



Configuring Tenant Routed Multicast

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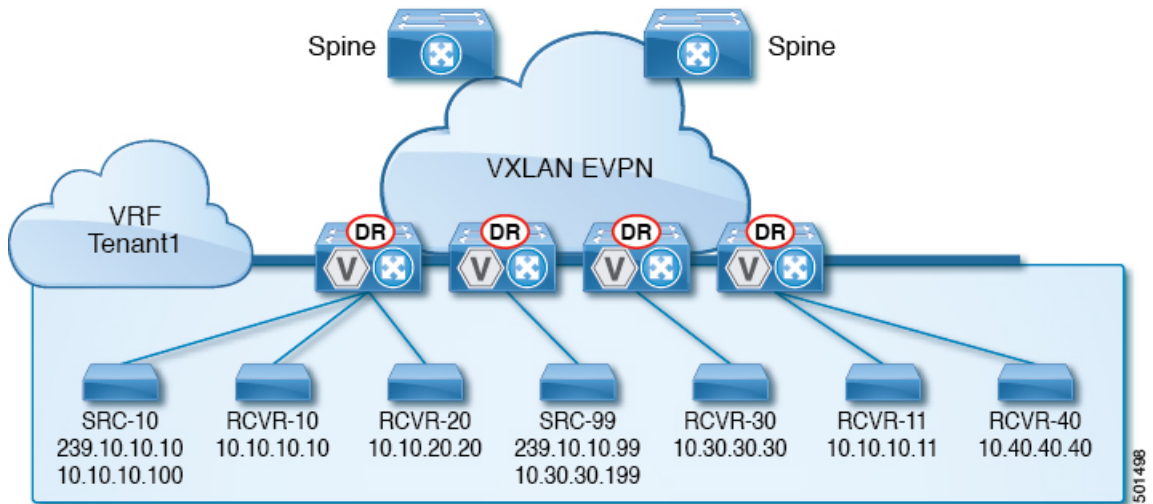
About Tenant Routed Multicast

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

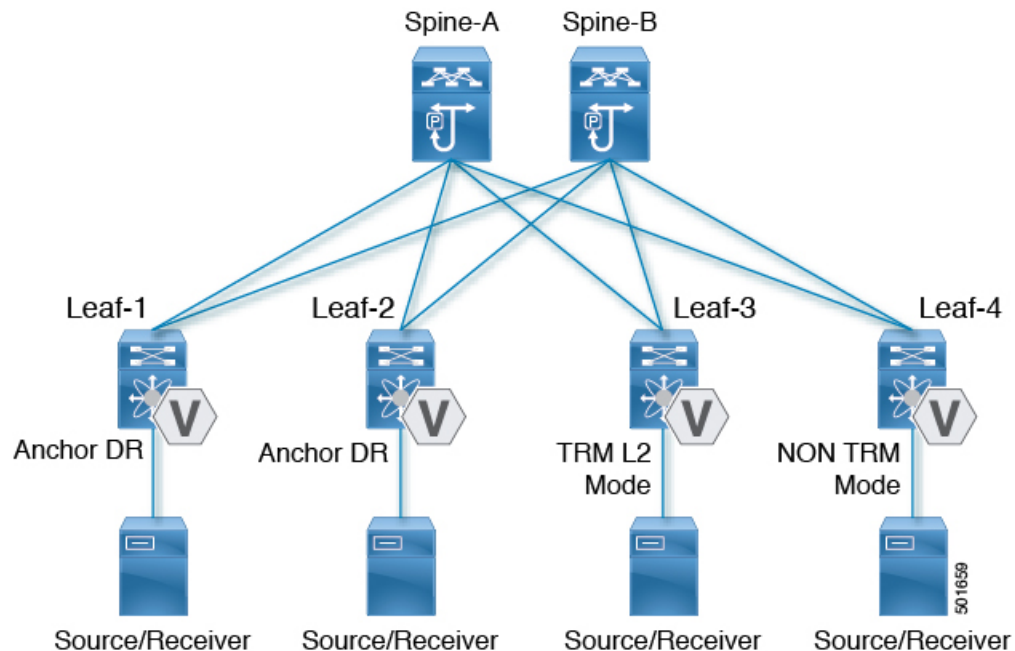


With TRM enabled, multicast forwarding in the underlay is leveraged to replicate VXLAN encapsulated routed multicast traffic. A Default Multicast Distribution Tree (Default-MDT) is built per-VRF. This is an addition to the existing multicast groups for Layer-2 VNI Broadcast, Unknown Unicast, and Layer-2 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:

- Beginning with Cisco NX-OS Release 10.1(2), TRM Multisite with vPC BGW is supported.
- With Tenant Routed Multicast enabled, FEX is not supported.
- If VXLAN TRM feature is enabled on a VTEP, it would stop to send IGMP messages to the VXLAN fabric.
- The Guidelines and Limitations for VXLAN also apply to TRM.
- With TRM enabled, SVI as a core link 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.
- In a Transit Routing Multicast (TRM) deployment, the RP-on-stick model can sometimes lead to traffic drops if there is flapping on the Protocol Independent Multicast (PIM) enabled interface. Use the **ip pim spt-switch-graceful** command on the turnaround router that leads to the RP. This command allows for a graceful switch to the Shortest Path Tree (SPT) during flapping, which can minimize traffic drops.
- TRM with Multi-Site is not supported on Cisco Nexus 9504-R platforms.
- TRM supports multiple border nodes. Reachability to an external RP/source via multiple border leaf switches is supported with ECMP and requires symmetric unicast routing.
- Both PIM and **ip igmp snooping vxlan** must be enabled on the L3 VNI's VLAN in a VXLAN vPC setup.
- For traffic streams with an internal source and external L3 receiver using an external RP, the external L3 receiver might send PIM S,G join requests to the internal source. Doing so triggers the recreation of S,G on the fabric FHR, and it can take up to 10 minutes for this S,G to be cleared.

Guidelines and Limitations for Layer 3 Tenant Routed Multicast

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

- When upgrading from Cisco NX-OS Release 9.3(3) to Cisco NX-OS Release 9.3(6), if you do not retain configurations of the TRM enabled VRFs from Cisco NX-OS Release 9.3(3), or if you create new VRFs after the upgrade, the auto-generation of **ip multicast multipath s-g-hash next-hop-based** CLI, when **feature ngmvpn** is enabled, will not happen. You must enable the CLI manually for each TRM enabled VRF.
- Layer 3 TRM is supported for Cisco Nexus 9200, 9300-EX, and 9300-FX/FX2/FX3/FXP and 9300-GX platform switches.
- Beginning with Cisco NX-OS Release 9.3(7), Cisco Nexus N9K-C9316D-GX, N9K-C9364C-GX, and N9K-X9716D-GX platform switches support the combination of Layer 3 TRM and EVPN Multi-Site.
- Cisco Nexus 9300-GX platform switches do not support the combination of Layer 3 TRM and EVPN Multi-Site in Cisco NX-OS Release 9.3(5).
- Beginning with Cisco NX-OS Release 9.3(3), the Cisco Nexus 9504 and 9508 platform switches with -R/RX line cards support TRM in Layer 3 mode. This feature is supported on IPv4 overlays only. Layer 2 mode and L2/L3 mixed mode are not supported.
The Cisco Nexus 9504 and 9508 platform switches with -R/RX line cards can function as a border leaf for Layer 3 unicast traffic. For Anycast functionality, the RP can be internal, external, or RP everywhere.
- 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 Multi-Site functionality is not supported on Cisco Nexus 9504 platform switches with -R/RX line cards.
- If one or both VTEPs is a Cisco Nexus 9504 or 9508 platform switch with -R/RX line cards, the packet TTL is decremented twice, once for routing to the L3 VNI on the source leaf and once for forwarding from the destination L3 VNI to the destination VLAN on the destination leaf.
- TRM with vPC border leafs is supported only for Cisco Nexus 9200, 9300-EX, and 9300-FX/FX2/FX3/GX platform switches and Cisco Nexus 9500 platform switches with -EX/FX or -R/RX 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
- Layer 2/Layer 3 Tenant Routed Multicast (TRM) is not supported on Cisco Nexus 9300-FX3/GX platform switches.

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)	<p>Supported in 7.0(3)I7(x) releases starting from 7.0(3)I7(5)</p> <p>Not supported in 9.2(x)</p> <p>Supported in NX-OS releases beginning with 9.3(1) for the following Nexus 9000 switches:</p> <ul style="list-style-type: none"> • Cisco Nexus 9200 Series switches • Cisco Nexus 9364C platform switches • Cisco Nexus 9300-EX/FX/FX2 platform switches (excluding the Cisco Nexus 9300-FXP platform switch) <p>Supported for Cisco Nexus 9300-FX3 platform switches beginning with Cisco NX-OS Release 9.3(5)</p>
TRM L2L3 Mode	7.0(3)I7(1), 9.2(x)	N/A	N/A

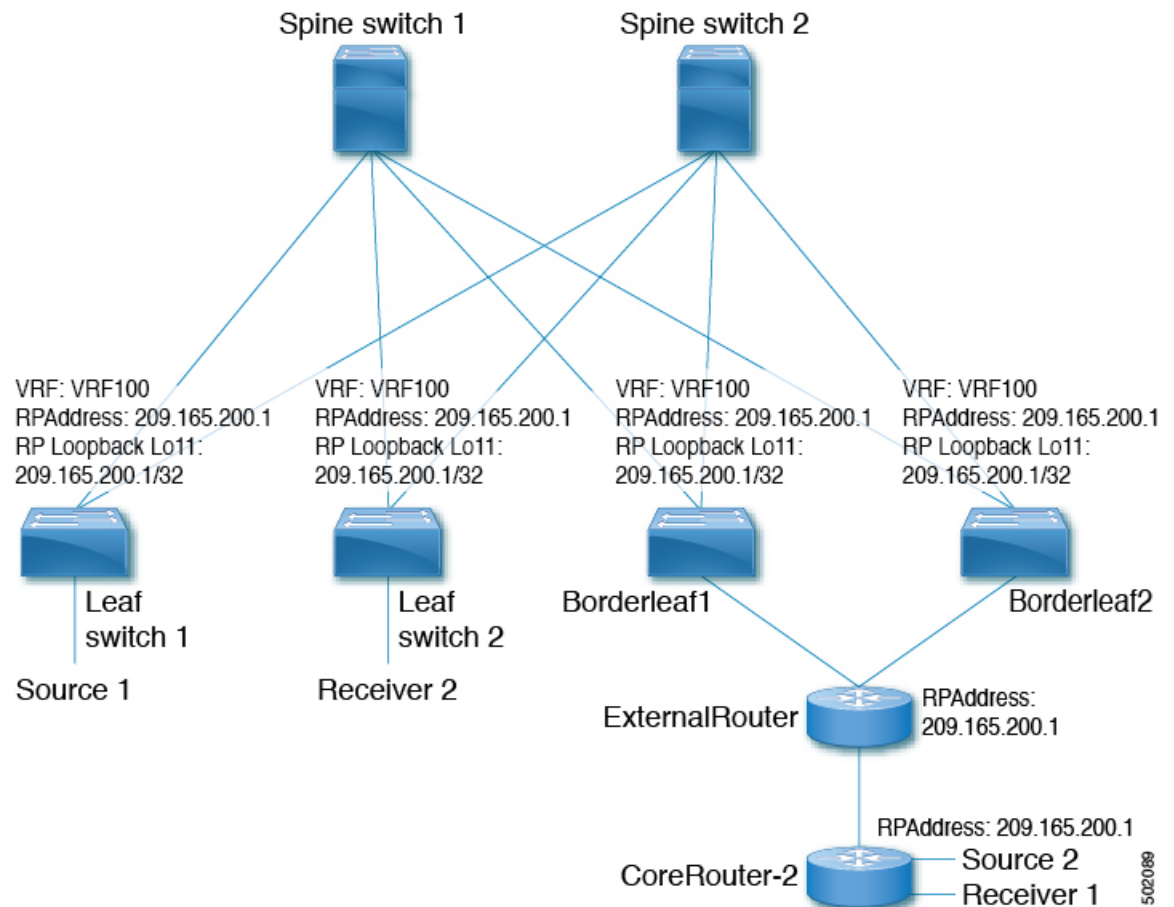
Configuring a Rendezvous Point for Tenant Routed Multicast

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

- [Configuring a Rendezvous Point Inside the VXLAN Fabric, on page 7](#)
- [Configuring an External Rendezvous Point, on page 8](#)
- [Configuring RP Everywhere with PIM Anycast, on page 10](#)
- [Configuring RP Everywhere with MSDP Peering, on page 16](#)

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).



SUMMARY STEPS

1. **configure terminal**

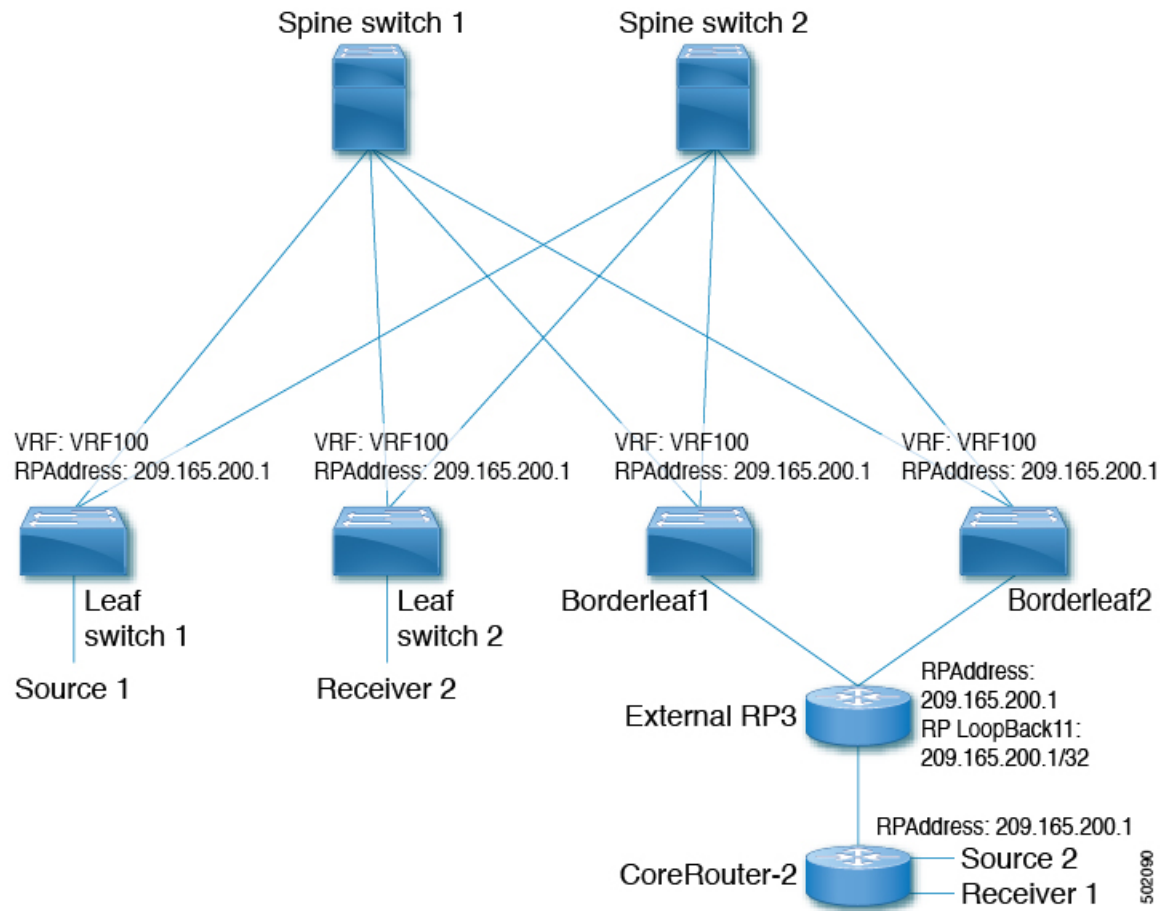
2. **interface loopback** *loopback_number*
3. **vrf member** *vxlan-number*
4. **ip address** *ip-address*
5. **ip pim sparse-mode**
6. **vrf context** *vrf-name*
7. **ip pim rp-address** *ip-address-of-router group-list group-range-prefix*

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal	Enters global configuration mode.
Step 2	interface loopback <i>loopback_number</i> Example: switch(config)# interface loopback 11	Configure the loopback interface on all TRM-enabled nodes. This enables the rendezvous point inside the fabric.
Step 3	vrf member <i>vxlan-number</i> Example: switch(config-if)# vrf member vrf100	Configure VRF name.
Step 4	ip address <i>ip-address</i> 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 <i>vrf-name</i> Example: switch(config-if)# vrf context vrf100	Create a VXLAN tenant VRF.
Step 7	ip pim rp-address <i>ip-address-of-router group-list group-range-prefix</i> Example: switch(config-vrf)# ip pim rp-address 209.165.200.1 group-list 224.0.0.0/4	The value of the <i>ip-address-of-router</i> 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.



SUMMARY STEPS

1. configure terminal
2. vrf context vrf100
3. ip pim rp-address ip-address-of-router group-list group-range-prefix

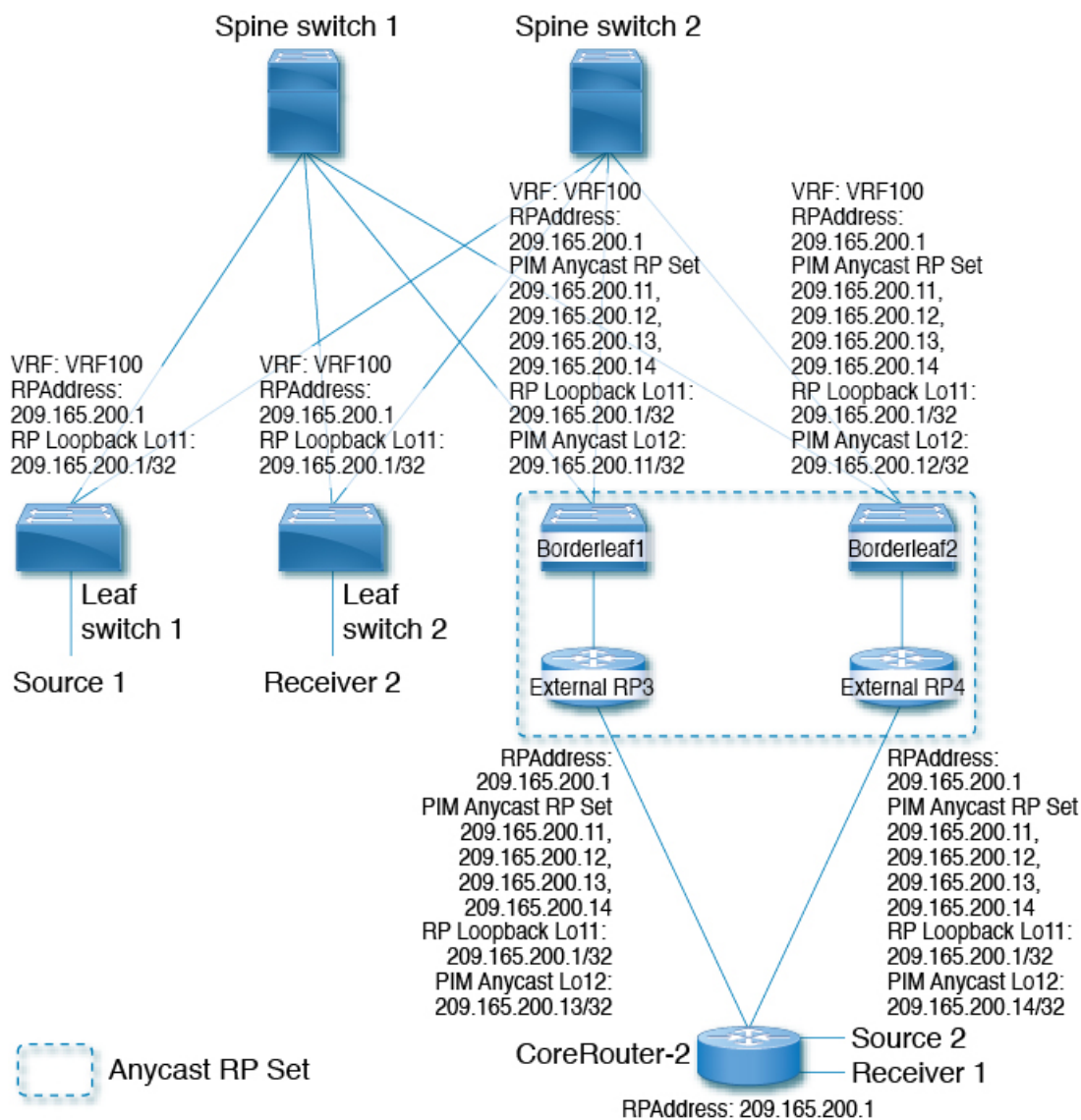
DETAILED STEPS

	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.

	Command or Action	Purpose
Step 3	<p>ip pim rp-address <i>ip-address-of-router</i> group-list <i>group-range-prefix</i></p> <p>Example:</p> <pre>switch(config-vrf)# ip pim rp-address 209.165.200.1 group-list 224.0.0.0/4</pre>	The value of the <i>ip-address-of-router</i> 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 RP Everywhere with PIM Anycast

RP Everywhere configuration with PIM Anycast solution.



For information about configuring RP Everywhere with PIM Anycast, see:

- [Configuring a TRM Leaf Node for RP Everywhere with PIM Anycast, on page 11](#)
- [Configuring a TRM Border Leaf Node for RP Everywhere with PIM Anycast, on page 12](#)
- [Configuring an External Router for RP Everywhere with PIM Anycast, on page 14](#)

Configuring a TRM Leaf Node for RP Everywhere with PIM Anycast

Configuration of Tenant Routed Multicast (TRM) leaf node for RP Everywhere.

SUMMARY STEPS

1. **configure terminal**
2. **interface loopback** *loopback_number*
3. **vrf member** *vrf-name*
4. **ip address** *ip-address*
5. **ip pim sparse-mode**
6. **vrf context** *vxlan*
7. **ip pim rp-address** *ip-address-of-router* **group-list** *group-range-prefix*

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal	Enter configuration mode.
Step 2	interface loopback <i>loopback_number</i> Example: switch(config)# interface loopback 11	Configure the loopback interface on all VXLAN VTEP devices.
Step 3	vrf member <i>vrf-name</i> Example: switch(config-if)# vrf member vrf100	Configure VRF name.
Step 4	ip address <i>ip-address</i> 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 <i>vxlan</i> Example: switch(config-if)# vrf context vrf100	Create a VXLAN tenant VRF.

	Command or Action	Purpose
Step 7	ip pim rp-address <i>ip-address-of-router</i> group-list <i>group-range-prefix</i> Example: <pre>switch(config-vrf)# ip pim rp-address 209.165.200.1 group-list 224.0.0.0/4</pre>	The value of the <i>ip-address-of-router</i> parameters is that of the RP. The same IP address must be on all the edge devices (VTEPs) for a fully distributed RP.

Configuring a TRM Border Leaf Node for RP Everywhere with PIM Anycast

Configuring the TRM Border Leaf Node for RP Anywhere with PIM Anycast.

SUMMARY STEPS

1. **configure terminal**
2. **{ip | ipv6} pim evpn-border-leaf**
3. **interface loopback** *loopback_number*
4. **vrf member** *vrf-name*
5. **ip address** *ip-address*
6. **ipv6 pim sparse-mode**
7. **interface loopback** *loopback_number*
8. **vrf member** *vlan-number*
9. **ipv6 address** *ipv6-address*
10. **ipv6 pim sparse-mode**
11. **vrf context** *vrf-name*
12. **ipv6 pim rp-address** *ipv6-address-of-router* **group-list** *group-range-prefix*
13. **ipv6 pim anycast-rp** *anycast-rp-address* *address-of-rp*
14. **ipv6 pim anycast-rp** *anycast-rp-address* *address-of-rp*
15. **ipv6 pim anycast-rp** *anycast-rp-address* *address-of-rp*
16. **ipv6 pim anycast-rp** *anycast-rp-address* *address-of-rp*

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>switch# configure terminal</pre>	Enter configuration mode.
Step 2	{ip ipv6} pim evpn-border-leaf Example: <pre>switch(config)# ipv6 pim evpn-border-leaf</pre>	Configure VXLAN VTEP as TRM border leaf node,
Step 3	interface loopback <i>loopback_number</i> Example: <pre>switch(config)# interface loopback 11</pre>	Configure the loopback interface on all VXLAN VTEP devices.

	Command or Action	Purpose
Step 4	vrf member <i>vrf-name</i> Example: switch(config-if)# vrf member vrf100	Configure VRF name.
Step 5	ip address <i>ip-address</i> Example: switch(config-if)# ip address 209.165.200.1/32	Specify IP address.
Step 6	ipv6 pim sparse-mode Example: switch(config-if)# ipv6 pim sparse-mode	Configure sparse-mode PIM on an interface.
Step 7	interface loopback <i>loopback_number</i> Example: switch(config)# interface loopback 12	Configure the PIM Anycast set RP loopback interface.
Step 8	vrf member <i>vxlان-number</i> Example: switch(config-if)# vrf member vxlan-number	Configure VRF name.
Step 9	ipv6 address <i>ipv6-address</i> Example: switch(config-if)# ip address 209.165.200.11/32	Specify IP address.
Step 10	ipv6 pim sparse-mode Example: switch(config-if)# ipv6 pim sparse-mode	Configure sparse-mode PIM on an interface.
Step 11	vrf context <i>vrf-name</i> Example: switch(config-if)# vrf context vrf100	Create a VXLAN tenant VRF.
Step 12	ipv6 pim rp-address <i>ipv6-address-of-router group-list group-range-prefix</i> Example: switch(config-vrf)# ipv6 pim rp-address 2090:165:200::1 group ffile::/16	The value of the <i>ip-address-of-router</i> parameters is that of the RP. The same IP address must be on all the edge devices (VTEPs) for a fully distributed RP.
Step 13	ipv6 pim anycast-rp <i>anycast-rp-address address-of-rp</i> Example: switch(config-vrf)# ipv6 pim anycast-rp 2090:165:2000::1 2090:165:2000::11	Configure PIM Anycast RP set.
Step 14	ipv6 pim anycast-rp <i>anycast-rp-address address-of-rp</i> Example:	Configure PIM Anycast RP set.

	Command or Action	Purpose
	<code>switch(config-vrf)# ipv6 pim anycast-rp 2090:165:2000::1 2090:165:2000::12</code>	
Step 15	ipv6 pim anycast-rp <i>anycast-rp-address address-of-rp</i> Example: <code>switch(config-vrf)# ipv6 pim anycast-rp 2090:165:2000::1 2090:165:2000::13</code>	Configure PIM Anycast RP set.
Step 16	ipv6 pim anycast-rp <i>anycast-rp-address address-of-rp</i> Example: <code>switch(config-vrf)# ipv6 pim anycast-rp 2090:165:2000::1 2090:165:2000::14</code>	Configure PIM Anycast RP set.

Configuring an External Router for RP Everywhere with PIM Anycast

Use this procedure to configure an external router for RP Everywhere.

SUMMARY STEPS

1. **configure terminal**
2. **interface loopback** *loopback_number*
3. **vrf member** *vrf-name*
4. **ip address** *ip-address*
5. **ip pim sparse-mode**
6. **interface loopback** *loopback_number*
7. **vrf member** *vxlan-number*
8. **ip address** *ip-address*
9. **ip pim sparse-mode**
10. **vrf context** *vxlan*
11. **ip pim rp-address** *ip-address-of-router* **group-list** *group-range-prefix*
12. **ip pim anycast-rp** *anycast-rp-address address-of-rp*
13. **ip pim anycast-rp** *anycast-rp-address address-of-rp*
14. **ip pim anycast-rp** *anycast-rp-address address-of-rp*
15. **ip pim anycast-rp** *anycast-rp-address address-of-rp*

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: <code>switch# configure terminal</code>	Enter configuration mode.
Step 2	interface loopback <i>loopback_number</i> Example:	Configure the loopback interface on all VXLAN VTEP devices.

	Command or Action	Purpose
	<code>switch(config)# interface loopback 11</code>	
Step 3	vrf member <i>vrf-name</i> Example: <code>switch(config-if)# vrf member vfr100</code>	Configure VRF name.
Step 4	ip address <i>ip-address</i> Example: <code>switch(config-if)# ip address 209.165.200.1/32</code>	Specify IP address.
Step 5	ip pim sparse-mode Example: <code>switch(config-if)# ip pim sparse-mode</code>	Configure sparse-mode PIM on an interface.
Step 6	interface loopback <i>loopback_number</i> Example: <code>switch(config)# interface loopback 12</code>	Configure the PIM Anycast set RP loopback interface.
Step 7	vrf member <i>vxlان-number</i> Example: <code>switch(config-if)# vrf member vrf100</code>	Configure VRF name.
Step 8	ip address <i>ip-address</i> Example: <code>switch(config-if)# ip address 209.165.200.13/32</code>	Specify IP address.
Step 9	ip pim sparse-mode Example: <code>switch(config-if)# ip pim sparse-mode</code>	Configure sparse-mode PIM on an interface.
Step 10	vrf context <i>vxlان</i> Example: <code>switch(config-if)# vrf context vrf100</code>	Create a VXLAN tenant VRF.
Step 11	ip pim rp-address <i>ip-address-of-router group-list group-range-prefix</i> Example: <code>switch(config-vrf)# ip pim rp-address 209.165.200.1 group-list 224.0.0.0/4</code>	The value of the <i>ip-address-of-router</i> parameters is that of the RP. The same IP address must be on all the edge devices (VTEPs) for a fully distributed RP.
Step 12	ip pim anycast-rp <i>anycast-rp-address address-of-rp</i> Example: <code>switch(config-vrf)# ip pim anycast-rp 209.165.200.1 209.165.200.11</code>	Configure PIM Anycast RP set.

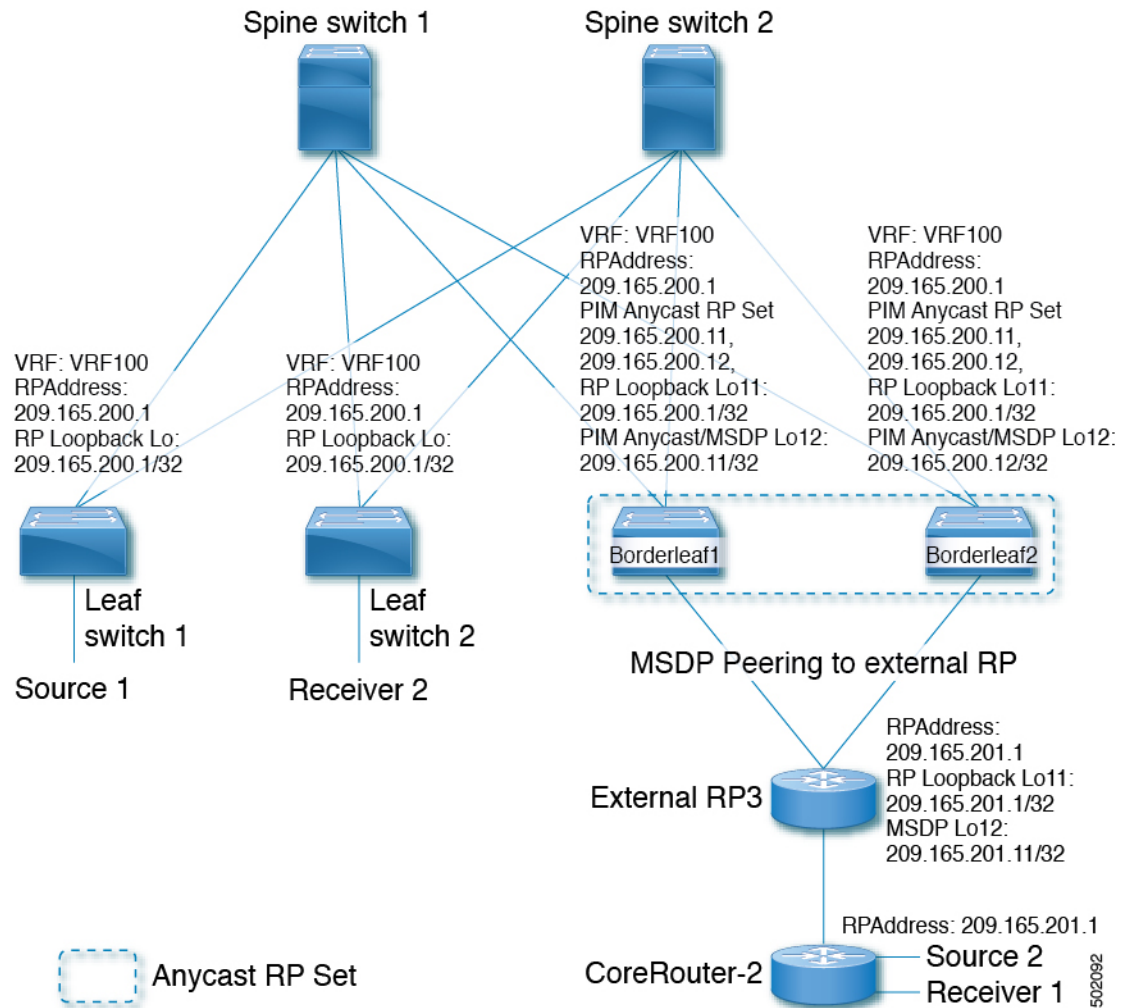
	Command or Action	Purpose
Step 13	ip pim anycast-rp <i>anycast-rp-address address-of-rp</i> Example: <pre>switch(config-vrf)# ip pim anycast-rp 209.165.200.1 209.165.200.12</pre>	Configure PIM Anycast RP set.
Step 14	ip pim anycast-rp <i>anycast-rp-address address-of-rp</i> Example: <pre>switch(config-vrf)# ip pim anycast-rp 209.165.200.1 209.165.200.13</pre>	Configure PIM Anycast RP set.
Step 15	ip pim anycast-rp <i>anycast-rp-address address-of-rp</i> Example: <pre>switch(config-vrf)# ip pim anycast-rp 209.165.200.1 209.165.200.14</pre>	Configure PIM Anycast RP set.

Configuring RP Everywhere with MSDP Peering

The following figure represents the RP Everywhere configuration with MSDP RP solution.

For information about configuring RP Everywhere with MSDP Peering, see:

- [Configuring a TRM Leaf Node for RP Everywhere with MSDP Peering, on page 17](#)
- [Configuring a TRM Border Leaf Node for RP Everywhere with MSDP Peering, on page 18](#)
- [Configuring an External Router for RP Everywhere with MSDP Peering, on page 21](#)



Configuring a TRM Leaf Node for RP Everywhere with MSDP Peering

Configuring a TRM leaf node for RP Everywhere with MSDP peering.

SUMMARY STEPS

1. **configure terminal**
2. **interface loopback** *loopback_number*
3. **vrf member** *vrf-name*
4. **ip address** *ip-address*
5. **ip pim sparse-mode**
6. **vrf context** *vrf-name*
7. **ip pim rp-address** *ip-address-of-router group-list group-range-prefix*

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal	Enter configuration mode.
Step 2	interface loopback <i>loopback_number</i> Example: switch(config)# interface loopback 11	Configure the loopback interface on all VXLAN VTEP devices.
Step 3	vrf member <i>vrf-name</i> Example: switch(config-if)# vrf member vrf100	Configure VRF name.
Step 4	ip address <i>ip-address</i> 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 <i>vrf-name</i> Example: switch(config-if)# vrf context vrf100	Create a VXLAN tenant VRF.
Step 7	ip pim rp-address <i>ip-address-of-router</i> group-list <i>group-range-prefix</i> Example: switch(config-vrf)# ip pim rp-address 209.165.200.1 group-list 224.0.0.0/4	The value of the <i>ip-address-of-router</i> parameters is that of the RP. The same IP address must be on all the edge devices (VTEPs) for a fully distributed RP.

Configuring a TRM Border Leaf Node for RP Everywhere with MSDP Peering

Use this procedure to configure a TRM border leaf for RP Everywhere with PIM Anycast.

SUMMARY STEPS

1. **configure terminal**
2. **feature msdp**
3. **ip pim evpn-border-leaf**
4. **interface loopback** *loopback_number*
5. **vrf member** *vrf-name*
6. **ip address** *ip-address*
7. **ip pim sparse-mode**

8. **interface loopback** *loopback_number*
9. **vrf member** *vrf-name*
10. **ip address** *ip-address*
11. **ip pim sparse-mode**
12. **vrf context** *vrf-name*
13. **ip pim rp-address** *ip-address-of-router* **group-list** *group-range-prefix*
14. **ip pim anycast-rp** *anycast-rp-address* *address-of-rp*
15. **ip pim anycast-rp** *anycast-rp-address* *address-of-rp*
16. **ip msdp originator-id** *loopback*
17. **ip msdp peer** *ip-address* **connect-source** *loopback*

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal	Enter configuration mode.
Step 2	feature msdp Example: switch(config)# feature msdp	Enable feature MSDP.
Step 3	ip pim evpn-border-leaf Example: switch(config)# ip pim evpn-border-leaf	Configure VXLAN VTEP as TRM border leaf node,
Step 4	interface loopback <i>loopback_number</i> Example: switch(config)# interface loopback 11	Configure the loopback interface on all VXLAN VTEP devices.
Step 5	vrf member <i>vrf-name</i> Example: switch(config-if)# vrf member vrf100	Configure VRF name.
Step 6	ip address <i>ip-address</i> Example: switch(config-if)# ip address 209.165.200.1/32	Specify IP address.
Step 7	ip pim sparse-mode Example: switch(config-if)# ip pim sparse-mode	Configure sparse-mode PIM on an interface.
Step 8	interface loopback <i>loopback_number</i> Example: switch(config)# interface loopback 12	Configure the PIM Anycast set RP loopback interface.

	Command or Action	Purpose
Step 9	vrf member <i>vrf-name</i> Example: switch(config-if)# vrf member vrf100	Configure VRF name.
Step 10	ip address <i>ip-address</i> Example: switch(config-if)# ip address 209.165.200.11/32	Specify IP address.
Step 11	ip pim sparse-mode Example: switch(config-if)# ip pim sparse-mode	Configure sparse-mode PIM on an interface.
Step 12	vrf context <i>vrf-name</i> Example: switch(config-if)# vrf context vrf100	Create a VXLAN tenant VRF.
Step 13	ip pim rp-address <i>ip-address-of-router</i> group-list <i>group-range-prefix</i> Example: switch(config-vrf)# ip pim rp-address 209.165.200.1 group-list 224.0.0.0/4	The value of the <i>ip-address-of-router</i> parameter is that of the RP. The same IP address must be on all the edge devices (VTEPs) for a fully distributed RP.
Step 14	ip pim anycast-rp <i>anycast-rp-address</i> <i>address-of-rp</i> Example: switch(config-vrf)# ip pim anycast-rp 209.165.200.1 209.165.200.11	Configure PIM Anycast RP set.
Step 15	ip pim anycast-rp <i>anycast-rp-address</i> <i>address-of-rp</i> Example: switch(config-vrf)# ip pim anycast-rp 209.165.200.1 209.165.200.12	Configure PIM Anycast RP set.
Step 16	ip msdp originator-id <i>loopback</i> Example: switch(config-vrf)# ip msdp originator-id loopback12	Configure MSDP originator ID.
Step 17	ip msdp peer <i>ip-address</i> connect-source <i>loopback</i> Example: switch(config-vrf)# ip msdp peer 209.165.201.11 connect-source loopback12	Configure MSDP peering between border node and external RP router.

Configuring an External Router for RP Everywhere with MSDP Peering

SUMMARY STEPS

1. **configure terminal**
2. **feature msdp**
3. **interface loopback** *loopback_number*
4. **vrf member** *vrf-name*
5. **ip address** *ip-address*
6. **ip pim sparse-mode**
7. **interface loopback** *loopback_number*
8. **vrf member** *vrf-name*
9. **ip address** *ip-address*
10. **ip pim sparse-mode**
11. **vrf context** *vrf-name*
12. **ip pim rp-address** *ip-address-of-router* **group-list** *group-range-prefix*
13. **ip msdp originator-id loopback12**
14. **ip msdp peer** *ip-address* **connect-source loopback12**

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: <code>switch# configure terminal</code>	Enter configuration mode.
Step 2	feature msdp Example: <code>switch(config)# feature msdp</code>	Enable feature MSDP.
Step 3	interface loopback <i>loopback_number</i> Example: <code>switch(config)# interface loopback 11</code>	Configure the loopback interface on all VXLAN VTEP devices.
Step 4	vrf member <i>vrf-name</i> Example: <code>switch(config-if)# vrf member vrf100</code>	Configure VRF name.
Step 5	ip address <i>ip-address</i> Example: <code>switch(config-if)# ip address 209.165.201.1/32</code>	Specify IP address.
Step 6	ip pim sparse-mode Example: <code>switch(config-if)# ip pim sparse-mode</code>	Configure sparse-mode PIM on an interface.

	Command or Action	Purpose
Step 7	interface loopback <i>loopback_number</i> Example: switch(config)# interface loopback 12	Configure the PIM Anycast set RP loopback interface.
Step 8	vrf member <i>vrf-name</i> Example: switch(config-if)# vrf member vrf100	Configure VRF name.
Step 9	ip address <i>ip-address</i> Example: switch(config-if)# ip address 209.165.201.11/32	Specify IP address.
Step 10	ip pim sparse-mode Example: switch(config-if)# ip pim sparse-mode	Configure sparse-mode PIM on an interface.
Step 11	vrf context <i>vrf-name</i> Example: switch(config-if)# vrf context vrf100	Create a VXLAN tenant VRF.
Step 12	ip pim rp-address <i>ip-address-of-router</i> group-list <i>group-range-prefix</i> Example: switch(config-vrf)# ip pim rp-address 209.165.201.1 group-list 224.0.0.0/4	The value of the <i>ip-address-of-router</i> parameters is that of the RP. The same IP address must be on all the edge devices (VTEPs) for a fully distributed RP.
Step 13	ip msdp originator-id loopback12 Example: switch(config-vrf)# ip msdp originator-id loopback12	Configure MSDP originator ID.
Step 14	ip msdp peer <i>ip-address</i> connect-source loopback12 Example: switch(config-vrf)# ip msdp peer 209.165.200.11 connect-source loopback12	Configure MSDP peering between external RP router and all TRM border nodes.

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 leaves, 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. You will get a syslog message when you enable this command. The message informs you that ip multicast multipath s-g-hash next-hop-based is the recommended multipath hashing algorithm and you need enable it for the TRM enabled VRFs. The auto-generation of ip multicast multipath s-g-hash next-hop-based command does not happen after you enable the feature ngmvpn command. You need to configure ip multicast multipath s-g-hash next-hop-based as part of the VRF configuration.
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 <i>vni-range</i> 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
	<code>switch(config-if-nve-vni) # mcast-group 225.3.3.3</code>	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: <code>switch(config-if-nve-vni) # exit</code>	Exits command mode.
Step 8	exit Example: <code>switch(config-if) # exit</code>	Exits command mode.
Step 9	router bgp <as-number> Example: <code>switch(config) # router bgp 100</code>	Set autonomous system number.
Step 10	neighbor ip-addr Example: <code>switch(config-router) # neighbor 1.1.1.1</code>	Configure IP address of the neighbor.
Step 11	address-family ipv4 mvpn Example: <code>switch(config-router-neighbor) # address-family ipv4 mvpn</code>	Configure multicast VPN.
Step 12	send-community extended Example: <code>switch(config-router-neighbor-af) # send-community extended</code>	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: <code>switch(config-router-neighbor-af) # exit</code>	Exits command mode.
Step 14	exit Example: <code>switch(config-router) # exit</code>	Exits command mode.
Step 15	vrf context vrf_name Example: <code>switch(config-router) # vrf context vrf100</code>	Configures VRF name.

	Command or Action	Purpose
Step 16	ip multicast multipath s-g-hash next-hop-based Example: <pre>switch(config-vrf)# ip multicast multipath s-g-hash next-hop-based</pre>	Configures multicast multipath and initiates S, G, nexthop hashing (rather than the default of S/RP, G-based hashing) to select the RPF interface.
Step 17	ip pim rp-address ip-address-of-router group-list group-range-prefix Example: <pre>switch(config-vrf)# ip pim rp-address 209.165.201.1 group-list 226.0.0.0/8</pre>	<p>The value of the <i>ip-address-of-router</i> parameter is that of the RP. The same IP address must be on all of the edge devices (VTEPs) for a fully distributed RP.</p> <p>For overlay RP placement options, see the Configuring a Rendezvous Point for Tenant Routed Multicast, on page 7 section.</p>
Step 18	address-family ipv4 unicast Example: <pre>switch(config-vrf)# address-family ipv4 unicast</pre>	Configure unicast address family.
Step 19	route-target both auto mvpn Example: <pre>switch(config-vrf-af-ipv4)# route-target both auto mvpn</pre>	<p>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).</p> <p>Auto route targets are constructed by the 2-byte Autonomous System Number (ASN) and Layer 3 VNI.</p>
Step 20	ip multicast overlay-spt-only Example: <pre>switch(config)# ip multicast overlay-spt-only</pre>	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 21	interface vlan_id Example: <pre>switch(config)# interface vlan11</pre>	Configures the first-hop gateway (distributed anycast gateway for the Layer 2 VNI. No router PIM peering must ever happen with this interface.
Step 22	no shutdown Example: <pre>switch(config-if)# no shutdown</pre>	Disables an interface.
Step 23	vrf member vrf-num Example: <pre>switch(config-if)# vrf member vrf100</pre>	Configure VRF name.
Step 24	ipv6 address ipv6_address Example: <pre>switch(config-if)# ip address 11.1.1.1/24</pre>	Configure IP address.
Step 25	ipv6 pim sparse-mode Example: <pre>switch(config-if)# ip pim sparse-mode</pre>	Enables IGMP and PIM on the SVI. This is required is multicast sources and/or receivers exist in this VLAN.

	Command or Action	Purpose
Step 26	fabric forwarding mode anycast-gateway Example: switch(config-if)# fabric forwarding mode anycast-gateway	Configure Anycast Gateway Forwarding Mode.
Step 27	ip pim neighbor-policy NONE* Example: switch(config-if)# ip pim neighbor-policy NONE*	Creates an IP PIM neighbor policy to avoid PIM neighborhood with PIM routers within the VLAN. The none keyword is a configured route map to deny any ipv4 addresses to avoid establishing PIM neighborhood policy using anycast IP. Note Do not use Distributed Anycast Gateway for PIM Peerings.
Step 28	exit Example: switch(config-if)# exit	Exits command mode.
Step 29	interface vlan_id Example: switch(config)# interface vlan100	Configure Layer 3 VNI.
Step 30	no shutdown Example: switch(config-if)# no shutdown	Disable an interface.
Step 31	vrf member vrf100 Example: switch(config-if)# vrf member vrf100	Configure VRF name.
Step 32	ip forward Example: switch(config-if)# ip forward	Enable IP forwarding on interface.
Step 33	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](#).

SUMMARY STEPS

1. **configure terminal**
2. **route-map permitall permit 10**
3. **set ip next-hop unchanged**
4. **exit**
5. **router bgp [autonomous system] number**
6. **address-family ipv4 mvpn**
7. **retain route-target all**
8. **neighbor ip-address [remote-as number]**
9. **address-family ipv4 mvpn**
10. **disable-peer-as-check**
11. **rewrite-rt-asn**
12. **send-community extended**
13. **route-reflector-client**
14. **route-map permitall out**

DETAILED STEPS

	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 <ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • 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.

	Command or Action	Purpose
Step 6	address-family ipv4 mvpn Example: switch(config-router)# address-family ipv4 mvpn	Configure the address family IPv4 MVPN under the BGP.
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 leaves are using the same AS but the spines have a different AS than leaves. 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:	Applies route-map to keep the next-hop unchanged. Note Required for eBGP.

	Command or Action	Purpose
	<code>switch(config-router-neighbor-af) # route-map permitall out</code>	

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: <code>switch# configure terminal</code>	Enter configuration mode.
Step 2	feature ngmvpn Example: <code>switch(config)# feature ngmvpn</code>	Enables the Next-Generation Multicast VPN (ngMVPN) control plane. New address family commands become available in BGP.
Step 3	advertise evpn multicast Example: <code>switch(config)# advertise evpn multicast</code>	Advertises IMET and SMET routes into BGP EVPN towards non-TRM capable switches.
Step 4	ip igmp snooping vxlan Example: <code>switch(config)# ip igmp snooping vxlan</code>	Configure IGMP snooping for VXLAN VLANs.
Step 5	ip multicast overlay-spt-only Example: <code>switch(config)# ip multicast overlay-spt-only</code>	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).

	Command or Action	Purpose
Step 6	ip multicast overlay-distributed-dr Example: switch(config)# ip multicast overlay-distributed-dr	Enables distributed anchor DR function on this VTEP. 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 <i>vni-range</i> 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.
Step 16	interface nve1 Example: switch(config-if)# interface nve1	Configure NVE interface.

	Command or Action	Purpose
Step 17	shutdown Example: switch(config-if-nve)# shutdown	Disable the interface.
Step 18	mcast-routing override source-interface loopback <i>int-num</i> 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 <i>loopback10</i> 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.
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.

	Command or Action	Purpose
Step 27	ip pim rp-address <i>ip-address-of-router</i> group-list <i>group-range-prefix</i> Example: <pre>switch(config-vrf) # ip pim rp-address 209.165.201.1 group-list 226.0.0.0/8</pre>	<p>The value of the <i>ip-address-of-router</i> parameter is that of the RP. The same IP address must be on all of the edge devices (VTEPs) for a fully distributed RP.</p> <p>For overlay RP placement options, see the Configuring a Rendezvous Point for Tenant Routed Multicast, on page 7 - Internal RP section.</p>
Step 28	address-family ipv4 unicast Example: <pre>switch(config-vrf) # address-family ipv4 unicast</pre>	Configure unicast address family.
Step 29	route-target both auto mvpn Example: <pre>switch(config-vrf-af-ipv4) # route-target both auto mvpn</pre>	Specify target for mvpn routes.
Step 30	exit Example: <pre>switch(config-vrf-af-ipv4) # exit</pre>	Exits command mode.
Step 31	exit Example: <pre>switch(config-vrf) # exit</pre>	Exits command mode.
Step 32	interface <i>vlan_id</i> Example: <pre>switch(config) # interface vlan11</pre>	Configure Layer 2 VNI.
Step 33	no shutdown Example: <pre>switch(config-if) # no shutdown</pre>	Disable an interface.
Step 34	vrf member <i>vrf100</i> Example: <pre>switch(config-if) # vrf member vrf100</pre>	Configure VRF name.
Step 35	ip address <i>ip_address</i> Example: <pre>switch(config-if) # ip address 11.1.1.1/24</pre>	Configure IP address.
Step 36	ip pim sparse-mode Example: <pre>e switch(config-if) # ip pim sparse-mode</pre>	Configure sparse-mode PIM on the interface.

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

SUMMARY STEPS

1. `configure terminal`
2. `feature vpc`
3. `feature interface-vlan`
4. `feature lacp`
5. `feature pim`
6. `feature ospf`
7. `ip pim rp-address address group-list range`
8. `vpc domain domain-id`
9. `peer switch`
10. `peer gateway`

11. **peer-keepalive destination** *ipaddress*
12. **ip arp synchronize**
13. **ipv6 nd synchronize**
14. Create vPC peer-link.
15. **system nve infra-vlans** *range*
16. **vlan** *number*
17. Create the SVI.
18. (Optional) **delay restore interface-vlan** *seconds*

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: <code>switch# configure terminal</code>	Enter global configuration mode.
Step 2	feature vpc Example: <code>switch(config)# feature vpc</code>	Enables vPCs on the device.
Step 3	feature interface-vlan Example: <code>switch(config)# feature interface-vlan</code>	Enables the interface VLAN feature on the device.
Step 4	feature lacp Example: <code>switch(config)# feature lacp</code>	Enables the LACP feature on the device.
Step 5	feature pim Example: <code>switch(config)# feature pim</code>	Enables the PIM feature on the device.
Step 6	feature ospf Example: <code>switch(config)# feature ospf</code>	Enables the OSPF feature on the device.
Step 7	ip pim rp-address <i>address group-list range</i> Example: <code>switch(config)# ip pim rp-address 100.100.100.1 group-list 224.0.0/4</code>	Defines a PIM RP address for the underlay multicast group range.
Step 8	vpc domain <i>domain-id</i> Example: <code>switch(config)# vpc domain 1</code>	Creates a vPC domain on the device and enters vpc-domain configuration mode for configuration purposes. There is no default. The range is from 1 to 1000.

	Command or Action	Purpose
Step 9	peer switch Example: <pre>switch(config-vpc-domain) # peer switch</pre>	Defines the peer switch.
Step 10	peer gateway Example: <pre>switch(config-vpc-domain) # peer gateway</pre>	To enable Layer 3 forwarding for packets destined to the gateway MAC address of the virtual port channel (vPC), use the peer-gateway command.
Step 11	peer-keepalive destination ipaddress Example: <pre>switch(config-vpc-domain) # peer-keepalive destination 172.28.230.85</pre>	<p>Configures the IPv4 address for the remote end of the vPC peer-keepalive link.</p> <p>Note The system does not form the vPC peer link until you configure a vPC peer-keepalive link.</p> <p>The management ports and VRF are the defaults.</p> <p>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.</p> <p>For more information about creating and configuring VRFs, see the Cisco Nexus 9000 NX-OS Series Unicast Routing Config Guide, 9.3(x).</p>
Step 12	ip arp synchronize Example: <pre>switch(config-vpc-domain) # ip arp synchronize</pre>	Enables IP ARP synchronize under the vPC Domain to facilitate faster ARP table population following device reload.
Step 13	ipv6 nd synchronize Example: <pre>switch(config-vpc-domain) # ipv6 nd synchronize</pre>	Enables IPv6 nd synchronization under the vPC domain to facilitate faster nd table population following device reload.
Step 14	<p>Create vPC peer-link.</p> <p>Example:</p> <pre>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</pre>	Creates the vPC peer-link port-channel interface and adds two member interfaces to it.

	Command or Action	Purpose
	<pre>switch(config)# channel-group 1 mode active switch(config)# no shutdown</pre>	
Step 15	<p>system nve infra-vlans <i>range</i></p> <p>Example:</p> <pre>switch(config)# system nve infra-vlans 10</pre>	Defines a non-VXLAN enabled VLAN as a backup routed path.
Step 16	<p>vlan <i>number</i></p> <p>Example:</p> <pre>switch(config)# vlan 10</pre>	Creates the VLAN to be used as an infra-VLAN.
Step 17	<p>Create the SVI.</p> <p>Example:</p> <pre>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</pre>	Creates the SVI used for the backup routed path over the vPC peer-link.
Step 18	<p>(Optional) delay restore interface-vlan <i>seconds</i></p> <p>Example:</p> <pre>switch(config-vpc-domain)# delay restore interface-vlan 45</pre>	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.

Configuring TRM with vPC Support (Cisco Nexus 9504-R and 9508-R)

SUMMARY STEPS

1. **configure terminal**
2. **feature vpc**
3. **feature interface-vlan**
4. **feature lacp**
5. **feature pim**
6. **feature ospf**
7. **ip pim rp-address** *address group-list range*
8. **vpc domain** *domain-id*
9. **hardware access-list team region mac-ifacl**
10. **hardware access-list team region vxlan 10**
11. **reload**
12. **peer switch**

13. **peer gateway**
14. **peer-keepalive destination** *ipaddress*
15. **ip arp synchronize**
16. **ipv6 nd synchronize**
17. Create vPC peer-link.
18. **system nve infra-vlans** *range*
19. **vlan** *number*
20. Create the SVI.
21. (Optional) **delay restore interface-vlan** *seconds*

DETAILED STEPS

	Command or Action	Purpose
Step 1	configure terminal Example: <code>switch# configure terminal</code>	Enter global configuration mode.
Step 2	feature vpc Example: <code>switch(config)# feature vpc</code>	Enables vPCs on the device.
Step 3	feature interface-vlan Example: <code>switch(config)# feature interface-vlan</code>	Enables the interface VLAN feature on the device.
Step 4	feature lacp Example: <code>switch(config)# feature lacp</code>	Enables the LACP feature on the device.
Step 5	feature pim Example: <code>switch(config)# feature pim</code>	Enables the PIM feature on the device.
Step 6	feature ospf Example: <code>switch(config)# feature ospf</code>	Enables the OSPF feature on the device.
Step 7	ip pim rp-address <i>address group-list range</i> Example: <code>switch(config)# ip pim rp-address 100.100.100.1 group-list 224.0.0/4</code>	Defines a PIM RP address for the underlay multicast group range.
Step 8	vpc domain <i>domain-id</i> Example: <code>switch(config)# vpc domain 1</code>	Creates a vPC domain on the device and enters vpc-domain configuration mode for configuration purposes. There is no default. The range is 1–1000.

	Command or Action	Purpose
Step 9	hardware access-list tcam region mac-ifacl Example: <pre>switch(config)# hardware access-list tcam region mac-ifacl 0</pre>	Carves the TCAM region for the ACL database. Note This TCAM carving command is required to enable TRM forwarding for N9K-X9636C-RX line cards only. With no TCAM region carved for mac-ifacl , the TCAM resources are used for TRM instead.
Step 10	hardware access-list tcam region vxlan 10 Example: <pre>switch(config)# hardware access-list tcam region vxlan 10</pre>	Assigns the the TCAM region for use by a VXLAN. Note This TCAM carving command is required to enable TRM forwarding for N9K-X9636C-RX line cards only.
Step 11	reload Example: <pre>switch(config)# reload</pre>	Reloads the switch config for the TCAM assignments to become active.
Step 12	peer switch Example: <pre>switch(config-vpc-domain)# peer switch</pre>	Defines the peer switch.
Step 13	peer gateway Example: <pre>switch(config-vpc-domain)# peer gateway</pre>	To enable Layer 3 forwarding for packets that are destined to the gateway MAC address of the virtual port channel (vPC), use the peer-gateway command.
Step 14	peer-keepalive destination ipaddress Example: <pre>switch(config-vpc-domain)# peer-keepalive destination 172.28.230.85</pre>	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 15	ip arp synchronize Example: <pre>switch(config-vpc-domain)# ip arp synchronize</pre>	Enables IP ARP synchronize under the vPC Domain to facilitate faster ARP table population following device reload.

	Command or Action	Purpose
Step 16	ipv6 nd synchronize Example: <pre>switch(config-vpc-domain) # ipv6 nd synchronize</pre>	Enables IPv6 and synchronization under the vPC domain to facilitate faster and table population following device reload.
Step 17	Create vPC peer-link. Example: <pre>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</pre>	Creates the vPC peer-link port-channel interface and adds two member interfaces to it.
Step 18	system nve infra-vlans range Example: <pre>switch(config) # system nve infra-vlans 10</pre>	Defines a non-VXLAN enabled VLAN as a backup routed path.
Step 19	vlan number Example: <pre>switch(config) # vlan 10</pre>	Creates the VLAN to be used as an infra-VLAN.
Step 20	Create the SVI. Example: <pre>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</pre>	Creates the SVI used for the backup routed path over the vPC peer-link.
Step 21	(Optional) delay restore interface-vlan seconds Example: <pre>switch(config-vpc-domain) # delay restore interface-vlan 45</pre>	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.