Configuring Tenant Routed Multicast

This chapter contains the following sections:

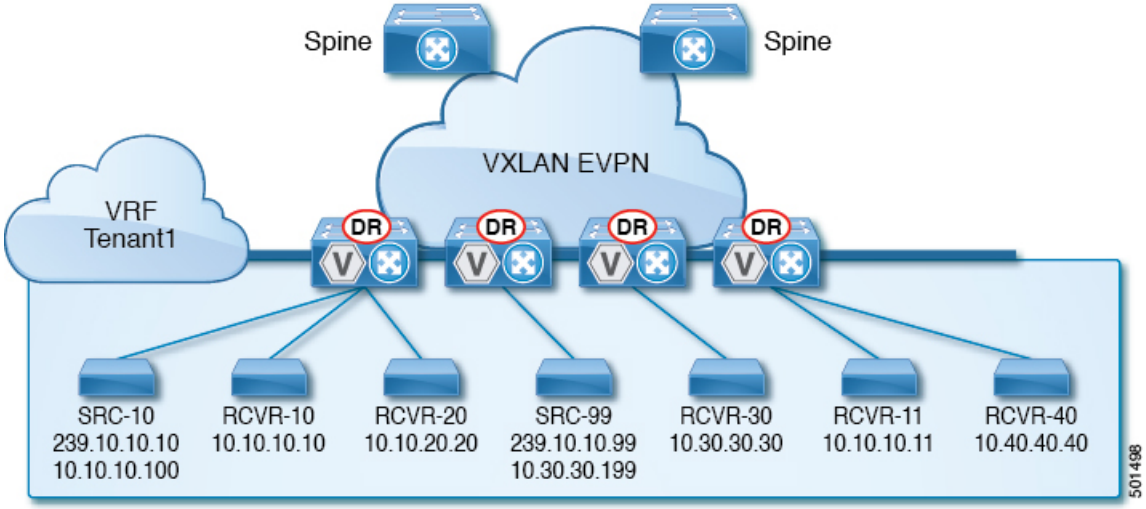
About Tenant Routed Multicast

Tenant Routed Multicast (TRM) enables multicast forwarding on the VXLAN fabric that uses a BGP-based EVPN control plane. TRM provides multi-tenancy aware multicast forwarding between senders and receivers within the same or different subnet local or across VTEPs.

This feature brings the efficiency of multicast delivery to VXLAN overlays. It is based on the standards-based next generation control plane (ngMVPN) described in IETF RFC 6513, 6514. TRM enables the delivery of customer IP multicast traffic in a multitenant fabric, and thus in an efficient and resilient manner. The delivery of TRM improves Layer-3 overlay multicast functionality in our networks.

While BGP EVPN provides the control plane for unicast routing, ngMVPN provides scalable multicast routing functionality. It follows an “always route” approach where every edge device (VTEP) with distributed IP Anycast Gateway for unicast becomes a Designated Router (DR) for Multicast. Bridged multicast forwarding is only present on the edge-devices (VTEP) where IGMP snooping optimizes the multicast forwarding to interested receivers. Every other multicast traffic beyond local delivery is efficiently routed.

Figure 1: VXLAN EVPN TRM

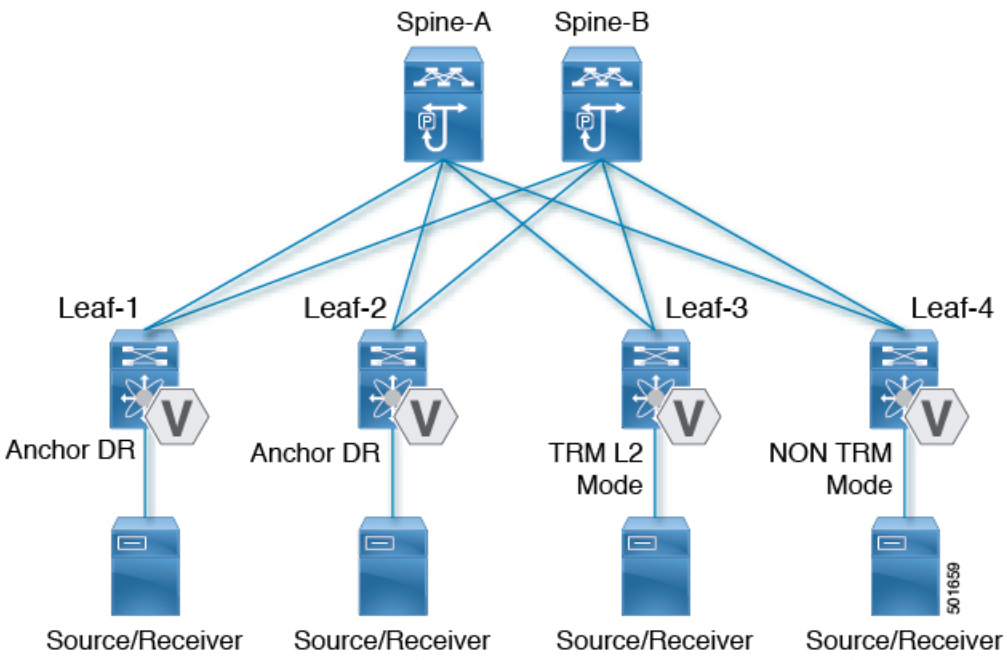


With TRM enabled, multicast forwarding in the underlay is leveraged to replicate VXLAN encapsulated routed multicast traffic. A Default Multicast Distribution Tree (Default-MDT) is built per-VRF. This is an addition to the existing multicast groups for Layer-2 VNI Broadcast, Unknown Unicast, and Layer-2 multicast replication group. The individual multicast group addresses in the overlay are mapped to the respective underlay multicast address for replication and transport. The advantage of using a BGP-based approach allows the VXLAN BGP EVPN fabric with TRM to operate as fully distributed Overlay Rendezvous-Point (RP), with the RP presence on every edge-device (VTEP).

A multicast-enabled data center fabric is typically part of an overall multicast network. Multicast sources, receivers, and multicast rendezvous points, might reside inside the data center but might also be inside the campus or externally reachable via the WAN. TRM allows a seamless integration with existing multicast networks. It can leverage multicast rendezvous points external to the fabric. Furthermore, TRM allows for tenant-aware external connectivity using Layer-3 physical interfaces or subinterfaces.

About Tenant Routed Multicast Mixed Mode

Figure 2: TRM Layer 2/Layer 3 Mixed Mode



Guidelines and Limitations for Tenant Routed Multicast

Tenant Routed Multicast (TRM) has the following guidelines and limitations:

- Tenant Routed Multicast is not supported on Cisco Nexus 9500 platform switches with -R line cards.
- The Guidelines and Limitations for VXLAN also apply to TRM
- With TRM enabled, SVI as a core link is not supported.
- With TRM enabled, Multicast Source/Receiver behind FEX is not supported.
- If TRM is configured, ISSU is disruptive.
- TRM supports IPv4 multicast only.
- TRM requires an IPv4 multicast-based underlay using PIM Any Source Multicast (ASM) which is also known as sparse mode.
- TRM supports overlay PIM ASM and PIM SSM only. PIM BiDir is not supported in the overlay.
- RP has to be configured either internal or external to the fabric.
- The internal RP must be configured on all TRM-enabled VTEPs including the border nodes.
- The external RP must be external to the border nodes.

- The RP must be configured within the VRF pointing to the external RP IP address (static RP). This ensures that unicast and multicast routing is enabled to reach the external RP in the given VRF.
- TRM supports multiple border nodes. Beginning with Cisco NX-OS Release 9.2(3), reachability to an external RP via multiple border leaf switches is supported (ECMP). In prior releases, the external RP could only be reachable via a single border leaf (non-ECMP).
- Within EVPN Multi-Site, TRM enabled East-West multicast traffic is not supported. In case the same external RP is used for multiple sites, overlapping multicast groups between sites must be avoided.

Guidelines and Limitations for Layer 3 Tenant Routed Multicast

Layer 3 Tenant Routed Multicast (TRM) has the following configuration guidelines and limitations:

- Layer 3 TRM is supported for Cisco Nexus 9200, 9300-EX, and 9300-FX/FX2/FX3/FXP and 9300-GX platform switches.
- When configuring TRM VXLAN BGP EVPN, the following platforms are supported:
  - Cisco Nexus 9200, 9332C, 9364C, 9300-EX, and 9300-FX/FX2/FX3/FXP platform switches.
  - Cisco Nexus 9500 platform switches with 9700-EX line cards, 9700-FX line cards, or a combination of both line cards.
- Layer 3 TRM and VXLAN EVPN Multi-Site are supported on the same physical switch. For more information, see Configuring Multi-Site.
- TRM with vPC border leafs is supported only for Cisco Nexus 9200, 9300-EX, and 9300-FX/FX2 platform switches and Cisco Nexus 9500 platform switches with -EX/FX line cards. The **advertise-pip** and **advertise virtual-rmac** commands must be enabled on the border leafs to support this functionality. For configuration information, see the "Configuring VIP/PIP" section.
- Well-known local scope multicast (224.0.0.0/24) is excluded from TRM and is bridged.
- When an interface NVE is brought down on the border leaf, the internal overlay RP per VRF must be brought down.

Guidelines and Limitations for Layer 2/Layer 3 Tenant Routed Multicast (Mixed Mode)

Layer 2/Layer 3 Tenant Routed Multicast (TRM) has the following configuration guidelines and limitations:

- All TRM Layer 2/Layer 3 configured switches must be Anchor DR. This is because in TRM Layer 2/Layer 3, you can have switches configured with TRM Layer 2 mode that co-exist in the same topology. This mode is necessary if non-TRM and Layer 2 TRM mode edge devices (VTEPs) are present in the same topology.
- Anchor DR is required to be an RP in the overlay.
- An extra loopback is required for anchor DRs.

- Non-TRM and Layer 2 TRM mode edge devices (VTEPs) require an IGMP snooping querier configured per multicast-enabled VLAN. Every non-TRM and Layer 2 TRM mode edge device (VTEP) requires this IGMP snooping querier configuration because in TRM multicast control-packets are not forwarded over VXLAN.
- The IP address for the IGMP snooping querier can be re-used on non-TRM and Layer 2 TRM mode edge devices (VTEPs).
- The IP address of the IGMP snooping querier in a VPC domain must be different on each VPC member device.
- When interface NVE is brought down on the border leaf, the internal overlay RP per VRF should be brought down.
- The NVE interface must be shut and unshut while configuring the **ip multicast overlay-distributed-dr** command.
- Beginning with Cisco NX-OS Release 9.2(1), TRM with vPC border leafs is supported. Advertise-PIP and Advertise Virtual-Rmac need to be enabled on border leafs to support with functionality. For configuring advertise-pip and advertise virtual-rmac, see the "Configuring VIP/PIP" section.
- Anchor DR is supported only on the following hardware platforms:
  - Cisco Nexus 9200, 9300-EX, and 9300-FX/FX2 platform switches
  - Cisco Nexus 9500 platform switches with 9700-EX line cards, 9700-FX line cards, or a combination of both line cards

Rendezvous Point for Tenant Routed Multicast

With TRM enabled Internal and External RP is supported. The following table displays the first release in which RP positioning is or is not supported.

	RP Internal	RP External	PIM-Based RP Everywhere
TRM L2 Mode	N/A	N/A	N/A
TRM L3 Mode	7.0(3)I7(1), 9.2(x)	7.0(3)I7(4), 9.2(3)	Supported in 7.0(3)I7(x) releases starting from 7.0(3)I7(5) Not supported in 9.2(x)
TRM L2L3 Mode	7.0(3)I7(1), 9.2(x)	N/A	N/A

Configuring a Rendezvous Point for Tenant Routed Multicast

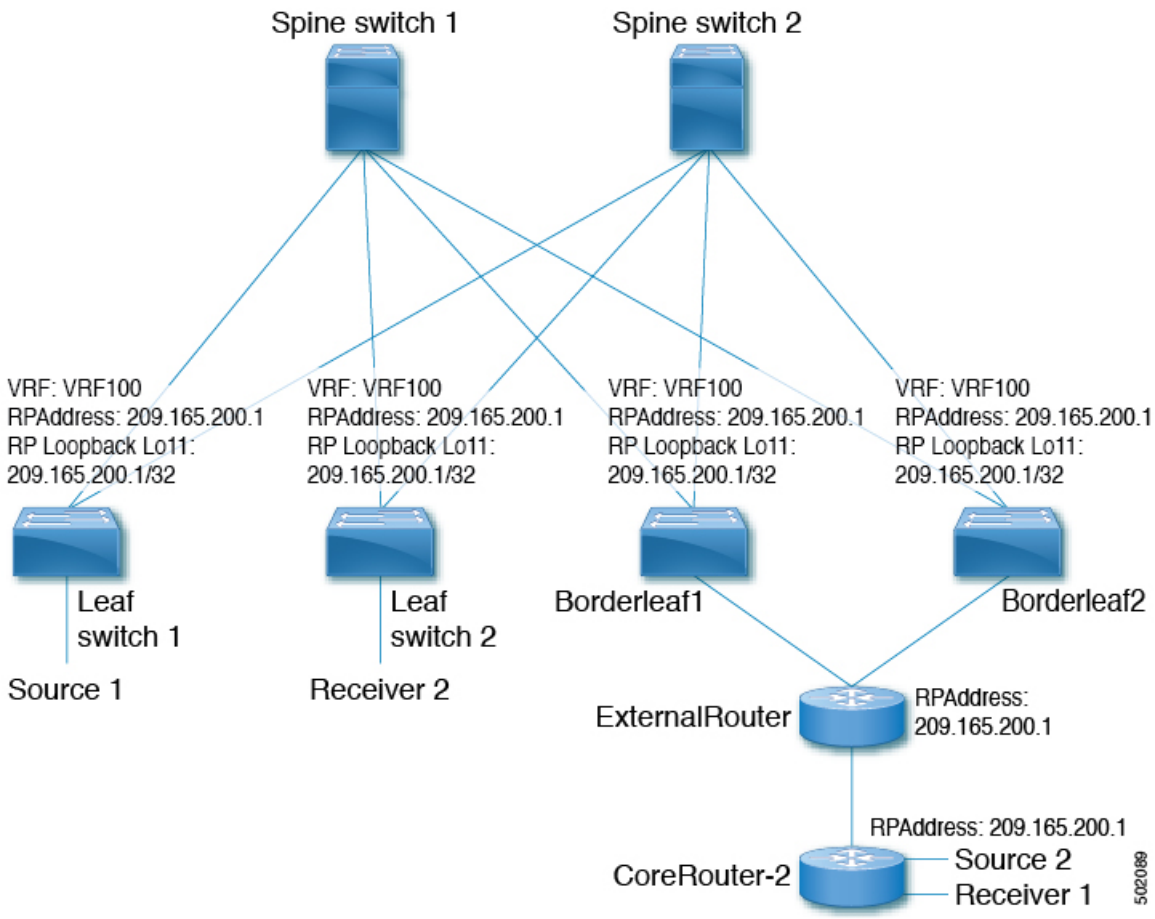
For Tenant Routed Multicast, the following rendezvous point options are supported:

- Configuring a Rendezvous Point Inside the VXLAN Fabric, on page 6

• Configuring an External Rendezvous Point, on page 7

Configuring a Rendezvous Point Inside the VXLAN Fabric

Configure the loopback for the TRM VRFs with the following commands on all devices (VTEP). Ensure it is reachable within EVPN (advertise/redistribute).



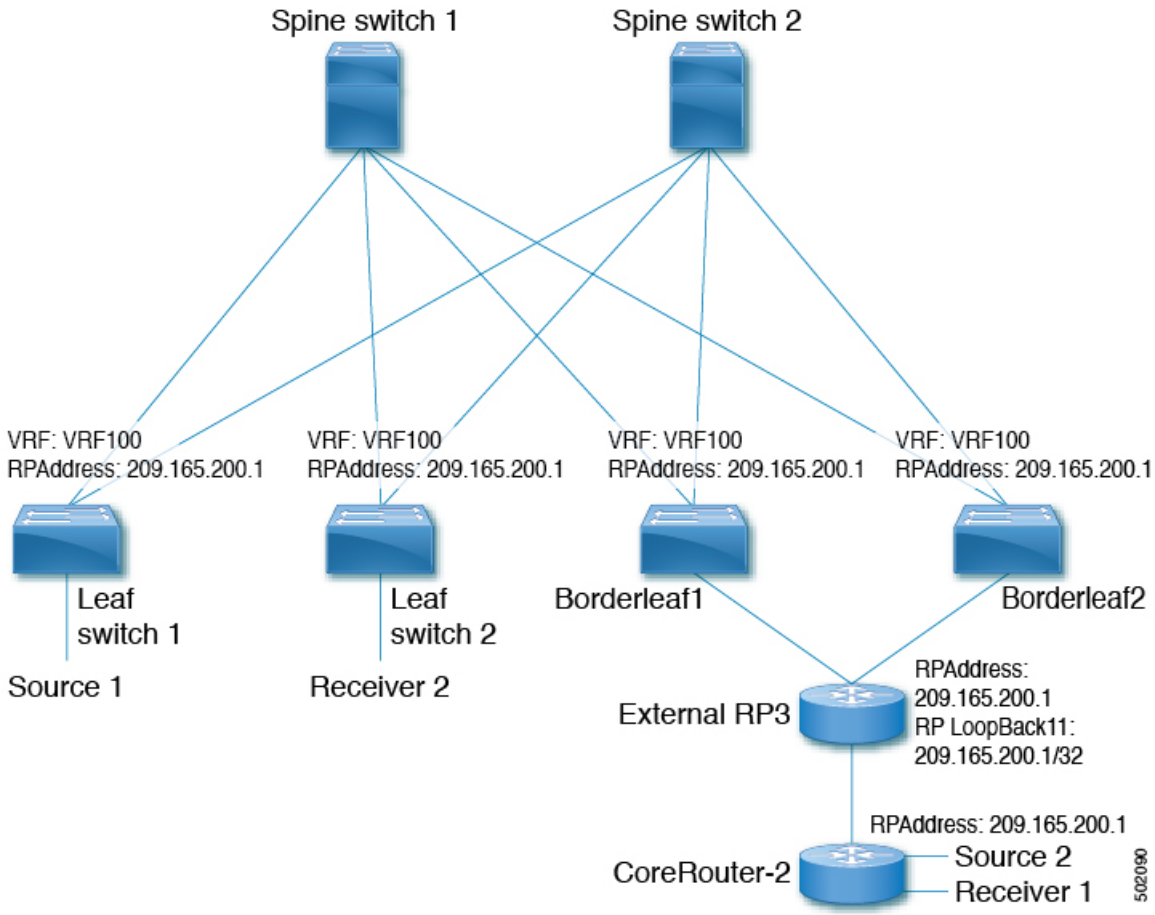
Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enters global configuration mode.
Step 2	**interface loopback** *loopback_number* **Example:** `switch(config)# interface loopback 11`	Configure the loopback interface on all TRM-enabled nodes. This enables the rendezvous point inside the fabric.

	Command or Action	Purpose
Step 3	**vrf member** *vxlan-number* **Example:** `switch(config-if)# vrf member vrf100`	Configure VRF name.
Step 4	**ip address** *ip-address* **Example:** `switch(config-if)# ip address 209.165.200.1/32`	Specify IP address.
Step 5	**ip pim sparse-mode** **Example:** `switch(config-if)# ip pim sparse-mode`	Configure sparse-mode PIM on an interface.
Step 6	**vrf context** *vrf-name* **Example:** `switch(config-if)# vrf context vrf100`	Create a VXLAN tenant VRF.
Step 7	**ip pim rp-address** *ip-address-of-router* **group-list** *group-range-prefix* **Example:** `switch(config-vrf# ip pim rp-address 209.165.200.1 group-list 224.0.0.0/4`	The value of the *ip-address-of-router* parameter is that of the RP. The same IP address must be on all the edge devices (VTEPs) for a fully distributed RP.

Configuring an External Rendezvous Point

Configure the external rendezvous point (RP) IP address within the TRM VRFs on all devices (VTEP). In addition, ensure reachability of the external RP within the VRF via the border node.



Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter configuration mode.
Step 2	**vrf context vrf100** **Example:** `switch(config)# vrf context vrf100`	Enter configuration mode.
Step 3	**ip pim rp-address** *ip-address-of-router* **group-list** *group-range-prefix* **Example:** `switch(config-vrf)# ip pim rp-address 209.165.200.1 group-list 224.0.0.0/4`	The value of the *ip-address-of-router* parameter is that of the RP. The same IP address must be on all of the edge devices (VTEPs) for a fully distributed RP.

Configuring Layer 3 Tenant Routed Multicast

This procedure enables the Tenant Routed Multicast (TRM) feature. TRM operates primarily in the Layer 3 forwarding mode for IP multicast by using BGP MVPN signaling. TRM in Layer 3 mode is the main feature and the only requirement for TRM enabled VXLAN BGP EVPN fabrics. If non-TRM capable edge devices (VTEPs) are present, the Layer 2/Layer 3 mode and Layer 2 mode have to be considered for interop.

To forward multicast between senders and receivers on the Layer 3 cloud and the VXLAN fabric on TRM vPC border leafs, the VIP/PIP configuration must be enabled. For more information, see Configuring VIP/PIP.

Note TRM follows an always-route approach and hence decrements the Time to Live (TTL) of the transported IP multicast traffic.

Before you begin

VXLAN EVPN **feature nv overlay** and **nv overlay evpn** must be configured.

The rendezvous point (RP) must be configured.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter configuration mode.
Step 2	**feature ngmvpn** **Example:** `switch(config)# feature ngmvpn`	Enables the Next-Generation Multicast VPN (ngMVPN) control plane. New address family commands become available in BGP.
Step 3	**ip igmp snooping vxlan** **Example:** `switch(config)# ip igmp snooping vxlan`	Configure IGMP snooping for VXLAN VLANs.
Step 4	**interface nve1** **Example:** `switch(config)# interface nve 1`	Configure the NVE interface.
Step 5	**member vni** *vni-range* **associate-vrf** **Example:** `switch(config-if-nve)# member vni 200100 associate-vrf`	Configure the Layer 3 virtual network identifier. The range of *vni-range* is from 1 to 16,777,214.
Step 6	**mcast-group** *ip-prefix* **Example:**	Builds the default multicast distribution tree for the VRF VNI (Layer 3 VNI).

	Command or Action	Purpose
	`switch(config-if-nve-vni)# mcast-group 225.3.3.3`	The multicast group is used in the underlay (core) for all multicast routing within the associated Layer 3 VNI (VRF). **Note** We recommend that underlay multicast groups for Layer 2 VNI, default MDT, and data MDT not be shared. Use separate, non-overlapping groups.
Step 7	**exit** **Example:** `switch(config-if-nve-vni)# exit`	Exits command mode.
Step 8	**exit** **Example:** `switch(config-if)# exit`	Exits command mode.
Step 9	**router bgp <as-number>** **Example:** `switch(config)# router bgp 100`	Set autonomous system number.
Step 10	**neighbor** *ip-addr* **Example:** `switch(config-router)# neighbor 1.1.1.1`	Configure IP address of the neighbor.
Step 11	**address-family ipv4 mvpn** **Example:** `switch(config-router-neighbor)# address-family ipv4 mvpn`	Configure multicast VPN.
Step 12	**send-community extended** **Example:** `switch(config-router-neighbor-af)# send-community extended`	Enables ngMVPN for address family signalization. The **send community extended** command ensures that extended communities are exchanged for this address family.
Step 13	**exit** **Example:** `switch(config-router-neighbor-af)# exit`	Exits command mode.
Step 14	**exit** **Example:** `switch(config-router)# exit`	Exits command mode.

	Command or Action	Purpose
Step 15	**vrf context** *vrf_name* **Example:** `switch(config-router)# vrf context vrf100`	Configures VRF name.
Step 16	**ip pim rp-address** *ip-address-of-router* **group-list** *group-range-prefix* **Example:** `switch(config-vrf)# ip pim rp-address 209.165.201.1 group-list 226.0.0.0/8`	The value of the *ip-address-of-router* parameter is that of the RP. The same IP address must be on all of the edge devices (VTEPs) for a fully distributed RP. For overlay RP placement options, see the Configuring a Rendezvous Point for Tenant Routed Multicast, on page 5 section.
Step 17	**address-family ipv4 unicast** **Example:** `switch(config-vrf)# address-family ipv4 unicast`	Configure unicast address family.
Step 18	**route-target both auto mvpn** **Example:** `switch(config-vrf-af-ipv4)# route-target both auto mvpn`	Defines the BGP route target that is added as an extended community attribute to the customer multicast (C_Multicast) routes (ngMVPN route type 6 and 7). Auto route targets are constructed by the 2-byte Autonomous System Number (ASN) and Layer 3 VNI.
Step 19	**ip multicast overlay-spt-only** **Example:** `switch(config)# ip multicast overlay-spt-only`	Gratuitously originate (S,A) route when the source is locally connected. The **ip multicast overlay-spt-only** command is enabled by default on all MVPN-enabled Cisco Nexus 9000 Series switches (typically leaf node).
Step 20	**interface***vlan_id* **Example:** `switch(config)# interface vlan11`	Configures the first-hop gateway (distributed anycast gateway for the Layer 2 VNI. No router PIM peering must ever happen with this interface.
Step 21	**no shutdown** **Example:** `switch(config-if)# no shutdown`	Disables an interface.
Step 22	**vrf member** *vrf-num* **Example:** `switch(config-if)# vrf member vrf100`	Configure VRF name.
Step 23	**ipv6 address** *ipv6_address* **Example:**	Configure IP address.

	Command or Action	Purpose
	`switch(config-if)# ip address 11.1.1.1/24`	
Step 24	**ipv6 pim sparse-mode** **Example:** `switch(config-if)# ip pim sparse-mode`	Enables IGMP and PIM on the SVI. This is required is multicast sources and/or receivers exist in this VLAN.
Step 25	**fabric forwarding mode anycast-gateway** **Example:** `switch(config-if)# fabric forwarding mode anycast-gateway`	Configure Anycast Gateway Forwarding Mode.
Step 26	**ip pim neighbor-policy NONE*** **Example:** `switch(config-if)# ip pim neighbor-policy NONE*`	Creates an IP PIM neighbor policy to avoid PIM neighborship with PIM routers within the VLAN. The **none** keyword is a configured route map to deny any ipv4 addresses to avoid establishing PIM neighborship policy using anycast IP. **Note** Do not use Distributed Anycast Gateway for PIM Peerings.
Step 27	**exit** **Example:** `switch(config-if)# exit`	Exits command mode.
Step 28	**interface** *vlan_id* **Example:** `switch(config)# interface vlan100`	Configure Layer 3 VNI.
Step 29	**no shutdown** **Example:** `switch(config-if)# no shutdown`	Disable an interface.
Step 30	**vrf member vrf100** **Example:** `switch(config-if)# vrf member vrf100`	Configure VRF name.
Step 31	**ip forward** **Example:** `switch(config-if)# ip forward`	Enable IP forwarding on interface.
Step 32	**ip pim sparse-mode** **Example:** `switch(config-if)# ip pim sparse-mode`	Configure sparse-mode PIM on interface. There is no PIM peering happening in the Layer-3 VNI, but this command must be present for forwarding.

Configuring TRM on the VXLAN EVPN Spine

This procedure enables Tenant Routed Multicast (TRM) on a VXLAN EVPN spine switch.

Before you begin

The VXLAN BGP EVPN spine must be configured. See Configuring iBGP for EVPN on the Spine.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter configuration mode.
Step 2	**route-map permitall permit 10** **Example:** `switch(config)# route-map permitall permit 10`	Configure the route-map. **Note** The route-map keeps the next-hop unchanged for EVPN routes • Required for eBGP • Options for iBGP
Step 3	**set ip next-hop unchanged** **Example:** `switch(config-route-map)# set ip next-hop unchanged`	Set next hop address. **Note** The route-map keeps the next-hop unchanged for EVPN routes • Required for eBGP • Options for iBGP
Step 4	**exit** **Example:** `switch(config-route-map)# exit`	Return to exec mode.
Step 5	**router bgp [autonomous system]** *number* **Example:** `switch(config)# router bgp 65002`	Specify BGP.
Step 6	**address-family ipv4 mvpn** **Example:** `switch(config-router)# address-family ipv4 mvpn`	Configure the address family IPv4 MVPN under the BGP.

	Command or Action	Purpose
Step 7	**retain route-target all** **Example:** `switch(config-router-af)# retain route-target all`	Configure retain route-target all under address-family IPv4 MVPN [global]. **Note** Required for eBGP. Allows the spine to retain and advertise all MVPN routes when there are no local VNIs configured with matching import route targets.
Step 8	**neighbor** *ip-address* [**remote-as** *number*] **Example:** `switch(config-router-af)# neighbor 100.100.100.1`	Define neighbor.
Step 9	**address-family ipv4 mvpn** **Example:** `switch(config-router-neighbor)# address-family ipv4 mvpn`	Configure address family IPv4 MVPN under the BGP neighbor.
Step 10	**disable-peer-as-check** **Example:** `switch(config-router-neighbor-af)# 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 11	**rewrite-rt-asn** **Example:** `switch(config-router-neighbor-af)# rewrite-rt-asn`	Normalizes the outgoing route target's AS number to match the remote AS number. Uses the BGP configured neighbors remote AS. The **rewrite-rt-asn** command is required if the route target auto feature is being used to configure EVPN route targets.
Step 12	**send-community extended** **Example:** `switch(config-router-neighbor-af)# send-community extended`	Configures community for BGP neighbors.
Step 13	**route-reflector-client** **Example:** `switch(config-router-neighbor-af)# route-reflector-client`	Configure route reflector. **Note** Required for iBGP with route-reflector.
Step 14	**route-map permitall out** **Example:** `switch(config-router-neighbor-af)# route-map permitall out`	Applies route-map to keep the next-hop unchanged. **Note** Required for eBGP.

Configuring Tenant Routed Multicast in Layer 2/Layer 3 Mixed Mode

This procedure enables the Tenant Routed Multicast (TRM) feature. This enables both Layer 2 and Layer 3 multicast BGP signaling. This mode is only necessary if non-TRM edge devices (VTEPs) are present in the Cisco Nexus 9000 Series switches (1st generation). Only the Cisco Nexus 9000-EX and 9000-FX switches can do Layer 2/Layer 3 mode (Anchor-DR).

To forward multicast between senders and receivers on the Layer 3 cloud and the VXLAN fabric on TRM vPC border leafs, the VIP/PIP configuration must be enabled. For more information, see Configuring VIP/PIP.

All Cisco Nexus 9300-EX and 9300-FX platform switches must be in Layer 2/Layer 3 mode.

Before you begin

VXLAN EVPN must be configured.

The rendezvous point (RP) must be configured.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter configuration mode.
Step 2	**feature ngmvpn** **Example:** `switch(config)# feature ngmvpn`	Enables the Next-Generation Multicast VPN (ngMVPN) control plane. New address family commands become available in BGP.
Step 3	**advertise evpn multicast** **Example:** `switch(config)# advertise evpn multicast`	Advertises IMET and SMET routes into BGP EVPN towards non-TRM capable switches.
Step 4	**ip igmp snooping vxlan** **Example:** `switch(config)# ip igmp snooping vxlan`	Configure IGMP snooping for VXLAN VLANs.
Step 5	**ip multicast overlay-spt-only** **Example:** `switch(config)# ip multicast overlay-spt-only`	Gratuitously originate (S,A) route when source is locally connected. The **ip multicast overlay-spt-only** command is enabled by default on all MVPN-enabled Cisco Nexus 9000 Series switches (typically leaf nodes).
Step 6	**ip multicast overlay-distributed-dr** **Example:**	Enables distributed anchor DR function on this VTEP.

	Command or Action	Purpose
	`switch(config)# ip multicast overlay-distributed-dr`	**Note** The NVE interface must be shut and unshut while configuring this command.
Step 7	**interface nve1** **Example:** `switch(config)# interface nve 1`	Configure the NVE interface.
Step 8	**[no] shutdown** **Example:** `switch(config-if-nve)# shutdown`	Shuts down the NVE interface. The **no shutdown** command brings up the interface.
Step 9	**member vni** *vni-range* **associate-vrf** **Example:** `switch(config-if-nve)# member vni 200100 associate-vrf`	Configure the Layer 3 virtual network identifier. The range of *vni-range* is from 1 to 16,777,214.
Step 10	**mcast-group** *ip-prefix* **Example:** `switch(config-if-nve-vni)# mcast-group 225.3.3.3`	Configures the multicast group on distributed anchor DR.
Step 11	**exit** **Example:** `switch(config-if-nve-vni)# exit`	Exits command mode.
Step 12	**interface loopback** *loopback_number* **Example:** `switch(config-if-nve)# interface loopback 10`	Configure the loopback interface on all distributed anchor DR devices.
Step 13	**ip address** *ip_address* **Example:** `switch(config-if)# ip address 100.100.1.1/32`	Configure IP address. This IP address is the same on all distributed anchor DR.
Step 14	**ip router ospf** *process-tag* **area** *ospf-id* **Example:** `switch(config-if)# ip router ospf 100 area 0.0.0.0`	OSPF area ID in IP address format.
Step 15	**ip pim sparse-mode** **Example:** `switch(config-if)# ip pim sparse-mode`	Configure sparse-mode PIM on interface.

	Command or Action	Purpose
Step 16	**interface nve1** **Example:** `switch(config-if)# interface nve1`	Configure NVE interface.
Step 17	**shutdown** **Example:** `switch(config-if-nve)# shutdown`	Disable the interface.
Step 18	**mcast-routing override source-interface loopback** *int-num* **Example:** `switch(config-if-nve)# mcast-routing override source-interface loopback 10`	Enables that TRM is using a different loopback interface than the VTEPs default source-interface. The *loopback10* variable must be configured on every TRM-enabled VTEP (Anchor DR) in the underlay with the same IP address. This loopback and the respective **override** command are needed to serve TRM VTEPs in co-existence with non-TRM VTEPs.
Step 19	**exit** **Example:** `switch(config-if-nve)# exit`	Exits command mode.
Step 20	**router bgp 100** **Example:** `switch(config)# router bgp 100`	Set autonomous system number.
Step 21	**neighbor** *ip-addr* **Example:** `switch(config-router)# neighbor 1.1.1.1`	Configure IP address of the neighbor.
Step 22	**address-family ipv4 mvpn** **Example:** `switch(config-router-neighbor)# address-family ipv4 mvpn`	Configure multicast VPN.
Step 23	**send-community extended** **Example:** `switch(config-router-neighbor-af)# send-community extended`	Send community attribute.
Step 24	**exit** **Example:** `switch(config-router-neighbor-af)# exit`	Exits command mode.

	Command or Action	Purpose
Step 25	**exit** **Example:** `switch(config-router)# exit`	Exits command mode.
Step 26	**vrf** *vrf_name* **vrf100** **Example:** `switch(config)# vrf context vrf100`	Configure VRF name.
Step 27	**ip pim rp-address** *ip-address-of-router* **group-list** *group-range-prefix* **Example:** `switch(config-vrf)# ip pim rp-address 209.165.201.1 group-list 226.0.0.0/8`	The value of the *ip-address-of-router* parameter is that of the RP. The same IP address must be on all of the edge devices (VTEPs) for a fully distributed RP. For overlay RP placement options, see the Configuring a Rendezvous Point for Tenant Routed Multicast, on page 5 - Internal RP section.
Step 28	**address-family ipv4 unicast** **Example:** `switch(config-vrf)# address-family ipv4 unicast`	Configure unicast address family.
Step 29	**route-target both auto mvpn** **Example:** `switch(config-vrf-af-ipv4)# route-target both auto mvpn`	Specify target for mvpn routes.
Step 30	**exit** **Example:** `switch(config-vrf-af-ipv4)# exit`	Exits command mode.
Step 31	**exit** **Example:** `switch(config-vrf)# exit`	Exits command mode.
Step 32	**interface** *vlan_id* **Example:** `switch(config)# interface vlan11`	Configure Layer 2 VNI.
Step 33	**no shutdown** **Example:** `switch(config-if)# no shutdown`	Disable an interface.
Step 34	**vrf member vrf100** **Example:**	Configure VRF name.

	Command or Action	Purpose
	`switch(config-if)# vrf member vrf100`	
Step 35	**ip address** *ip_address* **Example:** `switch(config-if)# ip address 11.1.1.1/24`	Configure IP address.
Step 36	**ip pim sparse-mode** **Example:** e `switch(config-if)# ip pim sparse-mode`	Configure sparse-mode PIM on the interface.
Step 37	**fabric forwarding mode anycast-gateway** **Example:** `switch(config-if)# fabric forwarding mode anycast-gateway`	Configure Anycast Gateway Forwarding Mode.
Step 38	**ip pim neighbor-policy NONE*** **Example:** `switch(config-if)# ip pim neighbor-policy NONE*`	The **none** keyword is a configured route map to deny any IPv4 addresses to avoid establishing a PIM neighborship policy using anycase IP.
Step 39	**exit** **Example:** `switch(config-if)# exit`	Exits command mode.
Step 40	**interface** *vlan_id* **Example:** `switch(config)# interface vlan100`	Configure Layer 3 VNI.
Step 41	**no shutdown** **Example:** `switch(config-if)# no shutdown`	Disable an interface.
Step 42	**vrf member vrf100** **Example:** `switch(config-if)# vrf member vrf100`	Configure VRF name.
Step 43	**ip forward** **Example:** `switch(config-if)# ip forward`	Enable IP forwarding on interface.
Step 44	**ip pim sparse-mode** **Example:** `switch(config-if)# ip pim sparse-mode`	Configure sparse-mode PIM on the interface.

Configuring Layer 2 Tenant Routed Multicast

This procedure enables the Tenant Routed Multicast (TRM) feature. This enables Layer 2 multicast BGP signaling.

IGMP Snooping Querier must be configured per multicast-enabled VXLAN VLAN on all Layer-2 TRM leaf switches.

Before you begin

VXLAN EVPN must be configured.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter configuration mode.
Step 2	**feature ngmvpn** **Example:** `switch(config)# feature ngmvpn`	Enables EVPN/MVPN feature.
Step 3	**advertise evpn multicast** **Example:** `switch(config)# advertise evpn multicast`	Advertise L2 multicast capability.
Step 4	**ip igmp snooping vxlan** **Example:** `switch(config)# ip igmp snooping vxlan`	Configure IGMP snooping for VXLANs.
Step 5	**vlan configuration** *vlan-id* **Example:** `switch(config)# vlan configuration 101`	Enter configuration mode for VLAN 101.
Step 6	**ip igmp snooping querier** *querier-ip-address* **Example:** `switch(config-vlan-config)# ip igmp snooping querier 2.2.2.2`	Configure IGMP snooping querier for each multicast-enabled VXLAN VLAN.

Configuring TRM with vPC Support

This section provides steps to configure TRM with vPC support. Beginning with Cisco NX-OS Release 10.1(2), TRM Multisite with vPC BGW is supported.

Procedure

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `switch# configure terminal`	Enter global configuration mode.
Step 2	**feature vpc** **Example:** `switch(config)# feature vpc`	Enables vPCs on the device.
Step 3	**feature interface-vlan** **Example:** `switch(config)# feature interface-vlan`	Enables the interface VLAN feature on the device.
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`	To enable Layer 3 forwarding for packets destined to the gateway MAC address of the virtual port channel (vPC), use the **peer-gateway** command.

	Command or Action	Purpose
Step 11	**peer-keepalive destination** *ipaddress* **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. **Note** We recommend that you configure a separate VRF and use a Layer 3 port from each vPC peer device in that VRF for the vPC peer-keepalive link. For more information about creating and configuring VRFs, see the Cisco Nexus 9000 NX-OS Series Unicast Routing Config Guide, 9.3(x).
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.

Step 14	Create 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.

	Command or Action	Purpose
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 for **interface-vlan** to 45 seconds.