Sun Ethernet Fabric Operating System VXLAN Administration Guide

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Using This Documentation

- **Overview** – Provides information about the VXLAN feature and how to configure VXLAN
- **Audience** – Users implementing VXLAN protocol with other protocols in the router stack
- **Required knowledge** – Working knowledge of the protocol

Product Documentation Library

Documentation and resources for this product and related products are available at http://www.oracle.com/goto/es2-72_es2-64/docs.

Acronyms and Abbreviations

Terms	Explanation
BGP	Border Gateway Protocol
CLI	Command-line interface
IGMP	Internet Group Management Protocol
IP	Internet Protocol
NVE	Network virtualization edge
OSPF	Open Shortest Path First
PIM	Protocol Independent Multicast
SRC	Show running configuration
TOR	Top of rack
UDP	User Datagram Protocol
VM	Virtual machine (end devices in local LAN segment of VTEP)
VNI	VXLAN network identifier (or VXLAN segment ID)
VTEP	VXLAN tunnel end point
VXLAN	Virtual extensible local area network

CLI Command Modes

This table lists the various command modes used in this document with their access and exit methods.

Command Mode	Access Method	Prompt	Exit Method
User EXEC	Initial mode for starting a session.	`SEFOS>`	Use the `logout` command to return to the Oracle ILOM prompt.
Privileged EXEC	From User EXEC mode, use the `enable` command.	`SEFOS#`	Use the `disable` command to return to the User EXEC mode.
Global Configuration	From Privileged EXEC mode, use the `configure terminal` command.	`SEFOS(config)#`	Use the `exit` or `end` command to exit to the Privileged EXEC mode.
Interface Configuration	From Global Configuration mode, use the `interface-type` *interface-id* command.	`SEFOS(config-if)#`	Use the `exit` command to return to Global Configuration mode, or use the `end` command to return to Privileged EXEC mode.
VLAN Configuration	From Global Configuration mode, use the `vlan` *vlan-id* command.	`SEFOS(config-vlan)#`	Use the `exit` command to return to Global Configuration mode, or use the `end` command to return to Privileged EXEC mode.

Feedback

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VXLAN Overview

VXLAN Protocol Description

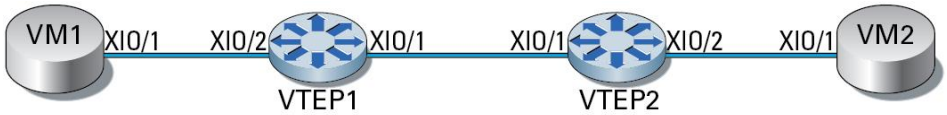
VXLAN is a Layer 2 overlay scheme over a Layer 3 network, and addresses the requirements of Layer 2 and Layer 3 data center network infrastructure in the presence of VMs in a multitenant environment.

VXLAN transports MAC frames generated by VMs in isolated Layer 2 networks over an IP network.

VXLAN enables Layer 2 communication of VMs across servers in a data center and across data centers. Across datacenters, VMs that are required to be in a separate domain are grouped as a VXLAN segment identified by unique VXLAN identifier (VNI). The overlay network is formed over Layer 3 network for communication between VMs in a segment.

VXLAN gateway functionality connects VXLAN-aware network devices to VXLAN-unaware network devices. For example, to connect natively VXLAN-aware servers with VMs to VXLAN-unaware servers with virtual machines (VMs) and targets, VXLAN gateway functionality is required.

Static and Ingress Replica Case Topology Example



VMs have the following MAC addresses:

- VM1 – `00:01:02:03:04:01`
- VM2 – `00:01:02:03:04:04`

VTEPs are connected back-to-back (directly) in this topology, which is used for VXLAN static and ingress replica functionality verification.

A route to the physical interface of the next VTEP need not be added in a VTEP, because the interfaces are directly connected in the same network.

Static Unicast

Static Unicast VXLAN configurations on VTEP1 and VTEP2

Ingress-Replica-Unknown Unicast

Ingress replica VXLAN configurations on VTEP1 and VTEP2

> **Note:** If the loopback IP of VTEP2 is used as remote VTEP-IP in VTEP1, then the route (static) to that loopback must be configured in VTEP1 for reachability.

Dynamic Case Topology

VMs have the following MAC addresses:

- VM1 – `00:01:02:03:04:01`
- VM2 – `00:04:02:03:04:01`

VTEPs are connected through an additional router in the middle. VTEP1 should have the route to VTEP2 and vice versa. The connection is achieved by performing the following steps:

1. Add static routes in VTEP1 and VTEP2.
    a. Add IP route to VTEP2 in VTEP1 through the Middle-R.
    b. Add IP route to VTEP1 in VTEP2 through the Middle-R.
2. Configure a routing protocol in the VTEPs. For example, iBGP, OSPF, or RIP.

In this document, iBGP routing protocol is used on all the routers to route packets between VTEP1 and VTEP2. This topology is used to verify the static and ingress replica functionality and dynamic VXLAN functionality.

1. Static (unicast) and ingress-replica (unknown-unicast)
    - Routing protocol iBGP on all the three routers
    - VXLAN configurations on VTEP1 and VTEP2
2. Dynamic multicast-based:
    - Routing protocol iBGP on all the three routers
    - VXLAN configurations on VTEP1 and VTEP2
    - IGMP on three routers for joining and leaving the multicast group
    - PIM protocol on middle router for forwarding the multicast packets

In real hardware boards, the ports can be extreme-ethernet (interface `Ex 0/1`) or XL-ethernet (interface `xl 0/1`) ports. Therefore, configurations must be changed according to the ports available in the board.

Configuring VXLAN

Enable VXLAN

VXLAN must be enabled for all the VXLAN-related configurations. See Static and Ingress Replica Case Topology Example for the topology for this configuration.

1. **To enable VXLAN, perform the following in `VTEP1`.**
   a. **Enter Global Configuration mode.**

      ```
      SEFOS# configure terminal
      ```

   b. **Enable VXLAN.**

      ```
      SEFOS(config)# set vxlan enable
      ```

      VXLAN is enabled in `VTEP1`.

   c. **Exit Global configuration mode.**

      ```
      SEFOS(config)# end
      ```

2. **View the status of VXLAN.**

   ```
   SEFOS# show running-config vxlan
    …
    set vxlan enable
    …
   ```

Configure a VXLAN UDP Port

The following configuration sets the UDP port number for VXLAN. By default, `4789` is set as the UDP port number. VXLAN must be configured in `VTEP1` before configuring UDP. See Static and Ingress Replica Case Topology Example for the topology for this configuration.

1. **To configure the UDP ports, perform the following in `VTEP1`.**
   a. **Enter Global Configuration mode.**

      ```
      SEFOS# configure terminal
      ```

   b. **Set the VXLAN UDP port number.**

      ```
      SEFOS(config)# vxlan udp-port 5566
      ```

      VXLAN UDP port number is set as 5566.

   c. **Exit Global Configuration mode.**

      ```
      SEFOS(config)# end
      ```

2. **View the VXLAN UDP port number.**

```
SEFOS# show vxlan udp-port
 Udp Port Number: 5566
```

Configure the VXLAN Trace Option

The following configuration sets the VXLAN debug trace option. VXLAN must be configured in `VTEP1` before configuring UDP. See Static and Ingress Replica Case Topology Example for the topology for this configuration.

1. **In `VTEP1`, set the debugging trace option for VXLAN.**

```
SEFOS# debug vxlan critical
```

   VXLAN has the following debug trace options:

   - `all`
   - `critical`
   - `entry-exit`
   - `failures`
   - `memory`
   - `mgmt`
   - `pkt`
   - `utilities`

2. **View the VXLAN debugging trace options.**

```
SEFOS# show running-config vxlan
 …
 debug vxlan critical
 …
```

Create a VXLAN Interface

1. **Enter Global Configuration mode in `VTEP1`.**

```
SEFOS# configure terminal
```

2. **Create an NVE interface.**

```
SEFOS(config)# interface nve 1
```

   A VXLAN interface is created.

3. **Exit Interface Configuration mode.**

```
SEFOS(config-if)# no shutdown
```

4. **Exit Global Configuration mode.**

```
SEFOS(config)# end
```

Configure a Source VTEP IP Address for VXLAN

This VXLAN configuration sets the IPv4 source VTEP IP addresses for VTEP. The IP address is used as a source IP in a VXLAN packet and is configured in the following two ways:

- Physical interface IP as source VTEP IP – For example: `source-interface vtep-ipv4 10.0.0.1`
- Loopback interface IP as source VTEP IP – For example: `source-interface loopback 0`

See Static and Ingress Replica Case Topology Example for the topology for this configuration.

1. **Type the following commands in `VTEP1`.**
   a. **Enter Global Configuration mode.**

   ```
   SEFOS# configure terminal
   ```

   b. **Create an NVE interface.**

   ```
   SEFOS(config)# interface nve 1
   ```

   A VXLAN interface is created.

   c. **Set the source VTEP IP address in one of the following ways:**

   - `SEFOS(config-if)# source-interface vtep-ipv4 10.0.0.1`
   - `SEFOS(config-if)# source-interface loopback 0`

   d. **Make the NVE interface UP.**

   ```
   SEFOS(config-if)# no shutdown
   ```

   e. **Exit Global Configuration mode.**

   ```
   SEFOS(config)# end
   ```

2. **View the VTEP source IP.**

   The physical interface IP is configured as source VTEP-IP:

   ```
   SEFOS# show vxlan nve interface nve 1
    NVE interface information
    -------------------------------------
    Interface: nve 1,  State:UP,  encapsulation:VXLAN
    source-interface:10.0.0.1
   ```

   The loopback interface IP is configured as source VTEP-IP:

   ```
   SEFOS# show vxlan nve interface nve 1
    NVE interface information
   ```

```
-------------------------------------------------------
Interface: nve 1,  State:UP,  encapsulation:VXLAN
source-interface:loopback 0
```

Note: The physical interface or the loopback IP must be configured before configuring the source VTEP-IP.

Configure VNI-VLAN Mapping

Create this VXLAN configuration to map VLAN to VXLAN, and to clear the packets sent, received, or dropped counters. See Static and Ingress Replica Case Topology Example for the topology for this configuration.

1. **Type the following commands.**

```
SEFOS# configure terminal
SEFOS(config)# switch default
SEFOS(config)# vlan 100
SEFOS(config)# ports Ex 0/2 un Ex 0/2
SEFOS(config)# end
```

2. **Type the following commands in `VTEP1`.**

   a. **Enter Global Configuration mode.**

   ```
   SEFOS# configure terminal
   ```

   b. **Enter VLAN mode.**

   ```
   SEFOS(config)# vlan 100
   ```

   c. **Configure the VNI-VLAN mapping.**

   ```
   SEFOS(config-if)# member vni 5000
   ```

   d. **Clear the statistics counters of VXLAN.**

   ```
   SEFOS(config-if)# member vni 5000 clear-counters
   ```

   e. **Make the NVE interface UP.**

   ```
   SEFOS(config-if)# no shutdown
   ```

   f. **Exit Interface and Global Configuration mode.**

   ```
   SEFOS(config-if)# end
   ```

3. **View the control plane statistics of packets sent, received, and dropped in VXLAN.**

```
SEFOS# show vxlan vni 5000 statistics
 VNI Statistics
 -------------------------------------------------------------
 VNI         VXLAN Pkt Sent Cnt  VXLAN Pkt Received Cnt  VXLAN Pkt
 Dropped Cnt
```

```
5000          0                    0                    0
```

Configure Remote VTEP

Configure the IPv4 remote VTEP IP addresses in VTEP. You can configure remote VTEP before multicast or ingress replica – VNI configuration. If this is not configured, remote VTEP is learned internally when the first VXLAN packet is received by `control plane`. See Static and Ingress Replica Case Topology Example for the topology for this configuration.

Note: You must configure the source VTEP before configuring the remote VTEP IP address.

Perform initial configurations in `VTEP1`.

1. **Enter Global Configuration mode.**

```
SEFOS# configure terminal
```

2. **Create an NVE interface.**

```
SEFOS(config)# interface nve 1
```

3. **Configure the NVE entry with the following values:**
   - VNI For example, `4096`
   - VTEP2-IP (loopback-IP or Interface-IP) as `remote-VTEP-`*IP*
   - MAC address of VM2 as `static-VM-MAC`

```
SEFOS(config-if)# member vni 4096 remote-vtep-ipv4 2.2.2.2
```

4. **Make the admin status of NVE interface UP.**

```
SEFOS(config-if)# no shutdown
SEFOS(config-if)# end
```

Configure Unicast VXLAN

Configure the remote VTEP IP address along with the VM MAC address in VTEP.

Note: You must configure the source VTEP before configuring the Remote VTEP IP address.

1. **Enter Global Configuration mode.**

```
SEFOS# configure terminal
```

2. **Create an NVE interface.**

```
SEFOS(config)# interface nve 1
```

3. **Configure NVE entry with the following values:**
   - VNI — For example: `4096`
   - VTEP2-IP (loopback-IP or Interface-IP) as remote-VTEP-IP

- MAC address of VM2 as static-VM-MAC

```
SEFOS(config-if)# member vni 4096 static-vm-mac 00:01:02:03:04:01
remote-vtep-ipv4 2.2.2.2
```

4. **Make the admin status of NVE interface UP.**

```
SEFOS(config-if)# no shutdown

SEFOS(config-if)# end
```

5. **View the VXLAN peers configured in VTEP1 using the following command.**

```
SEFOS# show vxlan nve peers
 VTEP Peers information
 ------------------------------------------------------------------
 Interface Peer-IP         VNI       VM-MAC               MAC-Type
 nve 1     2.2.2.2         4096      00:01:02:03:04:01    Static
```

Configure Ingress Replica (CLI)

Configure the replication VTEP IP addresses in VTEP. See Static and Ingress Replica Case Topology Example for the topology for this configuration.

Note: You must configure the source VTEP before configuring the ingress replica remote VTEP IP.

1. **Enter Global Configuration mode.**

```
SEFOS# configure terminal
```

2. **Create an NVE interface.**

```
SEFOS(config)# interface nve 1
```

3. **Configure NVE entry with the following values:**

- VNI — For example: `4096`
- VTEP2-IP (loopback-IP or Interface-IP) as `remote-VTEP-IP` in ingress replica

```
SEFOS(config-if)# member vni 4096 ingress-replication ipv4 2.2.2.2
3.3.3.3
```

Note: For dynamic remote VTEP learning, the following remote VTEP configuration is not required.

```
SEFOS(config-if)# member vni 4096 remote-vtep-ipv4 2.2.2.2.
```

4. **Make the admin status of NVE interface UP.**

```
SEFOS(config-if)# no shutdown

SEFOS(config-if)# end
```

5. **View the ingress replica VXLAN peers configured in VTEP1.**

```
SEFOS# sh vxlan nve interfaces nve 1 detail
```

```
NVE interface information
---------------------------------------------------------------------
Interface: nve 1,  State:UP,  encapsulation:VXLAN
source-interface:loopback 0
VNI            Ingress-Replica-VTEP-List
-----------------------------------------
4096           2.2.2.2, 3.3.3.3
```

Configure VXLAN Multicast (CLI)

Configure the multicast group IP Address in VTEP. See Dynamic Case Topology for the topology of this configuration.

Note: You must configure the source VTEP before configuring the multicast group IP.

1. **Enter Global Configuration mode.**

   ```
   SEFOS# configure terminal
   ```

2. **Create an NVE interface.**

   ```
   SEFOS(config)# interface nve 1
   ```

3. **Configure multicast entry with the following values:**

   - VNI —For example: `4096`
   - Multicast group IP to be joined — For example: `224.0.11.11`

   ```
   SEFOS(config-if)# member vni 4096 multicast-group-ipv4 224.0.11.11
   ```

   Note: For dynamic remote VTEP learning, the following remote VTEP configuration is not required.

   ```
   SEFOS(config-if)# member vni 4096 remote-vtep-ipv4 2.2.2.2
   ```

4. **Make the admin status of the NVE interface UP.**

   ```
   SEFOS(config-if)# no shutdown
   SEFOS(config-if)# end
   ```

5. **View the VXLAN multicast group configured in VTEP1.**

   ```
   SEFOS# show vxlan nve interfaces nve 1 detail
    NVE interface information
    ---------------------------------------------------------------------
    Interface: nve e1,  State:DOWN,  encapsulation:VXLAN
    source-interface:1.1.1.1
    VNI       Mcast          VNI-State
    4096      224.0.11.11      DOWN
   ```

Configure VXLAN for Static and Ingress Replica Case Topology

1. **Perform initial configurations on `VTEP1`.**
   a. **Configure `loopback 0` with an IP address.**

      For example: 1.1.1.1
   b. **Configure `VLAN-1000` and make it active.**

      This action connects to the other VTEP.
   c. **Configure the extreme-ethernet interface.**

      For example: `Ex 0/1` as a member port of `VLAN-1000.`
   d. **Configure the IP address to `VLAN-1000.`**

      For example: IP - `15.0.0.1` mask - `255.255.255.0`
   e. **Configure `VLAN-1000` and make it active.**

      This action connects to the host or VM.
   f. **Configure the extreme-ethernet interface.**

      For example: `extreme-ethernet 0/2` as a member port of `VLAN-100.`
   g. **Add a static route to the remote-VTEP (for example: `2.2.2.2`).**
2. **Perform initial configurations on `VTEP2`.**
   a. **Configure `loopback 0` with an IP address.**

      For example: 1.1.1.1
   b. **Configure `VLAN-1000` and make it active.**

      This action connects to the other VTEP.
   c. **Configure the extreme-ethernet interface.**

      For example: E`x 0/1` as a member port of `VLAN-1000`.
   d. **Configure the IP address to `VLAN-1000.`**

      For example: IP - `15.0.0.2` mask - `255.255.255.0`
   e. **Configure `VLAN-100` and make it active.**

      This action connects to the host or VM.
   f. **Configure the extreme-ethernet interface.**

      For example: `Ex 0/2` as a member port of `VLAN-100`
   g. **Add a static route to the remote-VTEP (for example: `1.1.1.1`).**
3. **Perform VXLAN configurations for static and ingress replica in `VTEP1`.**
   a. **Enter Global Configuration mode.**

      `SEFOS# configure terminal`

b. **Enable the VXLAN feature.**

```
SEFOS(config)# set vxlan enable
```

c. **Create an NVE interface.**

```
SEFOS(config)# interface nve 1
```

d. **Configure the source-VTEP IP.**

For example, with `loopback 0`

```
SEFOS(config-if)# source-interface loopback 0
```

e. **Make the admin status of NVE interface UP.**

```
SEFOS(config-if)# no shutdown
SEFOS(config-if)# end
```

f. **Make the NVE interface a member port of `VLAN-100` by configuring VLAN-VNI mapping.**

```
SEFOS# configure terminal
SEFOS# vlan 100
SEFOS(config-if)# member vni 4096
SEFOS(config-if)# end
```

4. **Perform VXLAN configurations for static and ingress replica in `VTEP2`.**

a. **Enter Global Configuration mode.**

```
SEFOS# configure terminal
```

b. **Enable the VXLAN feature.**

```
SEFOS(config)# set vxlan enable
```

c. **Create an NVE interface.**

```
SEFOS(config)# interface nve 1
```

d. **Configure the source-VTEP IP.**

For example, with `loopback 0.`

```
SEFOS(config-if)# source-interface loopback 0
```

e. **Make the admin status of NVE interface UP.**

```
SEFOS(config-if)# no shutdown
SEFOS(config-if)# end
```

f. **Make the NVE interface a member port of `VLAN-100` by configuring VLAN-VNI mapping.**

```
SEFOS# configure terminal
SEFOS# vlan 100
SEFOS(config-if)# member vni 4096
SEFOS(config-if)# end
```

5. **Perform static VXLAN configuration in `VTEP1`.**

   a. **Enter Global Configuration mode.**

   ```
   SEFOS# configure terminal
   ```

   b. **Create an NVE interface.**

   ```
   SEFOS(config)# interface nve 1
   ```

   c. **Configure NVE entry with the following values:**

   - VNI — For example: `4096`
   - VTEP2-IP (loopback-IP or Interface-IP) as remote-VTEP-IP
   - MAC address of VM2 as static-VM-MAC

   ```
   SEFOS(config-if)# member vni 4096 static-vm-mac 00:01:02:03:04:04
   remote-vtep-ipv4 2.2.2.2
   ```

   d. **Exit global configuration mode.**

   ```
   SEFOS(config-if)# end
   ```

6. **Perform static VXLAN configuration in `VTEP2`.**

   a. **Enter Global Configuration mode.**

   ```
   SEFOS# configure terminal
   ```

   b. **Create an NVE interface.**

   ```
   SEFOS(config)# interface nve 1
   ```

   c. **Configure the NVE entry with the following values:**

   - VNI — For example: `4096`
   - VTEP1-IP (loopback-IP or Interface-IP) as remote-VTEP-IP
   - MAC address of VM1 as static-VM-MAC

   ```
   SEFOS(config-if)# member vni 4096 static-vm-mac 00:04:02:03:04:01
   remote-vtep-ipv4 1.1.1.1
   ```

   d. **Exit Global Configuration mode.**

   ```
   SEFOS(config-if)# end
   ```

7. **Perform ingress replica VXLAN configuration in `VTEP1`.**

   a. **Enter Global Configuration mode.**

   ```
   SEFOS# configure terminal
   ```

   b. **Create an NVE interface.**

   ```
   SEFOS(config)# interface nve 1
   ```

   c. **Configure the NVE entry with the following values:**

   - VNI — For example: `4096`
   - VTEP2-IP(loopback-IP or Interface-IP) as remote-VTEP-IP in ingress replica

   Note: For dynamic remote VTEP learning, the following remote VTEP configuration is not required.

   ```
   SEFOS(config-if)# member vni 4096 remote-vtep-ipv4 2.2.2.2.
   ```

d. **Exit Global Configuration mode.**

```
SEFOS(config-if)# end
```

8. **Perform ingress replica VXLAN configuration in `VTEP2`.**

   a. **Enter Global Configuration mode.**

   ```
   SEFOS# configure terminal
   ```

   b. **Create an NVE interface.**

   ```
   SEFOS(config)# interface nve 1
   ```

   c. **Configure the NVE entry with the following values:**

   - VNI — For example: `4096`
   - VTEP2-IP(loopback-IP or Interface-IP) as remote-VTEP-IP in ingress replica

   ```
   SEFOS(config-if)# member vni 4096 ingress-replication ipv4 1.1.1.1
   ```

   Note: For dynamic remote VTEP learning, the following remote VTEP configuration is not required:

   ```
   SEFOS(config-if)# member vni 4096 remote-vtep-ipv4 1.1.1.1
   ```

   d. **Exit Global Configuration mode.**

   ```
   SEFOS(config-if)# end
   ```

Configure VXLAN Dynamic Case Topology

1. **Perform initial configurations on `VTEP1`.**

   a. **Configure `loopback 0` with an IP address.**

   For example: 1.1.1.1

   b. **Configure `VLAN-1000` and make it active.**

   This action connects to the other VTEP.

   c. **Configure the extreme-ethernet interface.**

   For example: `Ex 0/1` as a member port of `VLAN-1000`

   d. **Configure IP address to VLAN-1000.**

   For example: IP - `15.0.0.1` mask - `255.255.255.0`

   e. **Configure `VLAN-1000` and make it active.**

   This action connects to the host or VM.

   f. **Configure the extreme-ethernet interface.**

   For example: `Ex 0/2` as a member port of `VLAN-100`

   g. **Add a static route to the remote-VTEP (for example: `2.2.2.2`).**

2. **Perform initial configurations on `VTEP2`.**

   a. **Configure `loopback 0` with an IP address.**

For example: `2.2.2.2`

b. **Configure `VLAN-2000` and make it active.**

This action connects to the other VTEP.

c. **Configure the extreme-ethernet interface.**

For example: `Ex 0/1` as a member port of `VLAN-2000`

d. **Configure IP address to `VLAN-2000`.**

For example: IP - `16.0.0.1` mask - `255.255.255.0`

e. **Configure `VLAN-100` and make it active.**

This action connects to the host or VM.

f. **Configure the extreme-ethernet interface.**

For example: `Ex 0/2` as a member port of `VLAN-100`

3. **Perform middle router configurations.**

a. **Configure `VLAN-1000` and make it active.**

This action connects to `VTEP1`.

b. **Configure the extreme-ethernet interface.**

For example: `Ex 0/1` as a member port of `VLAN-1000`

c. **Configure IP address to `VLAN-1000`.**

For example: IP - `15.0.0.2` mask - `255.255.255.0`

d. **Configure `VLAN-2000` and make it active.**

This action connects to the host or VM.

e. **Configure the extreme-ethernet interface.**

For example: `Ex 0/2` as a member port of `VLAN-2000`

f. **Configure IP address to `VLAN-2000`.**

For example: IP - `16.0.0.2` mask - `255.255.255.0`

BGP Configuration

1. **Perform BGP configurations on `VTEP1`.**

You need to configure a routing protocol in the three routers to learn the routes between VTEPs. In this document, iBGP routing protocol with AS number `100` is used on all the routers to route packets between `VTEP1` and `VTEP2`.

a. **Configure BGP AS number.**

For example: `100`

b. **Configure the middle router as the BGP neighbor.**

2. **Perform BGP configurations on `VTEP2`.**

a. **Configure the BGP AS number.**

For example: `100`

b. **Configure the middle router as the BGP neighbor.**

3. **Perform middle router configurations.**

a. **Configure the BGP AS number.**

For example: `100`

b. **Configure the two VTEPs as BGP neighbors.**

IGMP and PIM Configuration

Enable the IGMP protocol globally in VTEP routers and on interfaces connected to the PIM router, which is responsible for routing the multicast packets to destination VTEP. Through this interface, VTEPs joins the particular multicast group.

Configure the PIM multicast protocol in core routers. For example, in this case the middle router. Enable PIM globally and on interfaces through which VTEPs join the IGMP multicast group. You can configure PIM in three modes, sparse mode, dense mode, and bi-directional mode.

VXLAN is tested with sparse mode on boards and mentioned as PIM sparse mode configurations in this document.

1. **Perform IGMP configurations on `VTEP1`.**

a. **Enable IGMP globally.**

b. **Enable IGMP on the interface that is connected to the middle router (PIM - enabled router).**

2. **Perform IGMP configurations on `VTEP2`.**

a. **Enable IGMP globally.**

b. **Enable IGMP on the interface that is connected to the middle router (PIM - enabled router).**

3. **Perform IGMP configurations on the middle router.**

a. **Enable IGMP globally.**

b. **Enable IGMP on interfaces through which VTEPs join the IGMP group.**

4. **Perform PIM configurations.**

a. **Enable PIM globally and configure the PIM component.**

b. **Enable PIM and configure PIM component on interfaces through which VTEPs join the IGMP group.**

c. **Configure PIM sparse mode.**

d. **Configure multicast group IDs range and `rp-candidate`.**

For example: `rp-candidate rp-address 224.0.11.11 255.255.255.255 15.0.0.2`

e. **Configure the `rp-candidate` hold time.**

For example: 200

VXLAN Configurations

For configuration steps, see Step 3 and Step 4 in Configure VXLAN for Static and Ingress Replica Case Topology.

Static VXLAN Configuration

For configuration steps, see Step 1, Step 2, Step 3, Step 4, Step 7, and Step 8 in Configure VXLAN for Static and Ingress Replica Case Topology.

Ingress Replica VXLAN Configuration

For configuration steps, see Step 1, Step 2, Step 3, Step 4, Step 7, and Step 8 in Configure VXLAN for Static and Ingress Replica Case Topology.

Multicast VXLAN Configuration

See Configure VXLAN for Static and Ingress Replica Case Topology.

1. **Perform multicast VXLAN configuration in `VTEP1`.**
   a. **Enter Global Configuration mode.**

      ```
      SEFOS# configure terminal
      ```

   b. **Create an NVE interface.**

      ```
      SEFOS(config)# interface nve 1
      ```

   c. **Configure the multicast entry with the following values:**
      - VNI —For example: `4096`
      - Multicast group IP to be joined —For example: `224.0.11.11`

      ```
      SEFOS(config-if)# member vni 4096 multicast-group-ipv4 224.0.11.11
      ```

      Note: For dynamic remote VTEP learning, the following remote VTEP configuration is not required.

      ```
      SEFOS(config-if)# member vni 4096 remote-vtep-ipv4 2.2.2.2
      ```

   d. **Exit Global Configuration mode.**

      ```
      SEFOS(config-if)# end
      ```

2. **Perform multicast VXLAN configuration in `VTEP2`.**
   a. **Enter Global Configuration mode.**

      ```
      SEFOS# configure terminal
      ```

   b. **Create an NVE interface.**

      ```
      SEFOS(config)# interface nve 1
      ```

   c. **Configure the multicast entry with the following values:**
      - VNI — for example: `4096`

- Multicast group IP to be joined — for example: 224.0.11.11

```
SEFOS(config-if)# member vni 4096 multicast-group-ipv4 224.0.11.11
```

Note: For dynamic remote VTEP learning, the following remote VTEP configuration is not required:

```
SEFOS(config-if)# member vni 4096 remote-vtep-ipv4 1.1.1.1
```

d. Exit Global Configuration mode.

```
SEFOS(config-if)# end
```

Configure Static Unicast-Based VXLAN (Script)

1. Configure static VXLAN on `VTEP1`.

```
configure terminal
set gvrp disable
set gmrp disable
interface vlan 1
sh
no ip addr
end

configure terminal
vlan 1
no ports
end

configure terminal
interface loopback 0
ip address 1.1.1.1  255.255.255.255
no shu
end

configure terminal
vlan 1000
ports Ex 0/1 untagged Ex 0/1
```

```
vlan active
end

configure terminal
interface Ex 0/1
sh
switchport pvid 1000
no sh
end

configure terminal
interface vlan 1000
ip addr 15.0.0.1 255.255.255.0
no sh
end

configure terminal
vlan 100
port add Ex 0/2 un Ex 0/2
exit
interface Ex 0/2
switchport pvid 100
no shu
exit

configure terminal
ip route 1.1.1.1 255.255.255.255 15.0.0.2
end

configure terminal
set vxlan enable
end

configure terminal
```

```
interface nve 1
source-interface loopback 0
no sh
end

configure terminal
interface nve 1
member vni 4096 static-vm-mac 00:04:02:03:04:01 remote-vtep-ipv4
2.2.2.2
end

configure terminal
vlan 100
mem vni 4096
end
```

2. **Configure static VXLAN on VTEP2.**

```
configure terminal
set gvrp disable
set gmrp disable
interface vlan 1
sh
no ip addr
end
configure terminal
vlan 1
no ports
end

configure terminal
interface loopback 0
ip address 2.2.2.2  255.255.255.255
no shu
end
```

```
configure terminal
vlan 1000
ports Ex 0/1 untagged Ex 0/1
vlan active
end

configure terminal
interface Ex 0/1
sh
switchport pvid 1000
no sh
end

configure terminal
interface vlan 1000
ip addr 15.0.0.2 255.255.255.0
no sh
end

configure terminal
vlan 100
port add Ex 0/2 un Ex 0/2
exit
interface Ex 0/2
switchport pvid 100
no shu
exit

configure terminal
ip route 2.2.2.2 255.255.255.255 15.0.0.1
end

configure terminal
```

```
set vxlan enable
end

configure terminal
interface nve 1
source-interface loopback 0
no sh
end

configure terminal
interface nve 1
member vni 4096 static-vm-mac 00:01:02:03:04:01 remote-vtep-ipv4
1.1.1.1
end

configure terminal
vlan 100
mem vni 4096
end
```

Configure Dynamic Multicast-Based VXLAN (Script)

1. **Configure dynamic VXLAN on `VTEP1`.**

```
configure terminal
set gvrp disable
set gmrp disable
set ip igmp enable
interface vlan 1
sh
no ip addr
end
```

```
configure terminal
vlan 1
no ports
end

configure terminal
interface loopback 0
ip address 1.1.1.1  255.255.255.255
no shu
end

configure terminal
vlan 1000
ports Ex 0/1 untagged Ex 0/1
vlan active
end

configure terminal
interface Ex 0/1
sh
switchport pvid 1000
no sh
end

configure terminal
interface vlan 1000
set ip igmp enable
ip addr 15.0.0.1 255.255.255.0
no sh
end

configure terminal
vlan 100
port add Ex 0/2 un Ex 0/2
```

```
exit
interface Ex 0/2
switchport pvid 100
no shu
exit

configure terminal
router bgp 100
redistribute connected
neighbor 15.0.0.2 remote-as 100
neighbor 15.0.0.2 update-source 15.0.0.1
end

configure terminal
set vxlan enable
end

configure terminal
interface nve 1
source-interface loopback 0
no sh
end

configure terminal
interface nve 1
member vni 4096 multicast-group-ipv4 224.0.11.11
end

configure terminal
vlan 100
mem vni 4096
end
```

2. **Configure dynamic VXLAN on `VTEP2`.**

```
configure terminal
```

```
set gvrp disable
set gmrp disable
set ip igmp enable
interface vlan 1
sh
no ip addr
end
configure terminal
vlan 1
no ports
end

configure terminal
interface loopback 0
ip address 2.2.2.2  255.255.255.255
no shu
end

configure terminal
vlan 2000
ports Ex 0/1 untagged Ex 0/1
vlan active
end

configure terminal
interface Ex 0/1
sh
switchport pvid 2000
no sh
end

configure terminal
interface vlan 2000
set ip igmp enable
```

```
ip addr 16.0.0.1 255.255.255.0
no sh
end

configure terminal
vlan 100
port add Ex 0/2 un Ex 0/2
exit
interface Ex 0/2
switchport pvid 100
no shu
exit

configure terminal
router bgp 100
redistribute connected
neighbor 16.0.0.2 remote-as 100
neighbor 16.0.0.2 update-source 16.0.0.1
end

configure terminal
set vxlan enable
end

configure terminal
interface nve 1
source-interface loopback 0
no sh
end

configure terminal
interface nve 1
member vni 4096 multicast-group-ipv4 224.0.11.11
end
```

```
configure terminal
vlan 100
mem vni 4096
end
```

Configure the Middle Router (Script)

- **Configure the middle router.**

```
configure terminal
set gvrp disable
set gmrp disable
set ip igmp enable
sh span
interface vlan 1
sh
no ip addr
end

configure terminal
vlan 1
no ports
end

configure terminal
set ip pim enable
ip pim component 1
rp-candidate holdtime 90
end

configure terminal
vlan 1000
ports Ex 0/1 untagged Ex 0/1
```

```
vlan active
exit
vlan 2000
ports Ex 0/2 untagged Ex 0/2
vlan active
exit
end

configure terminal
interface Ex 0/1
sh
speed 10000
switchport accep untagg
switchport mode access
switchport pvid 1000
no sh
end

configure terminal
interface Ex 0/2
sh
speed 10000
switchport accep untagg
switchport mode access
switchport pvid 2000
no sh
end

configure terminal
interface vlan 2000
set ip igmp enable
ip addr 16..0.0.2 255.255.255.0
no sh
ip pim component 1
```

```
exit
interface vlan 1000
set ip igmp enable
ip addr 15.0.0.2 255.255.255.0
no sh
ip pim component 1
ip pim bsr-candidate 40
exit
interface loopback 0
ip addr 1.1.200.200 255.255.255.255
no sh
end

configure terminal
ip pim component 1
set mode sparse
rp-candidate rp-address 224.0.11.11 255.255.255.255 15.0.0.2
rp-candidate holdtim 200
end

configure terminal
router bgp 100
redistribute connected
neighbor 16.0.0.1 remote-as 100
neighbor 16.0.0.1 update-source 16.0.0.2
neighbor 15.0.0.1 remote-as 100
neighbor 15.0.0.1 update-source 15.0.0.2
end
```

Configure Ingress Replication (Script)

1. **Configure ingress replication on `VTEP1`.**

```
configure terminal
```

```
set gvrp disable
set gmrp disableinterface vlan 1
sh
no ip addr
end
configure terminal
vlan 1
no ports
end

configure terminal
interface loopback 0
ip address 1.1.1.1  255.255.255.255
no shu
end

configure terminal
vlan 1000
ports Ex 0/1 untagged Ex 0/1
vlan active
end

configure terminal
interface Ex 0/1
sh
switchport pvid 1000
no sh
end

configure terminal
interface vlan 1000ip addr 15.0.0.1 255.255.255.0
no sh
end
```

```
configure terminal
vlan 100
port add Ex 0/2 un Ex 0/2
exit
interface Ex 0/2
switchport pvid 100
no shu
exit

configure terminal
ip route 1.1.1.1 255.255.255.255 15.0.0.2
end

configure terminal
set vxlan enable
end

configure terminal
interface nve 1
source-interface loopback 0
no sh
end

configure terminal
interface nve 1
member vni 4096 ingress-replication ipv4 2.2.2.2
end

configure terminal
vlan 100
mem vni 4096
end
```

2. **Configure ingress replication on `VTEP2`.**

```
configure terminal
```

```
set gvrp disable
set gmrp disableinterface vlan 1
sh
no ip addr
end
configure terminal
vlan 1
no ports
end

configure terminal
interface loopback 0
ip address 2.2.2.2  255.255.255.255
no shu
end

configure terminal
vlan 1000
ports Ex 0/1 untagged Ex 0/1
vlan active
end

configure terminal
interface Ex 0/1
sh
switchport pvid 1000
no sh
end

configure terminal
interface vlan 1000ip addr 15.0.0.2 255.255.255.0
no sh
end
```

```
configure terminal
vlan 100
port add Ex 0/2 un Ex 0/2
exit
interface Ex 0/2
switchport pvid 100
no shu
exit

configure terminal
ip route 2.2.2.2 255.255.255.255 15.0.0.1
end

configure terminal
set vxlan enable
end

configure terminal
interface nve 1
source-interface loopback 0
no sh
end

configure terminal
interface nve 1
member vni 4096 ingress-replication ipv4 1.1.1.1
end

configure terminal
vlan 100
mem vni 4096
end
```