGP neighbor.
Step 4	**remote-as** *value* **Example:** `switch(config-router-neighbor)# remote-as 69000`	Configures remote peer's autonomous system number.

	Command or Action	Purpose
Step 5	**peer-type fabric-external** **Example:** `switch(config-router-neighbor)# peer-type fabric-external`	Enables the next hop rewrite for Multi-Site. Defines site external BGP neighbors for EVPN exchange. The default for **peer-type** is **fabric-internal**. **Note** The **peer-type fabric-external** command is required only for VXLAN Multi-Site BGWs. It is not required for pseudo BGWs.
Step 6	**address-family l2vpn evpn** **Example:** `switch(config-router-neighbor)# address-family l2vpn evpn`	Configures the address family Layer 2 VPN EVPN under the BGP neighbor.
Step 7	**rewrite-evpn-rt-asn** **Example:** `switch(config-router-neighbor)# rewrite-evpn-rt-asn`	Rewrites the route target (RT) information to simplify the MAC-VRF and IP-VRF configuration. BGP receives a route, and as it processes the RT attributes, it checks if the AS value matches the peer AS that is sending that route and replaces it. Specifically, this command changes the incoming route target's AS number to match the BGP-configured neighbor's remote AS number. You can see the modified RT value in the receiver router.

Configuring VXLAN EVPN Multi-Site Storm Control

VXLAN EVPN Multi-Site Storm Control allows rate limiting of multidestination (BUM) traffic on Multi-Site BGWs. You can control BUM traffic sent over the DCI link using a policer on fabric links in the ingress direction.

Remote peer reachability must be only through DCI links. Appropriate routing configuration must ensure that remote site routes are not advertised over Fabric links.

Multicast traffic is policed only on DCI interfaces, while unknown unicast and broadcast traffic is policed on both DCI and fabric interfaces.

Cisco NX-OS Release 9.3(6) and later releases optimize rate granularity and accuracy. Bandwidth is calculated based on the accumulated DCI uplink bandwidth, and only interfaces tagged with DCI tracking are considered. (Prior releases also include fabric-tagged interfaces.) In addition, granularity is enhanced by supporting two digits after the decimal point. These enhancements apply to the Cisco Nexus 9300-EX, 9300-FX/FX2/FX3, and 9300-GX platform switches.

Note For information on access port storm control, see the Cisco Nexus 9000 Series NX-OS Layer 2 Configuration Guide.

SUMMARY STEPS

1. **configure terminal**

2. [**no**] **evpn storm-control** {**broadcast** | **multicast** | **unicast**} {**level** *level*}

DETAILED STEPS

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	[**no**] **evpn storm-control** {**broadcast**	**multicast**	**unicast**} {**level** *level*}
			Example:
			`switch(config)# evpn storm-control unicast level 10`
			Example:
			`switch(config)# evpn storm-control unicast level 10.20`
				Configures the storm suppression level as a number from 0–100.
				0 means that all traffic is dropped, and 100 means that all traffic is allowed. For any value in between, the unknown unicast traffic rate is restricted to a percentage of available bandwidth. For example, a value of 10 means that the traffic rate is restricted to 10% of the available bandwidth, and anything above that rate is dropped.
				Beginning with Cisco NX-OS Release 9.3(6), you can configure the level as a fractional value by adding two digits after the decimal point. For example, you can enter a value of 10.20.

Verifying VXLAN EVPN Multi-Site Storm Control

To display EVPN storm control setting information, enter the following command:

Command	Purpose
slot 1 show hardware vxlan storm-control	Displays the status of EVPN storm control setting.

Note Once the Storm control hits the threshold, a message is logged as stated below:

```
BGWY-1 %ETHPORT-5-STORM_CONTROL_ABOVE_THRESHOLD: Traffic in port Ethernet1/32 exceeds the
configured threshold , action - Trap (message repeated 38 times)
```

Multi-Site with vPC Support

About Multi-Site with vPC Support

The BGWs can be in a vPC complex. In this case, it is possible to support dually-attached directly-connected hosts that might be bridged or routed as well as dually-attached firewalls or service attachments. The vPC BGWs have vPC-specific multihoming techniques and do not rely on EVPN Type 4 routes for DF election or split horizon.

Guidelines and Limitations for Multi-Site with vPC Support

Multi-Site with vPC support has the following configuration guidelines and limitations:

- 4000 VNIs for vPC are not supported.
- For BUM with continued VIP use, the MCT link is used as transport upon core isolation or fabric isolation, and for unicast traffic in fabric isolation.
- Beginning with Cisco NX-OS Release 10.1(2), TRM Multisite with vPC BGW is supported.
- The routes to remote Multisite BGW loopback addresses must always prioritize the DCI link path over the iBGP protocol between vPC Border Gateway switches configured using the backup SVI. The backup SVI should be used strictly in the event of a DCI link failure.

Configuring Multi-Site with vPC Support

This procedure describes the configuration of Multi-Site with vPC support:

- Configure vPC domain.
- Configure port channels.
- Configuring vPC Peer Link.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enters global configuration mode.
Step 2	**feature vpc** **Example:** `switch(config)# feature vpc`	Enables vPCs on the device.
Step 3	**feature interface-vlan** **Example:**	Enables the interface VLAN feature on the device.

	Command or Action	Purpose
	`switch(config)# feature interface-vlan`	
Step 4	**feature lacp** **Example:** `switch(config)# feature lacp`	Enables the LACP feature on the device.
Step 5	**feature pim** **Example:** `switch(config)# feature pim`	Enables the PIM feature on the device.
Step 6	**feature ospf** **Example:** `switch(config)# feature ospf`	Enables the OSPF feature on the device.
Step 7	**ip pim rp-address** *address* **group-list** *range* **Example:** `switch(config)# ip pim rp-address 100.100.100.1 group-list 224.0.0/4`	Defines a PIM RP address for the underlay multicast group range.
Step 8	**vpc domain** *domain-id* **Example:** `switch(config)# vpc domain 1`	Creates a vPC domain on the device and enters vpn-domain configuration mode for configuration purposes. There is no default. The range is from 1 to 1000.
Step 9	**peer switch** **Example:** `switch(config-vpc-domain)# peer switch`	Defines the peer switch.
Step 10	**peer gateway** **Example:** `switch(config-vpc-domain)# peer gateway`	Enables Layer 3 forwarding for packets destined to the gateway MAC address of the vPC.
Step 11	**peer-keepalive destination** *ip-address* **Example:** `switch(config-vpc-domain)# peer-keepalive destination 172.28.230.85`	Configures the IPv4 address for the remote end of the vPC peer-keepalive link. **Note** The system does not form the vPC peer link until you configure a vPC peer-keepalive link. The management ports and VRF are the defaults.
Step 12	**ip arp synchronize** **Example:** `switch(config-vpc-domain)# ip arp synchronize`	Enables IP ARP synchronize under the vPC domain to facilitate faster ARP table population following device reload.
Step 13	**ipv6 nd synchronize** **Example:** `switch(config-vpc-domain)# ipv6 nd synchronize`	Enables IPv6 ND synchronization under the vPC domain to facilitate faster ND table population following device reload.

	Command or Action	Purpose

Step 14	Create the vPC peer-link.
	Example:
	`switch(config)# interface port-channel 1`
	`switch(config)# switchport`
	`switch(config)# switchport mode trunk`
	`switch(config)# switchport trunk allowed vlan 1,10,100-200`
	`switch(config)# mtu 9216`
	`switch(config)# vpc peer-link`
	`switch(config)# no shut`
	
	`switch(config)# interface Ethernet 1/1, 1/21`
	`switch(config)# switchport`
	`switch(config)# mtu 9216`
	`switch(config)# channel-group 1 mode active`
	`switch(config)# no shutdown`
		Creates the vPC peer-link port-channel interface and adds two member interfaces to it.

Step 15	**system nve infra-vlans** *range* **Example:** `switch(config)# system nve infra-vlans 10`	Defines a non-VXLAN-enabled VLAN as a backup routed path.
Step 16	**vlan** *number* **Example:** `switch(config)# vlan 10`	Creates the VLAN to be used as an infra-VLAN.

Step 17	Create the SVI.
	Example:
	`switch(config)# interface vlan 10`
	`switch(config)# ip address 10.10.10.1/30`
	`switch(config)# ip router ospf process UNDERLAY area 0`
	`switch(config)# ip pim sparse-mode`
	`switch(config)# no ip redirects`
	`switch(config)# mtu 9216`
	`switch(config)# no shutdown`
		Creates the SVI used for the backup routed path over the vPC peer-link.

Step 18	(Optional) **delay restore interface-vlan** *seconds* **Example:** `switch(config-vpc-domain)# delay restore interface-vlan 45`	Enables the delay restore timer for SVIs. We recommend tuning this value when the SVI/VNI scale is high. For example, when the SCI count is 1000, we recommend that you set the delay restore to 45 seconds.
Step 19	**evpn multisite border-gateway** *ms-id* **Example:** `switch(config)# evpn multisite border-gateway 100`	Configures the site ID for a site/fabric. The range of values for *ms-id* is 1 to 281474976710655. The *ms-id* must be the same in all BGWs within the same fabric/site.
Step 20	**interface nve 1** **Example:** `switch(config-evpn-msite-bgw)# interface nve 1`	Creates a VXLAN overlay interface that terminates VXLAN tunnels. **Note** Only one NVE interface is allowed on the switch.

	Command or Action	Purpose
Step 21	**source-interface loopback** *src-if* **Example:** `switch(config-if-nve)# source-interface loopback 0`	Defines the source interface, which must be a loopback interface with a valid /32 IP address. This /32 IP address must be known by the transient devices in the transport network and the remote VTEPs. This requirement is accomplished by advertising the address through a dynamic routing protocol in the transport network.
Step 22	**host-reachability protocol bgp** **Example:** `switch(config-if-nve)# host-reachability protocol bgp`	Defines BGP as the mechanism for host reachability advertisement.
Step 23	**multisite border-gateway interface loopback** *vi-num* **Example:** `switch(config-if-nve)# multisite border-gateway interface loopback 100`	Defines the loopback interface used for the BGW virtual IP address (VIP). The BGW interface must be a loopback interface that is configured on the switch with a valid /32 IP address. This /32 IP address must be known by the transient devices in the transport network and the remote VTEPs. This requirement is accomplished by advertising the address through a dynamic routing protocol in the transport network. This loopback must be different than the source interface loopback. The range of *vi-num* is from 0 to 1023.
Step 24	**no shutdown** **Example:** `switch(config-if-nve)# no shutdown`	Negates the **shutdown** command.
Step 25	**exit** **Example:** `switch(config-if-nve)# exit`	Exits the NVE configuration mode.
Step 26	**interface loopback** *loopback-number* **Example:** `switch(config)# interface loopback 0`	Configures the loopback interface.
Step 27	**ip address** *ip-address* **Example:** `switch(config-if)# ip address 198.0.2.0/32`	Configures the primary IP address for the loopback interface.
Step 28	**ip address** *ip-address* **secondary** **Example:** `switch(config-if)# ip address 198.0.2.1/32 secondary`	Configures the secondary IP address for the loopback interface.
Step 29	**ip pim sparse-mode** **Example:** `switch(config-if)# ip pim sparse-mode`	Configures PIM sparse mode on the loopback interface.

Verifying the Multi-Site with vPC Support Configuration

To display Multi-Site with vPC support information, enter one of the following commands:

show vpc brief	Displays general vPC and CC status.
show vpc consistency-parameters global	Displays the status of those parameters that must be consistent across all vPC interfaces.
show vpc consistency-parameters vni	Displays configuration information for VNIs under the NVE interface that must be consistent across both vPC peers.

Output example for the **show vpc brief** command:

```
switch# show vpc brief
Legend:
                (*) - local vPC is down, forwarding via vPC peer-link

vPC domain id                     : 1
Peer status                       : peer adjacency formed ok     (<--- peer up)
vPC keep-alive status             : peer is alive
Configuration consistency status  : success (<----- CC passed)
Per-vlan consistency status       : success                       (<---- per-VNI CCpassed)
Type-2 consistency status         : success
vPC role                          : secondary
Number of vPCs configured         : 1
Peer Gateway                      : Enabled
Dual-active excluded VLANs        : -
Graceful Consistency Check        : Enabled
Auto-recovery status              : Enabled, timer is off.(timeout = 240s)
Delay-restore status              : Timer is off.(timeout = 30s)
Delay-restore SVI status          : Timer is off.(timeout = 10s)
Operational Layer3 Peer-router    : Disabled
[...]
```

Output example for the **show vpc consistency-parameters global** command:

```
switch# show vpc consistency-parameters global

    Legend:
        Type 1 : vPC will be suspended in case of mismatch

Name                        Type  Local Value            Peer Value
-------------               ----  ---------------------- -----------------------
[...]
Nve1 Adm St, Src Adm St,    1     Up, Up, 2.1.44.5, CP,  Up, Up, 2.1.44.5, CP,
Sec IP, Host Reach, VMAC          TRUE, Disabled,        TRUE, Disabled,
Adv, SA,mcast l2, mcast           0.0.0.0, 0.0.0.0,      0.0.0.0, 0.0.0.0,
l3, IR BGP,MS Adm St, Reo         Disabled, Up,          Disabled, Up,
                                  200.200.200.200        200.200.200.200
[...]
```

Output example for the **show vpc consistency-parameters vni** command:

```
switch(config-if-nve-vni)# show vpc consistency-parameters vni

    Legend:
        Type 1 : vPC will be suspended in case of mismatch
```

```
Name                        Type  Local Value            Peer Value
--------------              ----  ---------------------- -----------------------
Nve1 Vni, Mcast, Mode,      1     11577, 234.1.1.1,      11577, 234.1.1.1,
Type, Flags                       Mcast, L2, MS IR       Mcast, L2, MS IR
Nve1 Vni, Mcast, Mode,      1     11576, 234.1.1.1,      11576, 234.1.1.1,
Type, Flags                       Mcast, L2, MS IR       Mcast, L2, MS IR
[...]
```

Configuration Example for Multi-Site with Asymmetric VNIs

The following example shows how two sites with different sets of VNIs can connect to the same MAC VRF or IP VRF. One site uses VNI 200 internally, and the other site uses VNI 300 internally. Route-target auto no longer matches because the VNI values are different. Therefore, the route-target values must be manually configured. In this example, the value 222:333 stitches together the two VNIs from different sites.

The BGW of site 1 has L2VNI 200 and L3VNI 201.

The BGW of site 2 has L2VNI 300 and L3VNI 301.

Note This configuration example assumes that basic Multi-Site configurations are already in place.

Note You must have VLAN-to-VRF mapping on the BGW. This requirement is necessary to maintain L2VNI-to-L3VNI mapping, which is needed for reorigination of MAC-IP routes at BGWs.

Layer 3 Configuration

In the BGW node of site 1, configure the common RT 201:301 for stitching the two sites using L3VNI 201 and L3VNI 301:

```
vrf context vni201
  vni 201
  address-family ipv4 unicast
    route-target both auto evpn
    route-target import 201:301 evpn
    route-target export 201:301 evpn
```

In the BGW node of site 2, configure the common RT 201:301 for stitching the two sites using L3VNI 201 and L3VNI 301:

```
vrf context vni301
  vni 301
  address-family ipv4 unicast
    route-target both auto evpn
    route-target import 201:301 evpn
    route-target export 201:301 evpn
```

Layer 2 Configuration

In the BGW node of site 1, configure the common RT 222:333 for stitching the two sites using L2VNI 200 and L2VNI 300:

```
evpn
  vni 200 l2
```

```
    rd auto
    route-target import auto
    route-target import 222:333
    route-target export auto
    route-target export 222:333
```

For proper reorigination of L3 labels of MAC-IP routes, associate the VRF (L3VNI) to the L2VNI:

```
interface Vlan 200
  vrf member vni201
```

In the BGW node of site 2, configure the common RT 222:333 for stitching the two sites using L2VNI 200 and L2VNI 300:

```
evpn
  vni 300 l2
    rd auto
    route-target import auto
    route-target import 222:333
    route-target export auto
    route-target export 222:333
```

For proper reorigination of L3 labels of MAC-IP routes, associate the VRF (L3VNI) to the L2VNI:

```
interface vlan 300
  vrf member vni301
```

TRM with Multi-Site

This section contains the following topics:

Information About Configuring TRM with Multi-Site

Tenant Routed Multicast (TRM) with Multi-Site enables multicast forwarding across multiple VXLAN EVPN fabrics that are connected via Multi-Site. This feature provides Layer 3 multicast services across sites for sources and receivers across different sites. It addresses the requirement of East-West multicast traffic between sites.

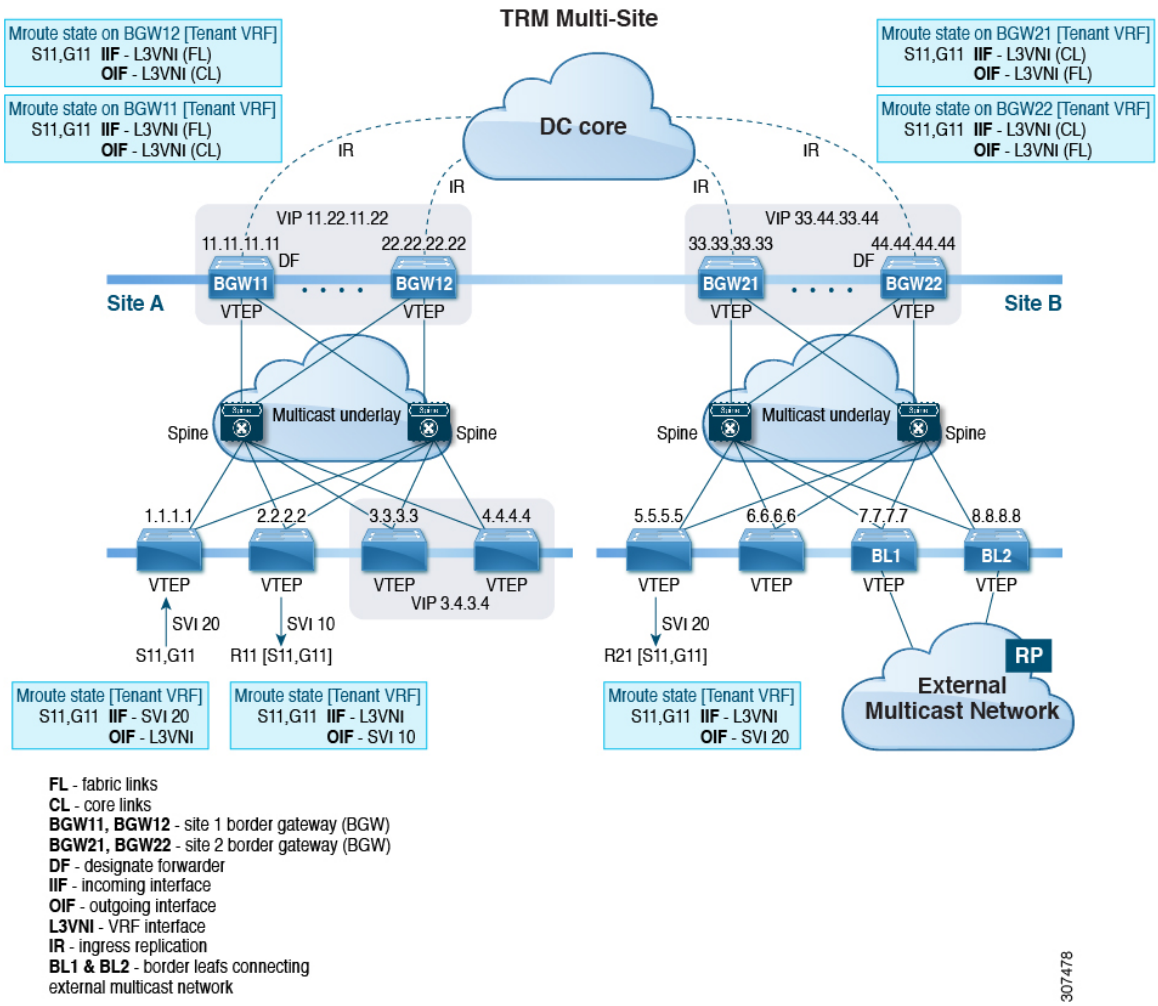
Each TRM site is operating independently. Border gateways on each site allow stitching across the sites. There can be multiple border gateways for each site. Multicast source and receiver information across sites is propagated by BGP on the border gateways that are configured with TRM. The border gateway on each site receives the multicast packet and re-encapsulates the packet before sending it to the local site. Beginning with Cisco NX-OS Release 10.1(2), TRM with Multi-Site supports both Anycast Border Gateway and vPC Border Gateway.

The border gateway that is elected as Designated Forwarder (DF) for the L3VNI forwards the traffic from fabric toward the core side. In the TRM Multicast-Anycast Gateway model, we use the VIP-R based model to send traffic toward remote sites. The IR destination IP is the VIP-R of the remote site. Each site that has the receiver gets only one copy from the source site. DF forwarding is applicable only on Anycast Border Gateways.

Note Only the DF sends the traffic toward remote sites.

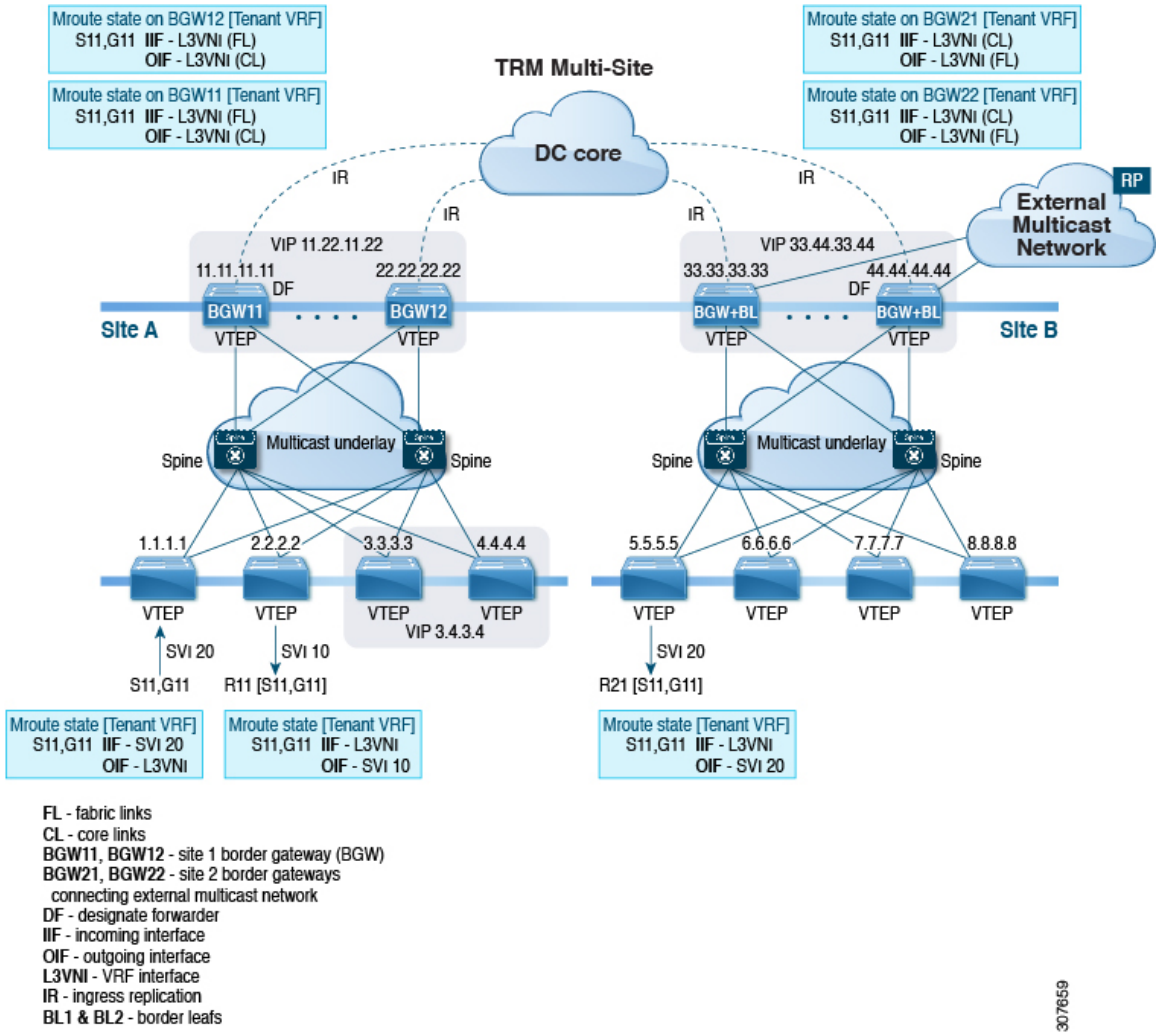
On the remote site, the BGW that receives the inter-site multicast traffic from the core forwards the traffic toward the fabric side. The DF check is not done from the core to fabric direction because non-DF can also receive the VIP-R copy from the source site.

Figure 1: TRM with Multi-Site Topology, BL External Multicast Connectivity



Beginning with Cisco NX-OS Release 9.3(3), TRM with Multi-Site supports BGW connections to the external multicast network in addition to the BL connectivity, which is supported in previous releases. Forwarding occurs as documented in the previous example, except the exit point to the external multicast network can optionally be provided through the BGW.

Figure 2: TRM with Multi-Site Topology, BGW External Multicast Connectivity



Guidelines and Limitations for TRM with Multi-Site

TRM with Multi-Site has the following guidelines and limitations:

- The following platforms support TRM with Multi-Site:
  - 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 -EX/FX line cards
- Beginning with Cisco NX-OS Release 9.3(3), a border leaf and Multi-Site border gateway can coexist on the same node for multicast traffic.

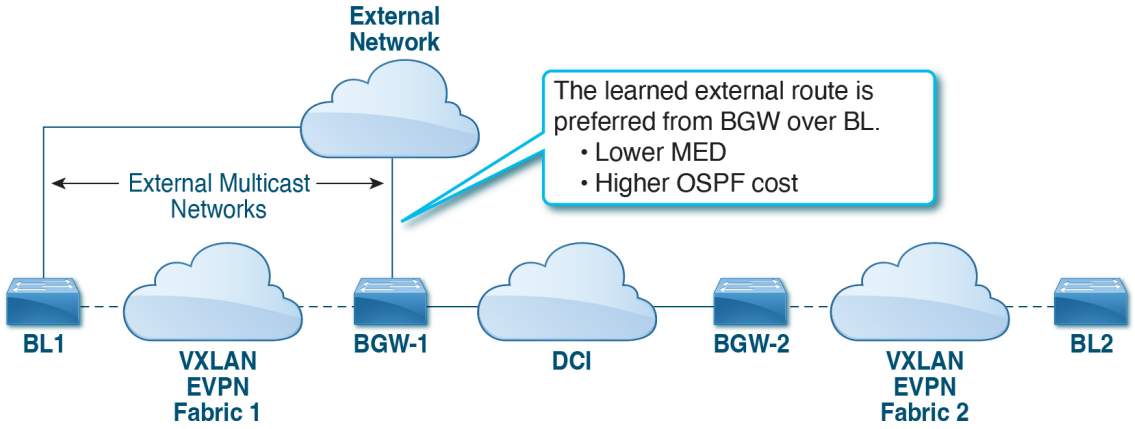
- Beginning with Cisco NX-OS Release 9.3(3), all border gateways for a given site must run the same Cisco NX-OS 9.3(x) image.
- Cisco NX-OS Release 10.1(2) has the following guidelines and limitations:
  - You need to add a VRF lite link (per Tenant VRF) between the vPC peers in order to support the L3 hosts attached to the vPC primary and secondary peers.
  - Backup SVI is needed between the two vPC peers.
  - Orphan ports attached with L2 and L3 are supported with vPC BGW.
  - TRM multi-site with vPC BGW is not supported with vMCT.

  For details on TRM and Configuring TRM with vPC Support, see Configuring Tenant Routed Multicast.
- TRM with Multi-Site supports the following features:
  - TRM Multi-Site with vPC Border Gateway.
  - PIM ASM multicast underlay in the VXLAN fabric
  - TRM with Multi-Site Layer 3 mode only
  - TRM with Multi-Site with Anycast Gateway
  - Terminating VRF-lite at the border leaf
  - The following RP models with TRM Multi-Site:
    - External RP
    - RP Everywhere
    - Internal RP
- Only one pair of vPC BGW can be configured on one site.
- A pair of vPC BGW and Anycast BGW cannot co-exist on the same site.
- Border routers reoriginate MVPN routes from fabric to core and from core to fabric.
- Only eBGP peering between border gateways of different sites is supported.
- Each site must have a local RP for the TRM underlay.
- Keep each site's underlay unicast routing isolated from another site's underlay unicast routing. This requirement also applies to Multi-Site.
- MVPN address family must be enabled between BGWs.
- When configuring BGW connections to the external multicast fabric, be aware of the following:
  - The multicast underlay must be configured between all BGWs on the fabric side even if the site doesn’t have any leafs in the fabric site.
  - Sources and receivers that are Layer-3 attached through VRF-Lite links to the BGW of a single site acting therefore also as Border Leaf (BL) node need to have reachability through the external Layer-3 network. If there's a Layer-3 attached source on BGW BL Node-1 and a Layer-3 attached receiver

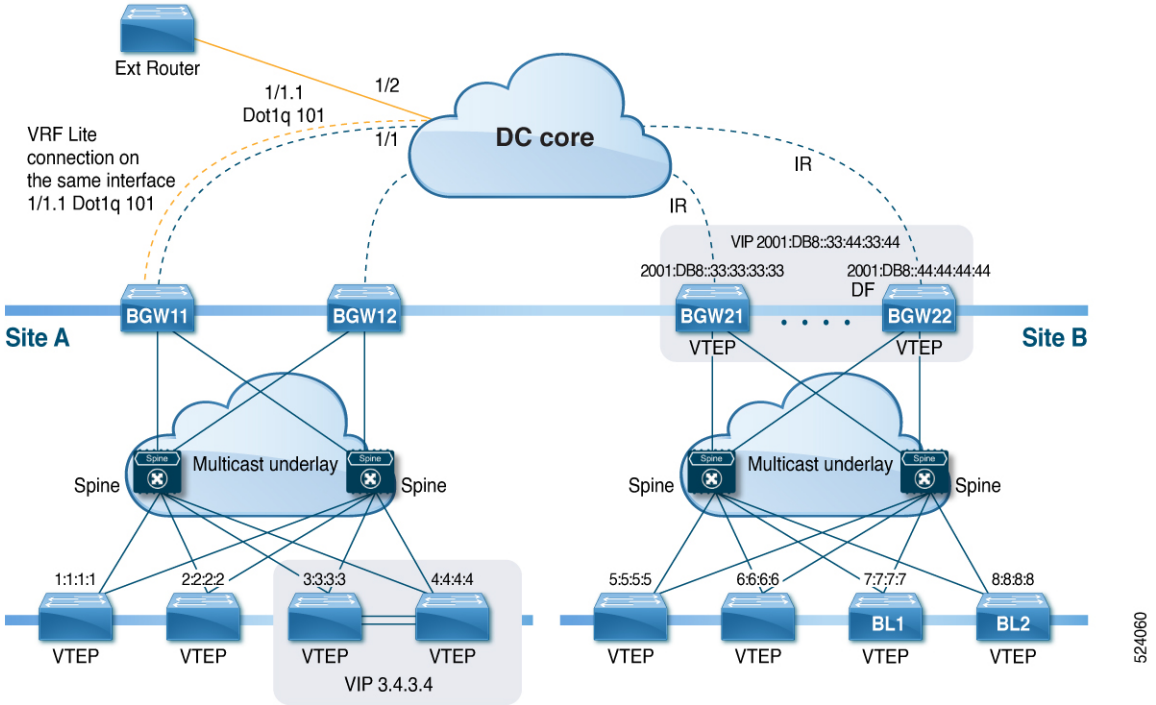
on BGW BL Node-2 for the same site, the traffic between these two endpoints flows through the external Layer-3 network and not through the fabric.

- External multicast networks should be connected only through the BGW or BL. If a deployment requires external multicast network connectivity from both the BGW and BL at the same site, make sure that external routes that are learned from the BGW are preferred over the BL. To do so, the BGW must have a lower MED and a higher OSPF cost (on the external links) than the BL.

  The following figure shows a site with external network connectivity through BGW-BLs and an internal leaf (BL1). The path to the external source should be through BGW-1 (rather than through BL1) to avoid duplication on the remote site receiver.



- The BGW supports VRF-lite hand-off and Multi-site configuration on the same physical interface as shown in the diagram.



- MED is supported for iBGP only.

Configuring TRM with Multi-Site

Before you begin

The following must be configured:

- VXLAN TRM
- VXLAN Multi-Site

This section provides the configuration procedure for Anycast BGW with TRM. For vPC BGW with TRM, vPC must be configured along with VxLAN TRM and VxLAN Multi-site.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enters global configuration mode.
Step 2	**interface nve1** **Example:** `switch(config)# interface nve1`	Configures the NVE interface.
Step 3	**no shutdown** **Example:** `switch(config-if-nve)# no shutdown`	Brings up the NVE interface.
Step 4	**host-reachability protocol bgp** **Example:** `switch(config-if-nve)# host-reachability protocol bgp`	Defines BGP as the mechanism for host reachability advertisement.
Step 5	**source-interface loopback** *src-if* **Example:** `switch(config-if-nve)# source-interface loopback 0`	Defines the source interface, which must be a loopback interface with a valid /32 IP address. This /32 IP address must be known by the transient devices in the transport network and the remote VTEPs. This requirement is accomplished by advertising the address through a dynamic routing protocol in the transport network.
Step 6	**multisite border-gateway interface loopback** *vi-num* **Example:** `switch(config-if-nve)# multisite border-gateway interface loopback 1`	Defines the loopback interface used for the border gateway virtual IP address (VIP). The border-gateway interface must be a loopback interface that is configured on the switch with a valid /32 IP address. This /32 IP address must be known by the transient devices in the transport network and the remote VTEPs. This requirement is accomplished by

	Command or Action	Purpose
		advertising the address through a dynamic routing protocol in the transport network. This loopback must be different than the source interface loopback. The range of *vi-num* is from 0 to 1023.
Step 7	**member vni** *vni-range* **associate-vrf** **Example:** `switch(config-if-nve)# member vni 10010 associate-vrf`	Configures the virtual network identifier (VNI). The range for *vni-range* is from 1 to 16,777,214 The value of *vni-range* can be a single value like 5000 or a range like 5001-5008.
Step 8	**mcast-group** *ip-addr* **Example:** `switch(config-if-nve-vni)# mcast-group 225.0.0.1`	Configures the NVE multicast group IP prefix within the fabric.
Step 9	**multisite ingress-replication optimized** **Example:** `switch(config-if-nve-vni)# multisite ingress-replication optimized`	Defines the Multi-Site BUM replication method for extending the Layer 2 VNI.

Verifying TRM with Multi-Site Configuration

To display the status for the TRM with Multi-Site configuration, enter the following command:

Command	Purpose
show nve vni *virtual-network-identifier*	Displays the L3VNI. **Note** For this feature, optimized IR is the default setting for the Multi-Site extended L3VNI. MS-IR flag inherently means that it's MS-IR optimized.

Example of the **show nve vni** command:

For IPv4

```
switch(config)# show nve vni 51001
Codes: CP - Control Plane        DP - Data Plane
       UC - Unconfigured         SA - Suppress ARP
       SU - Suppress Unknown Unicast
       Xconn - Crossconnect
       MS-IR - Multisite Ingress Replication

Interface VNI      Multicast-group   State Mode Type [BD/VRF]      Flags
--------- -------- ----------------- ----- ---- ------------------ -----
nve1      51001    226.0.0.1         Up    CP   L3 [cust_1]        MS-IR
```