



Configuring Seamless Integration of EVPN (TRM) with MVPN

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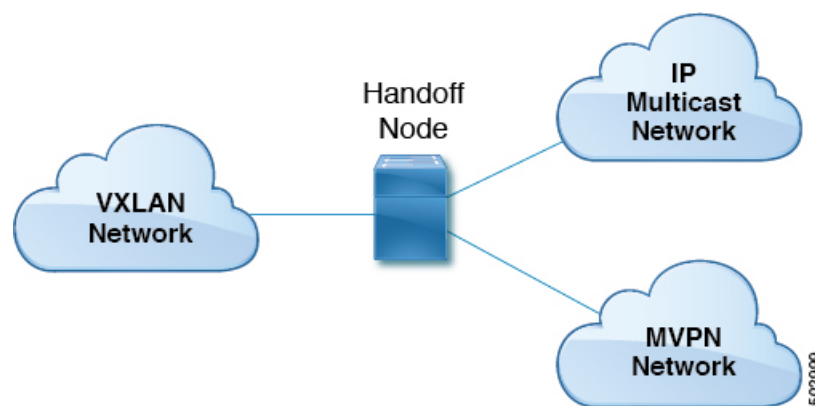
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About Seamless Integration of EVPN (TRM) with MVPN (Draft Rosen)

Seamless integration of EVPN (TRM) with MVPN (draft rosen) enables packets to be handed off between a VXLAN network (TRM or TRM Multi-Site) and an MVPN network. To support this feature, VXLAN TRM and MVPN must be supported on a Cisco Nexus device node, the handoff node.

The handoff node is the PE for the MVPN network and the VTEP for the VXLAN network. It connects to the VXLAN, MVPN, and IP multicast networks, as shown in the following figure.

Figure 1: VXLAN - MVPN Handoff Network



Sources and receivers can be in any of the three networks (VXLAN, MVPN, or IP multicast).

All multicast traffic (that is, the tenant traffic from the VXLAN, MVPN, or multicast network) is routed from one domain to another domain. The handoff node acts as the central node. It performs the necessary packet forwarding, encapsulation, and decapsulation to send the traffic to the respective receivers.

Supported RP Positions

The rendezvous point (RP) for the customer (overlay) network can be in any of the three networks (VXLAN, MVPN, or IP multicast).

Table 1: Supported RP Locations

RP Locations	Description
RP in IP network	<ul style="list-style-type: none"> The RP can be connected only to the MVPN PE and not to the handoff nodes. The RP can be connected only to the VXLAN handoff nodes. The RP can be connected to both the MVPN PE and VXLAN.
RP internal to VXLAN fabric	All VTEPs are RPs inside the VXLAN fabric. All MVPN PEs use the RP configured on the VXLAN fabric.
RP on VXLAN MVPN handoff node	The RP is the VXLAN MVPN handoff node.
RP in MVPN network	The RP is external to the VXLAN network. It's configured on one of the nodes in the MPLS cloud, other than the handoff node.
RP Everywhere (PIM Anycast RP or MSDP-based Anycast RP)	The Anycast RP can be configured on the VXLAN leaf. The RP set can be configured on the handoff node or any MVPN PE.

Guidelines and Limitations for Seamless Integration of EVPN (TRM) with MVPN

This feature has the following guidelines and limitations:

- The handoff node can have local (directly connected) multicast sources or receivers for the customer network.
- Any existing underlay properties, such as ASM/SSM for MVPN or ASM for TRM, are supported on the handoff node.
- The handoff node supports PIM SSM and ASM for the overlay.
- Inter-AS option A is supported on the handoff node toward the IP multicast network.

- The total number of supported MDT source loopback IP addresses and NVE loopback IP addresses is 16. If the number of loopback IP addresses exceeds this limit, traffic drops might occur.
- The following functionality isn't supported for seamless integration of EVPN (TRM) with MVPN:
 - vPC on the handoff node
 - VXLAN ingress replication
 - SVIs and subinterfaces as core-facing interfaces for MVPN
 - Inter-AS options B and C on MVPN nodes
 - PIM SSM as a VXLAN underlay
 - Bidirectional PIM as an underlay or overlay
 - ECMP with a mix of MPLS and IP paths
- Any existing limitations for VXLAN, TRM, and MVPN also apply to seamless integration of EVPN (TRM) with MVPN.

Configuring the Handoff Node for Seamless Integration of EVPN (TRM) with MVPN

This section documents the configurations that are required on the handoff node. Configurations for other nodes (such as VXLAN leafs and spines, MVPN PE, and RS/RR) are the same as in previous releases.

PIM/IGMP Configuration for the Handoff Node

Follow these guidelines when configuring PIM/IGMP for the handoff node:

- Make sure that the Rendezvous Point (RP) is different for TRM and the MVPN underlay, as shown in the following example.

```
ip pim rp-address 90.1.1.100 group-list 225.0.0.0/8 --- TRM Underlay
ip pim rp-address 91.1.1.100 group-list 233.0.0.0/8 --- MVPN Underlay
```

- Use a common RP for overlay multicast traffic.
- The RP can be in static, PIM Anycast, or PIM MSDP mode. The following example shows the RP configuration inside the VRF:

```
vrf context vrfVxLAN5001
  vni 5001
  ip pim rp-address 111.1.1.1 group-list 226.0.0.0/8
  ip pim rp-address 112.2.1.1 group-list 227.0.0.0/8
```

- Enable IGMP snooping for VXLAN traffic using the **ip igmp snooping vxlan** command.
- Enable PIM sparse mode on all source interfaces and interfaces required to carry PIM traffic.

BGP Configuration for the Handoff Node

Follow these guidelines when configuring BGP for the handoff node:

- Add all VXLAN leafs as L2EVPN and TRM neighbors; include the redundant handoff node. If a route reflector is used, add only RR as a neighbor.
- Add all MVPN PEs as VPN neighbors. In MDT mode, add the MVPN PEs as MDT neighbors.
- Import configuration to advertise unicast routes from L2EVPN neighbors to VPN neighbors and vice versa.
- The BGP source identifier can be different or the same as the source interfaces used for the VTEP identifier (configured under the NVE interface)/MVPN PE identifier.

```
feature bgp
address-family ipv4 mdt
address-family ipv4 mvpn

neighbor 2.1.1.1
  address-family ipv4 mvpn
  send-community extended
  address-family l2vpn evpn
  send-community extended
  import vpn unicast reoriginate

neighbor 30.30.30.30
  address-family vpv4 unicast
  send-community
  send-community extended
  next-hop-self
  import l2vpn evpn reoriginate
  address-family ipv4 mdt
  send-community extended
  no next-hop-third-party
```

- Never use Inter-AS option B between MVPN peers. Instead, configure the **no allocate-label option-b** command under the VPNv4 unicast address family.

```
address-family vpv4 unicast
  no allocate-label option-b
```

- Set maximum paths should be set in EBGP mode.

```
address-family l2vpn evpn
  maximum-paths 8
vrf vrfVxLAN5001
  address-family ipv4 unicast
  maximum-paths 8
```

- If handoff nodes are deployed in dual mode, use the **route-map** command to avoid advertising prefixes associated with orphan hosts under the VPN address family.

```
ip prefix-list ROUTES_CONNECTED_NON_LOCAL seq 2 permit 15.14.0.15/32

route-map ROUTES_CONNECTED_NON_LOCAL deny
  match ip address prefix-list ROUTES_CONNECTED_NON_LOCAL

neighbor 8.8.8.8
  remote-as 100
  update-source loopback1
  address-family vpv4 unicast
  send-community
```

```
send-community extended
route-map ROUTES_CONNECTED_NON_LOCAL out
```

VXLAN Configuration for the Handoff Node

Follow these guidelines when configuring VXLAN for the handoff node:

- Enable the following features:

```
feature nv overlay
feature ngmvpn
feature interface-vlan
feature vn-segment-vlan-based
```

- Configure the required L3 VNI:

```
L3VNIs are mapped to tenant VRF.
vlan 2501
  vn-segment 5001 <-- Associate VNI to a VLAN.
```

- Configure the NVE interface:

```
interface nve1
  no shutdown
  host-reachability protocol bgp
  source-interface loopback1 <-- This interface should not be the same as the MVPN
  source interface.
  global suppress-arp
  member vni 5001 associate-vrf <-- L3VNI
  mcast-group 233.1.1.1 <-- The underlay multicast group for VXLAN should be different
  from the MVPN default/data MDT.
```

- Configure the tenant VRF:

```
vrf context vrfVxLAN5001
  vni 5001 <-- Associate VNI to VRF.
  rd auto
  address-family ipv4 unicast
    route-target both auto
    route-target both auto mvpn
    route-target both auto evpn
```

```
interface Vlan2501 <-- SVI interface associated with the L3VNI
  no shutdown
  mtu 9216 <-- The overlay header requires 58 bytes, so the max tenant traffic is
  (Configured MTU - 58).
  vrf member vrfVxLAN5001
  no ip redirects
  ip forward
  ipv6 forward
  no ipv6 redirects
  ip pim sparse-mode <-- PIM is enabled.
```

```
interface Vlan2 <-- SVI interface associated with L2 VNI
  no shutdown
  vrf member vrfVxLAN5001
  no ip redirects
  ip address 100.1.1.1/16
  no ipv6 redirects
  ip pim sparse-mode <-- PIM enabled on L2VNI
  fabric forwarding mode anycast-gateway
```

MVPN Configuration for the Handoff Node

Follow these guidelines when configuring MVPN for the handoff node:

- Enable the following features:

```
install feature-set mpls
allow feature-set mpls
feature-set mpls
feature mpls l3vpn
feature mvpn
feature mpls ldp
```

- MPLS LDP Configuration:

- Enable MPLS LDP (**mpls ip**) on all interfaces that are MPLS links.
- Do not advertise loopback interfaces used for VXLAN as MPLS prefixes.
 - Configure a prefix list that contains IP addresses that identify the MVPN PE node.

```
ip prefix-list LDP-LOOPBACK seq 51 permit 9.1.1.10/32
ip prefix-list LDP-LOOPBACK seq 52 permit 9.1.2.10/32
```

- Configure label allocation only for MVPN PE identifiers.

```
mpls ldp configuration
explicit-null
advertise-labels for LDP-LOOPBACK
label allocate global prefix-list LDP-LOOPBACK
```

- Tenant VRF Configuration:

- For the default MDT mode, make the underlay multicast group the same for all tenant multicast traffic under the VRF.

```
vrf context vrfVxLAN5001
vni 5001
mdt default 225.1.100.1
mdt source loopback100 <-- If the source interface is not configured, the BGP
identifier is used as the source interface.
mdt asm-use-shared-tree <-- If the underlay is configured in ASM mode
no mdt enforce-bgp-mdt-safi <-- Enabled by default but should be negated if BGP
MDT should not be used for discovery.
mdt mtu <mtu-value> <-- Overlay ENCAP Max MTU value
```

- For the data MDT mode, configure a unique multicast group-set for a subset of or all tenant multicast traffic.

```
mdt data 229.1.100.2/32 immediate-switch
mdt data 232.1.10.4/24 immediate-switch
route-map DATA_MDT_MAP permit 10
match ip multicast group 237.1.1.1/32
mdt data 235.1.1.1/32 immediate-switch route-map DATA_MDT_MAP
```

- Enable MVPN tunnel statistics.

```
hardware profile mvpn-stats module all
```

CoPP Configuration for the Handoff Node

Both TRM and MVPN are heavily dependent on the control plane. Make sure to set the CoPP policy bandwidth as per the topology.

The following CoPP classes are used for TRM and MVPN traffic:

- **copp-system-p-class-multicast-router** (The default bandwidth is 3000 pps.)
- **copp-system-p-class-l3mc-data** (The default bandwidth is 3000 pps.)
- **copp-system-p-class-l2-default** (The default bandwidth is 50 pps.)
- **copp-class-normal-igmp** (The default bandwidth is 6000 pps.)

The following configuration example shows CoPP policies that can be configured to avoid control packet drops with multicast route scale.



Note The policer values in this example are approximations and might not be optimal for all topologies or traffic patterns. Configure the CoPP policies according to the MVPN/TRM traffic pattern.

```
copp copy profile strict prefix custom
  policy-map type control-plane custom-copp-policy-strict
    class custom-copp-class-normal-igmp
      police cir 6000 pps bc 512 packets conform transmit violate drop
  control-plane
  service-policy input custom-copp-policy-strict

copp copy profile strict prefix custom
  policy-map type control-plane custom-copp-policy-strict
    class custom-copp-class-multicast-router
      police cir 6000 pps bc 512 packets conform transmit violate drop
  control-plane
  service-policy input custom-copp-policy-strict

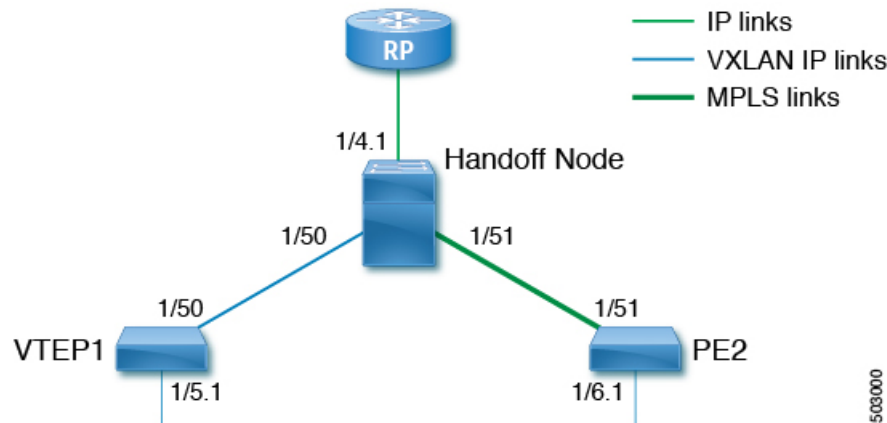
copp copy profile strict prefix custom
  policy-map type control-plane custom-copp-policy-strict
    class copp-system-p-class-l3mc-data
      police cir 3000 pps bc 512 packets conform transmit violate drop
  control-plane
  service-policy input custom-copp-policy-strict

copp copy profile strict prefix custom
  policy-map type control-plane custom-copp-policy-strict
    class custom-copp-class-l2-default
      police cir 9000 pps bc 512 packets conform transmit violate drop
  control-plane
  service-policy input custom-copp-policy-strict
```

Configuration Example for Seamless Integration of EVPN (TRM) with MVPN

The following figure shows a sample topology with a VXLAN network on the left, an MVPN network on the right, and a centralized handoff node.

Figure 2: Sample Topology for Seamless Integration of EVPN (TRM) with MVPN



The following example show sample configurations for the VTEP, handoff node, and PE in this topology.

Configuration on VTEP1:

```
feature ngmvpn
feature interface-vlan
feature vn-segment-vlan-based
feature nv overlay
feature pim
nv overlay evpn
ip pim rp-address 90.1.1.100 group-list 225.0.0.0/8
ip pim ssm range 232.0.0.0/8

vlan 555
  vn-segment 55500

route-map ALL_ROUTES permit 10
interface nve1
  no shutdown
  host-reachability protocol bgp
  source-interface loopback2
  member vni 55500 associate-vrf
  mcast-group 225.3.3.3

interface loopback1
  ip address 196.196.196.196/32

interface loopback2
  ip address 197.197.197.197/32
  ip pim sparse-mode

feature bgp
router bgp 1
  address-family l2vpn evpn
  maximum-paths 8
```



```

        maximum-paths ibgp 8
    neighbor 2.1.1.2
        remote-as 1
        update-source loopback 1
        address-family ipv4 unicast
            send-community extended
        address-family ipv6 unicast
            send-community extended
        address-family ipv4 mvpn
            send-community extended
        address-family l2vpn evpn
            send-community extended
    vrf vrfVxLAN5023
        address-family ipv4 unicast
        advertise l2vpn evpn
        redistribute direct route-map ALL_ROUTES
        maximum-paths 8
        maximum-paths ibgp 8

vrf context vpn1
    vni 55500
    ip pim rp-address 27.27.27.27 group-list 224.0.0.0/4
    ip pim ssm range 232.0.0.0/8
    ip multicast multipath s-g-hash next-hop-based
rd auto
    address-family ipv4 unicast
        route-target both auto
        route-target both auto mvpn
        route-target both auto evpn

interface Vlan555
    no shutdown
    vrf member vpn1
    ip forward
    ip pim sparse-mode

interface Ethernet 1/50
    ip pim sparse-mode

interface Ethernet1/5.1
    encapsulation dot1q 90
    vrf member vpn1
    ip address 10.11.12.13/24
    ip pim sparse-mode
    no shutdown

```

Configuration on the handoff node:

```

install feature-set mpls
    allow feature-set mpls
feature-set mpls
feature ngmvpn
feature bgp
feature pim
feature mpls l3vpn
feature mvpn
feature mpls ldp
feature interface-vlan
feature vn-segment-vlan-based
feature nv overlay
nv overlay evpn

ip pim rp-address 90.1.1.100 group-list 225.0.0.0/8
ip pim rp-address 91.1.1.100 group-list 232.0.0.0/8

```

```

interface loopback1
 ip address 90.1.1.100 /32
 ip pim sparse-mode

interface loopback2
 ip address 91.1.1.100 /32
 ip pim sparse-mode

ip prefix-list LDP-LOOPBACK seq 2 permit 20.20.20.20/32
ip prefix-list LDP-LOOPBACK seq 3 permit 30.30.30.30/32
mpls ldp configuration
 advertise-labels for LDP-LOOPBACK
 label allocate label global prefix-list LDP-LOOPBACK

interface Ethernet 1/50
 ip pim sparse-mode

interface Ethernet 1/51
 ip pim sparse-mode
 mpls ip

interface Ethernet1/4.1
 encapsulation dot1q 50
 vrf member vpn1
 ip pim sparse-mode
 no shutdown

interface loopback0
 ip address 20.20.20.20/32
 ip pim sparse-mode

vlan 555
 vn-segment 55500

route-map ALL_ROUTES permit 10

interface nve1
 no shutdown
 host-reachability protocol bgp
 source-interface loopback3
 member vni 55500 associate-vrf
 mcast-group 225.3.3.3

interface loopback3
 ip address 198.198.198.198/32
 ip pim sparse-mode

vrf context vpn1
 vni 55500
 ip pim rp-address 27.27.27.27 group-list 224.0.0.0/4
 ip pim ssm range 232.0.0.0/8
 ip multicast multipath s-g-hash next-hop-based
 mdt default 232.1.1.1
 mdt source loopback 0
 rd auto
 address-family ipv4 unicast
 route-target both auto
 route-target both auto mvpn
 route-target both auto evpn

interface Vlan555
 no shutdown
 vrf member vpn1

```

```

ip forward
ip pim sparse-mode

router bgp 1
  address-family l2vpn evpn
    maximum-paths 8
    maximum-paths ibgp 8
  address-family vpnv4 unicast
    no allocate-label option-b
  address-family ipv4 mdt
  address-family ipv4 mvpn
    maximum-paths 8
    maximum-paths ibgp 8
  neighbor 196.196.196.196
    remote-as 1
    address-family ipv4 unicast
      send-community extended
    address-family ipv6 unicast
      send-community extended
    address-family ipv4 mvpn
      send-community extended
    address-family l2vpn evpn
      send-community extended
    import vpn unicast reoriginate

router bgp 1
  neighbor 30.30.30.30
    remote-as 100
    update-source loopback0
    ebgp-multihop 255
  address-family ipv4 unicast
    send-community extended
  address-family vpnv4 unicast
    send-community
    send-community extended
    next-hop-self
    import l2vpn evpn reoriginate
  address-family ipv4 mdt
    send-community extended
    no next-hop-third-party

```

Configuration on PE2:

```

install feature-set mpls
  allow feature-set mpls
feature-set mpls
feature bgp
feature pim
feature mpls l3vpn
feature mpls ldp
feature interface-vlan

ip pim rp-address 91.1.1.100 group-list 232.0.0.0/8
ip prefix-list LDP-LOOPBACK seq 2 permit 20.20.20.20/32
ip prefix-list LDP-LOOPBACK seq 3 permit 30.30.30.30/32
mpls ldp configuration
  advertise-labels for LDP-LOOPBACK
  label allocate label global prefix-list LDP-LOOPBACK

interface Ethernet 1/51
  ip pim sparse-mode
  mpls ip

interface Ethernet1/6.1

```

```
encapsulation dot1q 50
vrf member vpn1
ip pim sparse-mode
no shutdown

interface loopback0
ip address 30.30.30.30/32
ip pim sparse-mode

vrf context vpn1
ip pim rp-address 27.27.27.27 group-list 224.0.0.0/4
ip pim ssm range 232.0.0.0/8
ip multicast multipath s-g-hash next-hop-based
mdt default 232.1.1.1
mdt source loopback 0
rd auto
address-family ipv4 unicast
route-target both auto
route-target both auto mvpn
route-target both auto evpn

router bgp 100
router-id 30.30.30.30
address-family vpnv4 unicast
additional-paths send
additional-paths receive
no allocate-label option-b
neighbor 20.20.20.20
remote-as 1
update-source loopback0
address-family vpnv4 unicast
send-community
send-community extended
address-family ipv4 mdt
send-community extended
no next-hop-third-party
```