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Junos® OS

OVSDB and VXLAN User Guide for MX Series Routers and EX9200 Switches

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The information in this document is current as of the date on the title page.

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

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About This Guide

The Open vSwitch Database (OVSDB) management protocol provides a control plane through which MX Series routers and EX9200 switches in the physical underlay can exchange control and statistical information with VMware NSX controllers in the virtual overlay. Virtual Extensible LAN (VXLAN) provides a data plane through which Layer 2 data packets can be tunneled over a Layer 3 transport network. Use this guide to learn how OVSDB-VXLAN is implemented on MX Series routers and EX9200 switches and to configure, monitor, and troubleshoot OVSDB-VXLAN on these Juniper Networks devices.

You can also use this guide to learn about and configure manual VXLAN, which enables you to manually create VXLANs on MX Series routers instead of using a controller. If you use this approach, you must also configure Protocol Independent Multicast (PIM), which enables two MX Series routers to create VXLAN tunnels between themselves.

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PART

OVSDB and VXLAN

CHAPTER 1

Understanding OVSDB

IN THIS CHAPTER

OVSDB Support on Juniper Networks Devices

The following Juniper Networks devices support the *Open vSwitch Database (OVSDB)* management protocol:

- EX9200 Line of Ethernet Switches
- MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020 Universal Routing Platforms
- QFX Series Switches

Starting with Junos OS Release 14.1X53-D30 for QFX5100 switches, 15.1X53-D20 for QFX10002 switches, 15.1X53-D30 for QFX10008 switches, 15.1X53-D60 for QFX10016 switches, 15.1X53-D210 for QFX5110 and QFX5200 switches, 16.1R1 for EX9200 switches and MX routers, and 18.1R1 for QFX5210 switches, the OVSDB software (jsdn) package is included in the Junos OS software (jinstall) package. As a result, if you have one of the listed releases or a later release, you no longer need to Install the separate jsdn package on the Juniper Networks devices.

Change History Table

Feature support is determined by the platform and release you are using. Use Feature Explorer to determine if a feature is supported on your platform.

Release	Description
14.1X53-D30	Starting with Junos OS Release 14.1X53-D30 for QFX5100 switches, 15.1X53-D20 for QFX10002 switches, 15.1X53-D30 for QFX10008 switches, 15.1X53-D60 for QFX10016 switches, 15.1X53-D210 for QFX5110 and QFX5200 switches, 16.1R1 for EX9200 switches and MX routers, and 18.1R1 for QFX5210 switches, the OVSDB software (jsdn) package is included in the Junos OS software (jinstall) package. As a result, if you have one of the listed releases or a later release, you no longer need to Install the separate jsdn package on the Juniper Networks devices.

Understanding the Junos OS Implementation of OVSDB and VXLAN in a VMware NSX for vSphere Environment

Some Juniper Networks devices support Virtual Extensible LAN (VXLAN) and the Open vSwitch Database (OVSDB) management protocol. (See "OVSDB Support on Juniper Networks Devices" on page 2.) Support for VXLAN and OVSDB enables the Juniper Networks devices in a physical network to be integrated into a virtual network.

The implementation of VXLAN and OVSDB on Juniper Networks devices is supported in a VMware NSX for NSX for vSphere environment for the data center. Table 1 on page 3 outlines the components that compose this environment and products that are typically deployed for each component.

Table 1: NSX for vSphere Components and Related Products

Component	Products
Cloud management platform (CMP)	CloudStack OpenStack Custom CMP
Network virtualization platform	NSX for vSphere

Table 1: NSX for vSphere Components and Related Products *(Continued)*

Component	Products
Hypervisor	Kernel-based Virtual Machine (KVM) Red Hat VMware ESXi Xen **NOTE**: Juniper Networks supports only KVM and ESXi.
Virtual switch	Open vSwitch (OVS) NSX vSwitch
SDN controller	NSX for vSphere controller
Overlay protocol	VXLAN
Media access control (MAC) learning protocol	OVSDB

Figure 1 on page 4 shows a high-level view of the NSX for vSphere platform architecture, while Figure 2 on page 5 provides a more detailed representation of the components in the virtual and physical networks.

Figure 1: High-Level View of NSX for vSphere Architecture

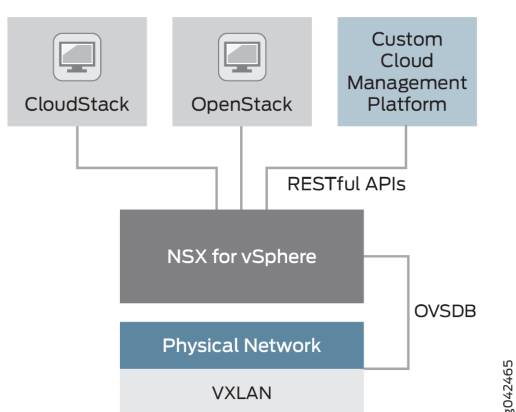
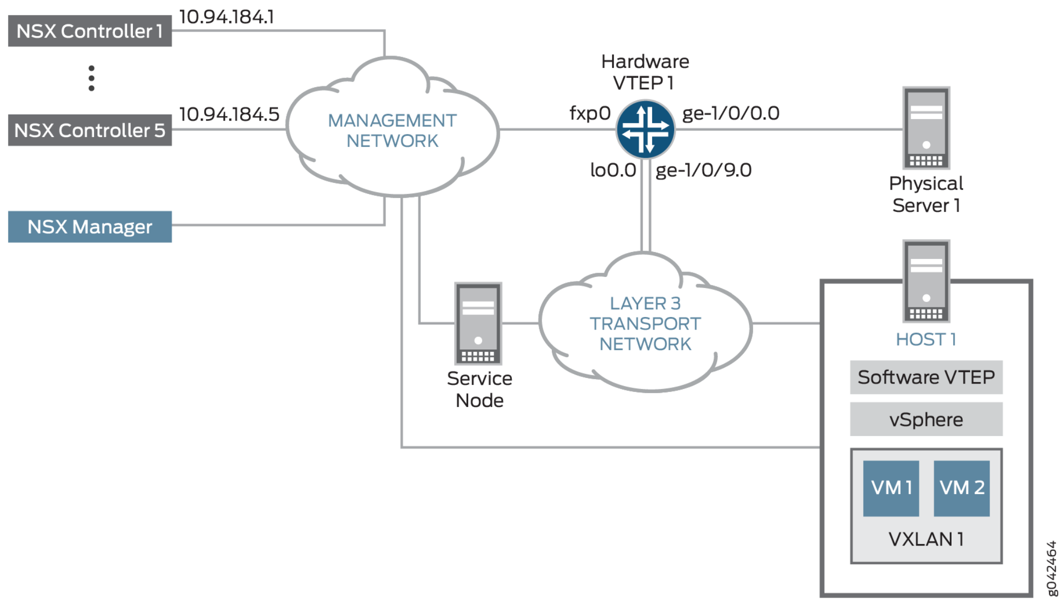


Figure 2: Integration of Juniper Networks Device into NSX for vSphere Environment



In the data center topology shown in Figure 2 on page 5, the physical and virtual servers need to communicate. To facilitate this communication, a Juniper Networks device that supports VXLAN is strategically deployed so that it serves as a *gateway*, which is also known as a hardware *virtual tunnel endpoint (VTEP)*, at the edge of the physical network. Working in conjunction with the software VTEP, which is deployed at the edge of the virtual network, the hardware VTEP encapsulates packets from resources on Physical Server 1 with a VXLAN header, and after the packets traverse the Layer 3 transport network, the software VTEP removes the VXLAN header from the packets and forwards the packets to the appropriate virtual machines (VMs). In essence, the encapsulation and de-encapsulation of packets by the hardware and software VTEPs enable the components in the physical and virtual networks to coexist without one needing to understand the workings of the other.

The same Juniper Networks device that acts as a hardware VTEP in Figure 2 on page 5 implements OVSDB, which enables this device to learn the MAC addresses of Physical Server 1 and other physical servers, and publish the addresses in the OVSDB schema, which was defined for physical devices. In the virtual network, one or more NSX controllers collect the MAC addresses of Host 1 and other virtual servers, and publish the addresses in the OVSDB schema. Using the OVSDB schema, components in the physical and virtual networks can exchange MAC addresses, as well as statistical information, enabling the components to learn about and reach each other in their respective networks.

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OVSDB Schema for Physical Devices | 12

Understanding the OVSDB Protocol Running on Juniper Networks Devices

The Juniper Networks Junos OS implementation of the Open vSwitch Database (OVSDB) management protocol provides a means through which Juniper Networks devices that support OVSDB can communicate with software-defined networking (SDN) controllers. Juniper Networks devices exchange control and statistical information with the SDN controllers, thereby enabling *virtual machine (VM)* traffic from the entities in a virtualized network to be forwarded to entities in a physical network and vice versa.

The Junos OS implementation of OVSDB includes an OVSDB server and an OVSDB client, both of which run on each Juniper Networks device that supports OVSDB.

The OVSDB server on a Juniper Networks device can communicate with an OVSDB client on an SDN controller. To establish a connection between a Juniper Networks device and an SDN controller, you must specify information about the SDN controller (IP address) and the connection (port over which the connection occurs and the communication protocol to be used) on each Juniper Networks device. After the configuration is successfully committed, the connection is established between the management port of the Juniper Networks device and the SDN controller port that you specify in the Junos OS configuration.

The OVSDB server stores and maintains an OVSDB database schema, which is defined for physical devices. This schema contains control and statistical information provided by the OVSDB client on the Juniper Networks devices and on SDN controllers. This information is stored in various tables in the schema. The OVSDB client monitors the schema for additions, deletions, and modifications to this information, and the information is used for various purposes, such as learning the media access control (MAC) addresses of virtual hosts and physical servers.

The schema provides a means through which the Juniper Networks devices and the SDN controllers can exchange information. For example, the Juniper Networks devices capture MAC routes to entities in the physical network and push this information to a table in the schema so that SDN controllers with connections to these Juniper Networks devices can access the MAC routes. Conversely, SDN controllers capture MAC routes to entities in the virtualized network and push this information to a table in the schema so that Juniper Networks devices with connections to the SDN controllers can access the MAC routes.

Some of the OVSDB table names include the words *local* or *remote*, for example, *unicast MACs local table* and *unicast MACs remote table*. Information in *local* tables is learned by a Juniper Networks device that functions as a hardware *virtual tunnel endpoint (VTEP)*, while information in *remote* tables is learned from other software or hardware VTEPs.

Understanding How to Set Up OVSDB Connections on a Juniper Networks Device

The Juniper Networks Junos OS implementation of the Open vSwitch Database (OVSDB) management protocol provides a means through which Juniper Networks devices that support OVSDB can communicate with software-defined networking (SDN) controllers. A Juniper Networks device exchanges control and statistical data with each SDN controller to which it is connected.

You can connect a Juniper Networks device to more than one SDN controller for redundancy.

In a VMware NSX environment, one cluster of NSX controllers typically includes three or five controllers. To implement the OVSDB management protocol on a Juniper Networks device, you must explicitly configure a connection to one SDN controller, using the Junos OS CLI. If the SDN controller to which you explicitly configure a connection is in a cluster, the controller pushes information about other controllers in the same cluster to the device, and the device establishes connections with the other controllers. However, you can also explicitly configure connections with the other controllers in the cluster, using the Junos OS CLI.

To implement the OVSDB management protocol on a Juniper Networks device in a Contrail environment, you must configure a connection to a Contrail controller, using the Junos OS CLI.

Connections to all SDN controllers are made on the management interface of the Juniper Networks device. To set up a connection between a Juniper Networks device and an SDN controller, you need to configure the following parameters on the Juniper Networks device:

- IP address of the SDN controller.
- The protocol that secures the connection. *Secure Sockets Layer (SSL)* is the supported protocol.

> **NOTE**: The SSL connection requires a private key and certificates, which must be stored in the **/var/db/certs** directory of the Juniper Networks device. See "Creating and Installing an SSL Key and Certificate on a Juniper Networks Device for Connection with SDN Controllers" on page 22.

- Number of the port over which the connection is made. The port number of the default port is 6632.

Optionally, you can configure the following connection timers on the Juniper Networks device:

- Inactivity probe duration—The maximum amount of time, in milliseconds, that the connection can be inactive before an inactivity probe is sent. The default value is 0 milliseconds, which means that an inactivity probe is never sent.

- Maximum backoff duration—If an attempt to connect to an SDN controller fails, the maximum amount of time, in milliseconds, before the device can make the next attempt. The default value is 1000 milliseconds.

RELATED DOCUMENTATION

Setting Up the OVSDB Protocol on Juniper Networks Devices that Support Manual Configuration of VXLANs | 23

Setting Up OVSDB on Juniper Networks Devices That Support the Dynamic Configuration of VXLANs

Understanding How Layer 2 BUM and Layer 3 Routed Multicast Traffic Are Handled with OVSDB

The Juniper Networks Junos OS implementation of the Open vSwitch Database (OVSDB) management protocol provides a means through which software-defined networking (SDN) controllers and Juniper Networks devices that support OVSDB can communicate.

This topic explains how a Juniper Networks device with Virtual Extensible LAN (VXLAN) and OVSDB management protocol capabilities handles the following types of traffic:

- (This scenario applies to all Juniper Networks devices that support VXLAN and OVSDB.) Layer 2 *broadcast, unknown unicast, and multicast (BUM)* traffic that originates in an OVSDB-managed VXLAN and is forwarded to interfaces within the same VXLAN.

  NOTE: You must explicitly configure the replication of unknown unicast traffic in a Contrail environment.

- (This scenario applies only to Juniper Networks devices that can function as a Layer 3 VXLAN gateway in an OVSDB-VXLAN environment.) Layer 3 multicast traffic that is received by an *integrated routing and bridging (IRB)* interface in an OVSDB-managed VXLAN and is forwarded to interfaces in another OVSDB-managed VXLAN.

By default, Layer 2 BUM traffic that originates in an OVSDB-managed VXLAN is handled by one or more software *virtual tunnel endpoints (VTEPs)*, service nodes, or top-of-rack service nodes (TSNs) in the same VXLAN. (In this topic, software VTEPs, service nodes, and TSNs are known collectively as *replicators*.) The table for remote multicast media access control (MAC) addresses in the OVSDB schema for physical devices contains only one entry that has the keyword `unknown-dst` as the MAC string and a list of replicators.

Given the previously described table entry, Layer 2 BUM traffic received on an interface in the OVSDB-managed VXLAN is forwarded to one of the replicators. The replicator to which a BUM packet is forwarded is determined by the Juniper Networks device on which the OVSDB-managed VXLAN is configured. On receiving the BUM packet, the entity replicates the packet and forwards the replicas to all interfaces within the VXLAN.

Instead of using replicators, you can optionally enable ingress node replication to handle Layer 2 BUM traffic on Juniper Networks devices that support OVSDB.

NOTE: Ingress node replication is supported on all Juniper Networks devices that support OVSDB except the QFX Series switches.

With ingress node replication enabled, on receiving a Layer 2 BUM packet on an interface in an OVSDB-managed VXLAN, the Juniper Networks device replicates the packet and then forwards the replicas to all software VTEPs included in the unicast MACs remote table in the OVSDB schema. The software VTEPs then forward the replicas to all *virtual machines (VMs)*, except service VMs, or nodes, on the same host.

NOTE: When Juniper Networks devices replicate Layer 2 BUM packets to a large number of remote software VTEPs, the performance of the Juniper Networks devices can be impacted.

On IRB interfaces that forward Layer 3 multicast traffic from one OVSDB-managed VXLAN to another, ingress node replication is automatically implemented. With ingress node replication, the Juniper Networks device replicates a Layer 3 multicast packet and then the IRB interface forwards the replicas to all hardware and software VTEPs, but not to service nodes, in the other OVSDB-managed VXLAN. For the routing of Layer 3 multicast traffic from one OVSDB-managed VXLAN to another, ingress node replication is the only option and does not need to be configured.

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Understanding BFD in a VMware NSX Environment with OVSDB and VXLAN

Understanding How to Manually Configure OVSDB-Managed VXLANs

IN THIS SECTION

The Juniper Networks Junos operating system (Junos OS) implementation of the Open vSwitch Database (OVSDB) management protocol provides a means through which VMware NSX controllers and Juniper Networks devices that support OVSDB can communicate.

In a Junos OS environment, the concept of an OVSDB-managed Layer 2 broadcast domain in which data flows are limited to that domain is known as a *VXLAN*. In an NSX environment, the same concept is known as a *logical switch*. Understanding the different terminology in turn enables you to better understand the configuration tasks required for setting up OVSDB-managed VXLANs.

The following sections explain what you need to do to configure OVSDB-managed VXLANs properly for each Juniper Networks device that supports OVSDB and VXLAN:

Understanding How to Manually Configure OVSDB-Managed VXLANs On Juniper Networks Devices

For each VXLAN that you plan to implement, you must first configure a logical switch, using NSX Manager or the NSX API. Based on the name and the VXLAN network identifier (VNI) that you specify, NSX automatically generates a universally unique identifier (UUID) for the logical switch. You must retain the UUID of the logical switch for later use.

Next, on the Juniper Networks device, you must manually configure the corresponding VXLAN, including the same VNI specified for the logical switch, using the Junos OS CLI. For the name of the VXLAN, you must specify the UUID for the logical switch.

When configuring a logical switch and a corresponding VXLAN, it is important that the UUID and VNI in both configurations are the same. If these elements are not the same, the logical switch and VXLAN cannot become operational, which means they cannot exchange MAC addresses learned in the NSX and Junos OS environments, respectively.

Table 2 on page 11 provides a summary of the procedure that you must perform for each OVSDB-managed VXLAN on each Juniper Networks device, where to get more information about the configuration task, and the configuration statements that you must use to configure the VXLAN.

Table 2: Summary of Configuration Tasks for Manually Configuring An OVSDB-Managed VXLAN

Juniper Networks Device That Supports OVSDB and VXLAN	Configure Logical Switch, Using NSX Manager or the NSX API?	Where to Find More Configuration Information	Manually Configure Corresponding VXLAN on Juniper Networks Device?	Junos OS Statement to Configure the OVSDB-Managed VXLAN	Where to Find More Configuration Information
MX Series routers	Yes	See the documentation that accompanies NSX Manager or the NSX API.	Yes	`ovsdb-managed` statement in the `[edit bridge-domains` *domain-name* `vxlan]` hierarchy. For the name of the VXLAN, specify the UUID for the logical switch configured in NSX Manager or in the NSX API.	"Configuring OVSDB-Managed VXLANs" on page 25
EX9200 switch	Yes	See the documentation that accompanies NSX Manager or the NSX API.	Yes	`ovsdb-managed` statement in the `[edit vlans` *vlan-name* `vxlan]` hierarchy. For the name of the VXLAN, specify the UUID for the logical switch configured in NSX Manager or in the NSX API.	"Configuring OVSDB-Managed VXLANs" on page 25

RELATED DOCUMENTATION

show ovsdb logical-switch

OVSDB Schema for Physical Devices

An Open vSwitch Database (OVSDB) server runs on a Juniper Networks device that supports the OVSDB management protocol. When this device is connected to one or more VMware NSX controllers, the connections provide a means through which the Juniper Networks device and the controllers can communicate.

In an NSX for vSphere environment, Juniper Networks devices that support OVSDB and NSX controllers exchange control and statistical data. This data is stored in the OVSDB database schema defined for physical devices. The schema resides in the OVSDB server. The schema includes several tables. Juniper Networks devices and NSX controllers, both of which have OVSDB clients, can add rows to the tables as well as monitor the tables for the addition, deletion, and modification of rows.

For example, the OVSDB client on a Juniper Networks device or on an NSX controller can collect MAC routes learned by entities in the physical or virtual networks, respectively, and publish the routes to the appropriate table in the schema. By using the MAC routes and other information provided in the table, Juniper Networks devices in the physical network and entities in the virtual network can determine where to forward virtual machine (VM) traffic.

Some of the OVSDB table names include the words *local* or *remote*—for example, the *unicast MACs local table* and the *unicast MACs remote table*. Information in *local* tables is learned by a Juniper Networks device that functions as a hardware virtual tunnel endpoint (VTEP), whereas information in *remote* tables is learned by other software or hardware VTEPs.

Table 3 on page 12 describes the tables in the schema, the physical or virtual entity that is the source of the data provided in the table, and the command that you can enter in the CLI of the Juniper Networks device to get similar information.

Table 3: OVSDB Schema Tables

Table Name	Description	Source of Information	Command
Global table	Includes the top-level configuration for the Juniper Networks device.	Juniper Networks device	–

Table 3: OVSDB Schema Tables *(Continued)*

Table Name	Description	Source of Information	Command
Manager table	Includes information for each NSX controller that is connected to the Juniper Networks device.	• Juniper Networks device • NSX controller	`show ovsdb controller`
Physical switch table	Includes information about the Juniper Networks device on which a hardware VTEP is implemented. This table includes information only for the device on which the table resides.	Juniper Networks device	–
Physical port table	Includes information about OVSDB-managed interfaces.	Juniper Networks device	`show ovsdb interface`
Logical switch table	Includes information about logical switches, which you configure in NSX Manager or in the NSX API, and the corresponding Virtual Extensible LANs (VXLANs), which are configured on the Juniper Networks device.	Juniper Networks device	`show ovsdb logical-switch`
Logical binding statistics table	Includes statistics for OVSDB-managed interfaces.	Juniper Networks device	`show ovsdb statistics interface`

Table 3: OVSDB Schema Tables *(Continued)*

Table Name	Description	Source of Information	Command
Physical locator table	Includes information about Juniper Networks devices configured as hardware VTEPs, software VTEPs, and service nodes.	Juniper Networks device	`show ovsdb virtual-tunnel-end-point`
Physical locator set table	Lists service nodes for a logical switch.	Juniper Networks device	–
Unicast MACs remote table	Contains reachability information, including unicast MAC addresses, for entities in the virtual network.	NSX controller	`show ovsdb mac`
Unicast MACs local table	Contains reachability information, including unicast MAC addresses, for entities in the physical network.	Juniper Networks device that is configured as a hardware VTEP.	`show ovsdb mac`
Multicast MACs remote table	Includes only one row. In this row, the MAC column includes the keyword `unknown dst` along with a list of software VTEPs that host a cluster of service nodes, which handle multicast traffic.	NSX controller	`show ovsdb mac`

Table 3: OVSDB Schema Tables *(Continued)*

Table Name	Description	Source of Information	Command
Multicast MACs local table	Includes one row for each logical switch. In this row, the MAC column includes the keyword `unknown dst` and a list of hardware VTEPs, which are identified by the IP address assigned to the hardware VTEP loopback interface (lo0). These hardware VTEPs can terminate or originate a VXLAN tunnel.	Juniper Networks device	`show ovsdb mac`

RELATED DOCUMENTATION

Understanding the OVSDB Protocol Running on Juniper Networks Devices | 6

Understanding How to Set Up OVSDB Connections on a Juniper Networks Device | 7

CHAPTER 2

Configuring OVSDB and VXLAN

IN THIS CHAPTER

OVSDB and VXLAN Configuration Workflows for VMware NSX Environment

IN THIS SECTION

The workflow that you use to configure Open vSwitch Database (OVSDB) and Virtual Extensible LAN (VXLAN) in a VMware NSX environment depends on the Juniper Networks device that you are configuring. This topic provides more information about the following workflows:

OVSDB and VXLAN Configuration Workflow for QFX Series Switches

Table 4 on page 17 provides a high-level workflow of the tasks that you must perform to configure OVSDB and VXLAN on QFX Series switches. You must perform the tasks in Table 4 on page 17 for each Juniper Networks switch that you plan to deploy in an OVSDB environment. In general, the successful completion of a task in this workflow depends on the successful completion of the previous task, so it is important to adhere to the task sequence provided in Table 4 on page 17.

Table 4: OVSDB and VXLAN Configuration Workflow for QFX Series Switches

Sequence	Task	For More Information
1	Create and install a Secure Sockets Layer (SSL) key and certificate.	"Creating and Installing an SSL Key and Certificate on a Juniper Networks Device for Connection with SDN Controllers" on page 22.
2	Enter the `set switch-options ovsdb-managed` configuration mode command on the Juniper Networks switch.	–
3	Explicitly configure a connection to at least one VMware NSX controller.	*Setting Up OVSDB on Juniper Networks Devices That Support the Dynamic Configuration of VXLANs*.
4	Specify that each physical interface associated with a VXLAN is to be managed by OVSDB.	*Setting Up OVSDB on Juniper Networks Devices That Support the Dynamic Configuration of VXLANs*.
5	Configure a logical switch for each OVSDB-managed VXLAN that you plan to implement.	See the VMware documentation that accompanies NSX Manager or the NSX API.

Table 4: OVSDB and VXLAN Configuration Workflow for QFX Series Switches *(Continued)*

Sequence	Task	For More Information
6	• For each Juniper Network switch on which OVSDB-managed VXLANs and interfaces are configured, create a gateway. • For each OVSDB-managed interface that you configure, create a gateway service. • For each logical interface that you plan to implement for a VXLAN, configure a logical switch port. **NOTE**: On QFX Series switches, when multiple logical interfaces are bound to an OVSDB-managed physical interface, keep in mind that all of the logical interfaces must be either access interfaces that handle untagged packets or trunk interfaces that handle tagged packets. An OVSDB-managed physical interface does not support a mix of access and trunk interfaces.	For general information about configuring gateways, gateway services, and logical switch ports, see the VMware documentation that accompanies NSX Manager or the NSX API. For key NSX Manager configuration details that help you configure gateways, gateway services, and logical switch ports so they function properly with their physical counterparts, see "VMware NSX Configuration for Juniper Networks Devices Functioning as Virtual Tunnel Endpoints" on page 28.
7	Configure the loopback interface (lo0) on the Juniper Networks switch for VXLAN by entering the following configuration mode commands: • `set interfaces lo0 unit 0 family inet address` *`ip-address`* `primary` • `set switch-options vtep-source-Interface lo0.0`	–

After you successfully complete task 6 in Table 4 on page 17, the Juniper Networks switch dynamically creates a VXLAN for each logical switch that you configured in task 5. The Juniper Networks switch also dynamically creates and associates interfaces with each VXLAN. The dynamically created interface configuration is based on the gateway service and logical switch ports that you configured in task 6. For more information, see *Understanding Dynamically Configured VXLANs in an OVSDB Environment*.

For OVSDB-VXLAN scenarios in which Juniper Networks switches are commonly deployed, see the following topics:

- *Example: Setting Up a VXLAN Layer 2 Gateway and OVSDB Connections in a VMware NSX Environment (Trunk Interfaces Supporting Untagged Packets)*
- *Example: Setting Up a VXLAN Layer 2 Gateway and OVSDB Connections in a VMware NSX Environment (Trunk Interfaces Supporting Tagged Packets)*

OVSDB and VXLAN Configuration Workflow for MX Series Routers and EX9200 Switches

Table 5 on page 19 provides a high-level workflow of the tasks that you must perform to configure OVSDB and VXLAN on MX Series routers and EX9200 switches. You must perform the tasks inTable 5 on page 19 for each Juniper Networks device that you plan to deploy in an OVSDB environment. In general, the successful completion of a task in this workflow depends on the successful completion of the previous task, so it is important to adhere to the task sequence provided in Table 5 on page 19.

Table 5: OVSDB and VXLAN Configuration Workflow for MX Series Routers and EX9200 Switches

Sequence	Task	For More Information
1	Create and install an SSL key and certificate.	"Creating and Installing an SSL Key and Certificate on a Juniper Networks Device for Connection with SDN Controllers" on page 22.
2	Explicitly configure a connection to at least one NSX controller.	"Setting Up the OVSDB Protocol on Juniper Networks Devices that Support Manual Configuration of VXLANs" on page 23.
3	Specify that each physical interface associated with a VXLAN is to be managed by OVSDB.	"Setting Up the OVSDB Protocol on Juniper Networks Devices that Support Manual Configuration of VXLANs" on page 23.
4	Configure a logical switch for each OVSDB-managed VXLAN that you plan to implement.	See the VMware documentation that accompanies NSX Manager or the NSX API.
5	Configure OVSDB-managed VXLANs.	"Configuring OVSDB-Managed VXLANs" on page 25.

Table 5: OVSDB and VXLAN Configuration Workflow for MX Series Routers and EX9200 Switches *(Continued)*

Sequence	Task	For More Information
6	For each Juniper Network device on which OVSDB-managed VXLANs and interfaces will be configured, create a gateway. For each OVSDB-managed interface that you configure, create a gateway service. For each logical interface that you plan to implement for a VXLAN, configure a logical switch port.	For general information about configuring gateways, gateway services, and logical switch ports, see the VMware documentation that accompanies NSX Manager or the NSX API. For key NSX Manager configuration details that help you configure gateways, gateway services, and logical switch ports, so that they function properly with their physical counterparts, see "VMware NSX Configuration for Juniper Networks Devices Functioning as Virtual Tunnel Endpoints" on page 28.
7	Configure the loopback interface (lo0) on the Juniper Networks device for VXLAN by entering the following configuration mode commands: • `set interfaces lo0 unit 0 family inet address` *`ip-address`* `primary` • `set switch-options vtep-source-Interface lo0.0`	–

For OVSDB-VXLAN scenarios in which these Juniper Networks devices are commonly deployed, see the following topics:

- "Example: Setting Up Inter-VXLAN Unicast Routing and OVSDB Connections in a Data Center" on page 32
- "Example: Setting Up Inter-VXLAN Unicast and Multicast Routing and OVSDB Connections in a Data Center" on page 47
- "Example: Configuring VXLAN to VPLS Stitching with OVSDB" on page 63

RELATED DOCUMENTATION

Verifying That a Logical Switch and Corresponding Junos OS OVSDB-Managed VXLAN Are Working Properly | 115

Installing OVSDB on Juniper Networks Devices

NOTE: The Open vSwitch Database (OVSDB) software is included in the **jsdn** package. For some Juniper Networks devices, the **jsdn** package is included in the Junos OS software (**jinstall**) package. On these Juniper Networks devices, you do not need to install the separate **jsdn** package, which means that you can skip the task described in this topic. For information about which devices do not require installation of the separate **jsdn** package, see "OVSDB Support on Juniper Networks Devices" on page 2.

If the **jsdn** package for your Juniper Networks device is not included in the **jinstall** package, you must copy a separate **jsdn** package to the Juniper Networks device and then install the package. The package name uses the following format:

jsdn-*packageID-release*

where:

- *packageID* identifies the package that must run on each Juniper Networks device.
- *release* identifies the release; for example, 16.2. The **jsdn** package release and the **jinstall** release running on the device must be the same.

To install the **jsdn** package on a Juniper Networks device:

1. Download the software package to the Juniper Networks device.
2. If an older **jsdn** package already exists on the Juniper Networks device, remove the package by issuing the `request system software delete` operational mode command.

```
user@device> request system software delete existing-ovsdb-package
```

3. Install the new **jsdn** package by using the `request system software add` operational mode command.

```
user@device> request system software add path-to-ovsdb-package
```

RELATED DOCUMENTATION

Creating and Installing an SSL Key and Certificate on a Juniper Networks Device for Connection with SDN Controllers

To secure a connection between a Juniper Networks device that supports the Open vSwitch Database (OVSDB) management protocol and one or more software-defined networking (SDN) controllers, the following Secure Sockets Layer (SSL) files must be present in the **/var/db/certs** directory on the device:

- **vtep-privkey.pem**
- **vtep-cert.pem**
- **ca-cert.pem**

You must create the **vtep-privkey.pem** and **vtep-cert.pem** files for the device and then install the two files in the **/var/db/certs** directory on the device.

Upon initial connection between a Juniper Networks device with OVSDB implemented and an SDN controller, the **ca-cert.pem** file is automatically generated and then installed in the **/var/db/certs** directory on the device.

NOTE: The situation at your particular site determines the possible methods that you can use to create the **vtep-privkey.pem** and **vtep-cert.pem** files and install them in the Juniper Networks device. Instead of providing procedures for all possible situations, this topic provides a procedure for one common scenario.

The procedure provided in this topic uses the OpenFlow public key infrastructure (PKI) management utility ovs-pki on a Linux computer to initialize a PKI and create the **vtep-privkey.pem** and **vtep-cert.pem** files. (If you have an existing PKI on your Linux computer, you can skip the step to initialize a new one.) By default, the utility initializes the PKI and places these files in the **/usr/local/share/openvswitch/pki** directory of the Linux computer.

To create and install an SSL key and certificate on a Juniper Networks device:

1. Initialize a PKI if one does not already exist on your Linux computer.

```
# ovs-pki init
```

2. On the same Linux computer on which the PKI exists, create a new key and certificate for the Juniper Networks device.

```
# ovs-pki req+sign vtep
```

3. Copy only the **vtep-privkey.pem** and **vtep-cert.pem** files from the Linux computer to the **/var/db/certs** directory on the Juniper Networks device.

RELATED DOCUMENTATION

Understanding How to Set Up OVSDB Connections on a Juniper Networks Device | 7

Setting Up the OVSDB Protocol on Juniper Networks Devices that Support Manual Configuration of VXLANs

To implement the Open vSwitch Database (OVSDB) management protocol on a Juniper Networks device, you must explicitly configure a connection to at least one VMware NSX controller, using the Junos OS CLI.

All NSX controller connections are made on the management interface (fxp0 or me0) of the Juniper Networks device. This connection is secured by using the Secure Sockets Layer (SSL) protocol. The default port number over which the connection is made is 6632.

You must also specify that any interface implemented for a Virtual Extensible LAN (VXLAN) is managed by OVSDB. By performing this configuration, you are essentially disabling the Juniper Networks device from learning about other Juniper Networks devices that function as hardware virtual tunnel endpoints (VTEPs) and the MAC addresses learned by the hardware VTEPs. Instead, you are enabling OVSDB to learn about the other hardware VTEPs and the MAC addresses learned by the hardware VTEPs.

Before setting up OVSDB on a Juniper Networks device, you must do the following:

- Ensure that the Juniper Networks device has a Juniper Networks VMware NSX software package installed, and that the software package release is the same as the Junos OS release running on the device.
- Create an SSL private key and certificate, and install them in the **/var/db/certs** directory of the Juniper Networks device. For more information, see "Creating and Installing an SSL Key and Certificate on a Juniper Networks Device for Connection with SDN Controllers" on page 22.
- Determine the IP address of the NSX controller.

To set up OVSDB on a Juniper Networks device:

1. Specify the IP address of the NSX controller.

```
[edit protocols ovsdb]
user@host# set controller  ip-address
```

2. Specify SSL as the protocol that secures the connection.

```
[edit protocols ovsdb controller ip-address]
user@host# set protocol  ssl
```

3. Set the number of the port over which the connection to the NSX controller is made.

```
[edit protocols ovsdb controller ip-address protocol ssl]
user@host# set port number
```

4. (Optional) Specify (in milliseconds) how long the connection can be inactive before an inactivity probe is sent.

```
[edit protocols ovsdb controller ip-address]
user@host# set inactivity-probe-duration milliseconds
```

5. (Optional) Specify (in milliseconds) how long the device must wait before it can try to connect to the NSX controller again if the previous attempt failed.

```
[edit protocols ovsdb controller ip-address]
user@host# set maximum-backoff-duration milliseconds
```

6. (Optional) Repeat steps 1 through 5 to explicitly configure a connection to an additional NSX controller in the same cluster.
7. Specify the interfaces that you want OVSDB to manage.

```
[edit protocols ovsdb]
user@host# set interfaces interface-name unit logical-unit-number
```

RELATED DOCUMENTATION

Understanding How to Set Up OVSDB Connections on a Juniper Networks Device | 7

Configuring OVSDB-Managed VXLANs

> **NOTE**: This topic does not apply to QFX5100 and QFX10002 switches, which support the dynamic configuration of OVSDB-managed VXLANs. Although the OVSDB-managed VXLAN configuration is automated on these switches, there are tasks that you must perform before and after the dynamic configuration. For more information about the required tasks, see *Understanding Dynamically Configured VXLANs in an OVSDB Environment*.

To implement the OVSDB management protocol on a Juniper Networks device, you must configure OVSDB-managed VXLANs.

For Layer 2 broadcast, unknown unicast, and multicast (BUM) traffic that originates in an OVSDB-managed VXLAN and is forwarded to interfaces within the same VXLAN, you can optionally enable ingress node replication. With this feature enabled, the Juniper Networks device handles the replication of these packets and the forwarding of the replicas to interfaces within the same OVSDB-managed VXLAN. For more information about using ingress node replication or a service node, which is the default way to handle Layer 2 BUM traffic, see "Understanding How Layer 2 BUM and Layer 3 Routed Multicast Traffic Are Handled with OVSDB" on page 8.

> **NOTE**: When Juniper Networks devices replicate Layer 2 BUM packets to a large number of remote software virtual tunnel endpoints (VTEPs), the performance of the Juniper Networks devices might be impacted.

Before you configure VXLANs on a Juniper Networks device, using the Junos OS CLI:

- You must perform the configuration described in "Setting Up the OVSDB Protocol on Juniper Networks Devices that Support Manual Configuration of VXLANs" on page 23.
- For each OVSDB-managed VXLAN that you plan to configure on a Juniper Networks device, you must configure a logical switch in VMware NSX Manager or in the NSX API. (For information about configuring a logical switch, see the documentation that accompanies NSX Manager or the NSX API.) Based on the name and VXLAN network identifier (VNI) that you configure for the logical switch, NSX automatically generates a universally unique identifier (UUID) for the logical switch. You must retain the UUID of the logical switch for use when configuring a corresponding VXLAN on the Juniper Networks device as described in the following procedure.

To configure an OVSDB-managed VXLAN on a Juniper Networks device:

1. Configure the VXLANs that you want OVSDB to manage. You can configure the VXLANs in the context of a bridge domain, VLAN, routing instance, or switching instance.

   > **NOTE**: For the name of the bridge domain or VLAN, you must specify the UUID for the logical switch configured in NSX Manager or the NSX API.

   Bridge domains:

   ```
   [edit bridge-domains bridge-domain-name vxlan]
   user@host# set ovsdb-managed
   ```

   VLANs:

   ```
   [edit vlans vlan-name vxlan]
   user@device# set ovsdb-managed
   ```

   Bridge domains within the specified routing instance:

   ```
   [edit routing-instances routing-instance-name bridge-domains bridge-domain-name vxlan]
   user@host# set ovsdb-managed
   ```

   VLANs within the specified routing instance:

   ```
   [edit routing-instances routing-instance-name vlans vlan-name vxlan]
   user@device# set ovsdb-managed
   ```

   Default switching instance within the specified routing instance:

   ```
   [edit routing-instances routing-instance-name switch-options]
   user@host# set ovsdb-managed
   ```

   All VXLAN entities within the specified routing instance:

   ```
   [edit routing-instances routing-instance-name vxlan]
   user@host# set ovsdb-managed
   ```

2. (Optional) Enable ingress node replication to handle Layer 2 BUM traffic on interfaces in the same VXLAN in which the traffic originated. You can configure ingress node replication in the context of a bridge domain, VLAN, or routing instance.

   Bridge domains:

   ```
   [edit bridge-domains bridge-domain-name vxlan]
   user@host# set ingress-node-replication
   ```

   VLANs:

   ```
   [edit vlans vlan-name vxlan]
   user@device# set ingress-node-replication
   ```

   Bridge domains, VLANs, or all VXLAN entities, respectively, within the specified routing instance:

   ```
   [edit routing-instances routing-instance-name bridge-domains bridge-domain-name vxlan]
   [edit routing-instances routing-instance-name vlans vlan-name vxlan]
   [edit routing-instances routing-instance-name vxlan]
   user@host# set ingress-node-replication
   ```

RELATED DOCUMENTATION

Understanding How to Manually Configure OVSDB-Managed VXLANs | **10**

OVSDB and VXLAN Configuration Workflows for VMware NSX Environment | **16**

Example: Setting Up Inter-VXLAN Unicast Routing and OVSDB Connections in a Data Center | **32**

Example: Setting Up Inter-VXLAN Unicast and Multicast Routing and OVSDB Connections in a Data Center | **47**

VMware NSX Configuration for Juniper Networks Devices Functioning as Virtual Tunnel Endpoints

IN THIS SECTION

When implementing the Open vSwitch Database (OVSDB) management protocol and Virtual Extensible LANs (VXLANs) on a Juniper Networks device, you must perform the following tasks in VMware NSX Manager or in the NSX API:

- For each Juniper Networks device on which OVSDB-managed VXLANs and physical interfaces are configured, you must create an NSX-equivalent entity, which is known as a *gateway*.
- For each OVSDB-managed physical interface that you configure on a Juniper Networks device, you must configure a gateway service—for example, a VTEP Layer 2 gateway service.
- For each logical interface that you want to implement for a VXLAN, you must configure a logical switch port.

The configurations described in this topic enable connectivity between physical servers in the physical network and virtual machines (VMs) in the virtual network.

This topic provides a high-level summary of the tasks that you must perform to create a gateway, gateway service, and logical switch ports. Although you can create these virtual entities either in NSX Manager or in the NSX API, this topic only describes how to perform the tasks in NSX Manager. Also, this topic does not include a complete procedure for each task. Rather, it includes key NSX Manager configuration details for ensuring the correct configuration of the virtual entities so that they function properly with the physical entities.

For complete information about performing the tasks described in this topic, see the documentation that accompanies NSX Manager.

This topic describes the following tasks:

Creating a Gateway

In NSX Manager, you must create a gateway for each Juniper Networks device on which OVSDB-managed VXLANs and physical interfaces are configured. Table 6 on page 29 provides a summary of key configuration fields in NSX Manager and how to configure them when creating a gateway.

Table 6: Key Configurations to Create a Gateway in NSX Manager

NSX Manager Configuration Page or Dialog Box	NSX Manager Configuration Field	How to Configure
Type	Transport Node Type	Select **Gateway**.
Properties	VTEP Enabled	Select **VTEP Enabled.**
Credential	Type	Select **Management Address.**
Credential	Management Address	Specify the management IP address of the Juniper Networks device.
Connections/Create Transport Connector	Transport Type	Select **VXLAN**.
Connections/Create Transport Connector	Transport Zone UUID	Select the UUID of an existing transport zone, or create a new transport zone.
Connections/Create Transport Connector	IP Address	Specify the IP address of the loopback interface (lo0) of the Juniper Networks device.

Creating a Gateway Service

In NSX Manager, you must create a gateway service for each OVSDB-managed physical interface that you configure on a Juniper Networks device. Creating a gateway service essentially does the following for each OVSDB-managed physical interface:

- Specifies a gateway service—for example, a VTEP Layer 2 gateway service.
- Binds the interface to a gateway that you created in "Creating a Gateway" on page 29.

Before you start this task, you must complete the following configurations:

- A gateway for the Juniper Networks device on which the OVSDB-managed physical interfaces are configured. See "Creating a Gateway" on page 29.
- The OVSDB-managed physical interfaces on the Juniper Networks device. For information about configuring OVSDB-managed interfaces on Juniper Networks devices that support the dynamic configuration of VXLANs, see *Setting Up OVSDB on Juniper Networks Devices That Support the Dynamic Configuration of VXLANs*. For information about configuring OVSDB-managed interfaces on Juniper Networks devices that support the manual configuration of VXLANs, see "Setting Up the OVSDB Protocol on Juniper Networks Devices that Support Manual Configuration of VXLANs" on page 23.

Table 7 on page 30 provides a summary of key configuration fields in NSX Manager and how to configure them when creating a gateway service.

Table 7: Key Configurations to Create a Gateway Service in NSX Manager

NSX Manager Configuration Page or Dialog Box	NSX Manager Configuration Field	How to Configure
Type	Gateway Service Type	Select **VTEP L2 Gateway Service**.
Transport Nodes/Edit Gateway	Transport Node	Select the gateway that you created for the Juniper Networks device.
Transport Nodes/Edit Gateway	Port ID	Select an OVSDB-managed physical interface configured on the Juniper Networks device.

Creating a Logical Switch Port

In NSX Manager, you must create a logical switch port for each logical interface that you plan to implement for a VXLAN. Creating the logical switch port essentially does the following for each logical interface:

- Binds the logical switch port to a logical switch that you created in NSX Manager or in the NSX API.
- Binds the logical interface to a gateway service that you configured in "Creating a Gateway Service" on page 29.

Before you start this task, you must complete the following configurations:

- A logical switch with which this logical port is associated. For information about configuring a logical switch, see the VMware documentation that accompanies NSX Manager or the NSX API.

- A gateway service that specifies the OVSDB-managed physical interface with which the logical interface is associated. See "Creating a Gateway Service" on page 29.

Table 8 on page 31 provides a summary of key configuration fields in NSX Manager and how to configure them when creating a logical switch port.

Table 8: Key Configurations to Create a Logical Switch Port in NSX Manager

NSX Manager Configuration Page or Dialog Box	NSX Manager Configuration Field	How to Configure
Logical Switch	Logical Switch UUID	Select the UUID of a logical switch.
Attachment	Attachment Type	Select **VTEP L2 Gateway**.
Attachment	VTEP L2 Gateway Service UUID	Select the UUID of a gateway service.
Attachment	VLAN	Select **0** to specify that the port handles untagged packets. Select **1** through **4000** to specify that the port handles tagged packets. **NOTE**: VLAN ID 4094 is reserved for a native VLAN in an OVSDB environment. Specifying this VLAN ID results in an error message. Do not specify this VLAN ID or any VLAN ID not in the accepted range.

RELATED DOCUMENTATION

OVSDB and VXLAN Configuration Workflows for VMware NSX Environment | 16

Example: Setting Up Inter-VXLAN Unicast Routing and OVSDB Connections in a Data Center

IN THIS SECTION

This example shows how to set up a data center in which virtual machines (VMs) in different Virtual Extensible LANs (VXLANs) need to communicate. The Juniper Networks device that is integrated into this environment functions as a hardware virtual tunnel endpoint (VTEP) that can route VM traffic from one VXLAN (Layer 2) environment to another.

The Juniper Networks device implements the Open vSwitch Database (OVSDB) management protocol and has a connection with a VMware NSX controller, both of which enable the device and the NSX controller to exchange MAC routes to and from VMs in the physical and virtual networks.

This example explains how to configure a Juniper Networks device as a hardware VTEP, set up the routing of unicast packets between VXLANs, and set up an OVSDB connection with an NSX controller. For information about setting up the routing of unicast and multicast packets between VXLANs, see "Example: Setting Up Inter-VXLAN Unicast and Multicast Routing and OVSDB Connections in a Data Center" on page 47.

Requirements

The topology for this example includes the following hardware and software components:

- A cluster of five NSX controllers.
- NSX Manager.
- A service node that handles broadcast, unknown unicast, and multicast (BUM) traffic within each of the two VXLANs.
- Two hosts, each of which includes VMs managed by a hypervisor. Each hypervisor includes a software VTEP. The VMs on each of the hosts belong to different VXLANs.
- A Juniper Networks device that routes VM traffic between the two VXLANs. For example, an MX Series router running Junos OS Release 14.1R2 or later, or an EX9200 switch running Junos OS

release 14.2 or later. The Juniper Networks device must also run an OVSDB software package, and the release of this package must be the same as the Junos OS release running on the device. This device is configured to function as a hardware VTEP.

Before you begin the configuration of the Juniper Networks device, you need to perform the following tasks:

- In NSX Manager or the NSX API, specify the IP address of the service node.
- In NSX Manager or the NSX API, configure a logical switch for each VXLAN that OVSDB will manage. This example implements two OVSDB-managed VXLANs; therefore, you must configure two logical switches. After the configuration of each logical switch, NSX automatically generates a universally unique identifier (UUID) for the logical switch. If you have not already, retrieve the UUID for each logical switch. A sample UUID is 28805c1d-0122-495d-85df-19abd647d772. When configuring the equivalent VXLANs on the Juniper Networks device, you must use the UUID of the logical switch as the bridge domain or VLAN name.

  For more information about logical switches and VXLANs, see "Understanding How to Manually Configure OVSDB-Managed VXLANs" on page 10.
- Create an SSL private key and certificate, and install them in the **/var/db/certs** directory of the Juniper Networks device. For more information, see "Creating and Installing an SSL Key and Certificate on a Juniper Networks Device for Connection with SDN Controllers" on page 22.

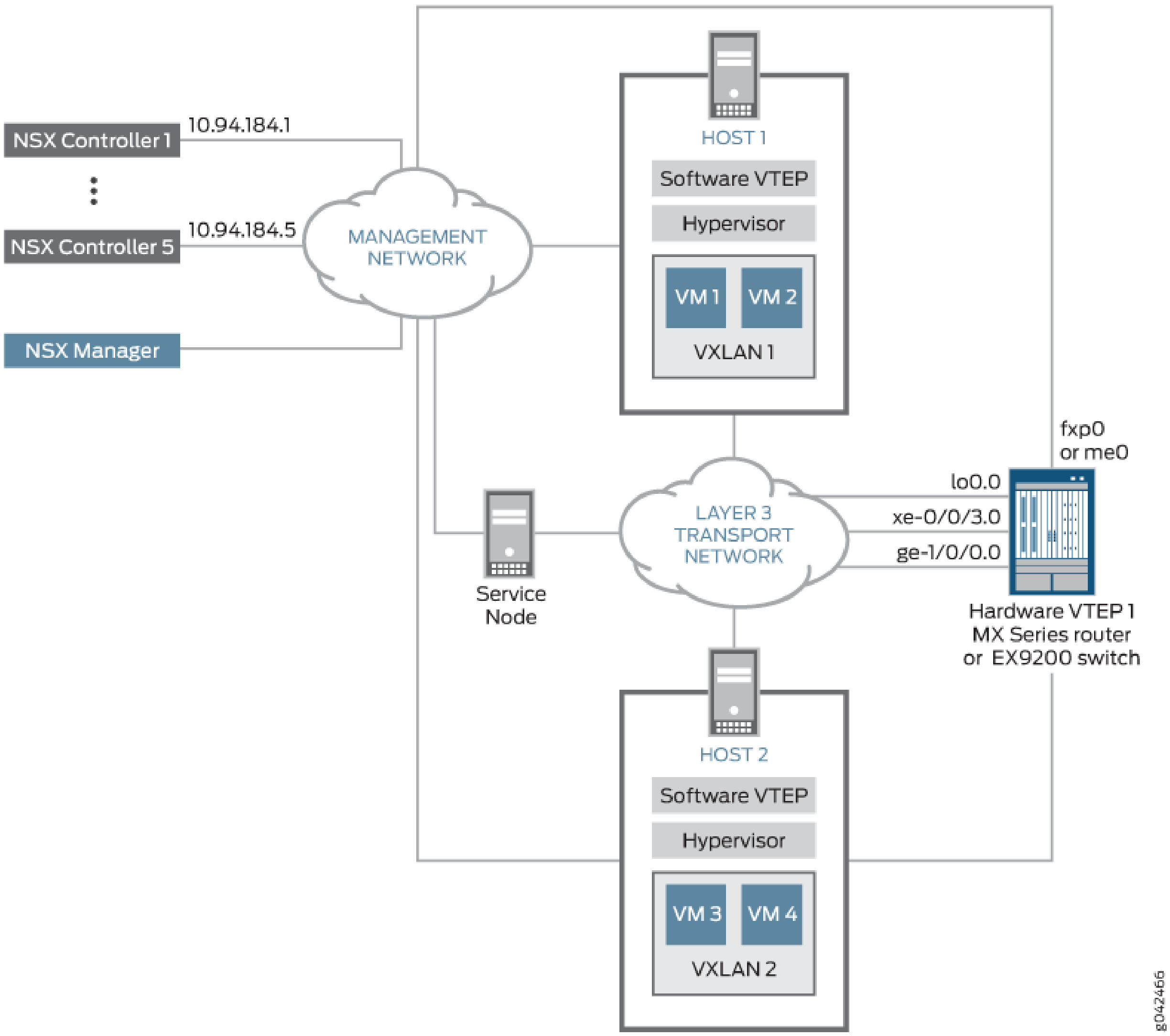
For information about using NSX Manager or the NSX API to perform these configuration tasks, see the documentation that accompanies the respective products.

Overview and Topology

IN THIS SECTION

In the topology shown in Figure 3 on page 34, VM 1 in VXLAN 1 needs to communicate with VM 3 in VXLAN 2. To enable this communication, hardware VTEP 1, which can be an MX Series router or an EX9200 switch, is configured to route VM unicast traffic between the two VXLANs.

Figure 3: Inter-VXLAN Unicast Routing and OVSDB Topology



On hardware VTEP 1, a routing instance (virtual switch) is set up. Within the routing instance, two VXLANs are configured: VXLAN 1 and VXLAN 2. Each VXLAN has an integrated routing and bridging (IRB) interface associated with it. The IRB interfaces handle the routing of VM unicast traffic between the VXLANs,

Within each of the two VXLANs, a service node replicates Layer 2 BUM packets then forwards the replicas to all interfaces in the VXLANs. Having the service node handle the Layer 2 BUM traffic is the default behavior, and no configuration is required for this Juniper Networks device.

On hardware VTEP 1, a connection with an NSX controller is configured on the management interface (fxp0 for an MX Series router and me0 for an EX9200 switch). This configuration enables the NSX controller to push MAC routes for VM 1 and VM 3 to the hardware VTEP by way of the table for remote unicast MAC addresses in the OVSDB schema for physical devices.

Each VXLAN-encapsulated packet must include a source IP address, which identifies the source hardware or software VTEP, in the outer IP header. In this example, for hardware VTEP 1, the IP address of the loopback interface (lo0.0) is used.

In this example, the tracing of all OVSDB events is configured. The output of the OVSDB events are placed in a file named **ovsdb**, which is stored in the **/var/log** directory. By default, a maximum of 10 trace files can exist, and the configured maximum size of each file is 50 MB.

Topology

Table 9 on page 35 describes the components for setting up inter-VXLAN routing and an OVSDB connection.

Table 9: Components for Setting Up Inter-VXLAN Routing and OVSDB Connections in a Data Center

Property	Settings
Routing instance	Name: vx1 Type: virtual switch OVSDB-managed VXLANs included: VXLAN 1 and VXLAN 2
VXLAN 1	Bridge domain or VLAN associated with: 28805c1d-0122-495d-85df-19abd647d772 Interface: xe-0/0/2.0 VLAN ID: 100 VNI: 100
VXLAN 2	Bridge domain or VLAN associated with: 96a382cd-a570-4ac8-a77a-8bb8b16bde70 Interface: xe-1/2/0.0 VLAN ID: 200 VNI: 200

Table 9: Components for Setting Up Inter-VXLAN Routing and OVSDB Connections in a Data Center *(Continued)*

Property	Settings
Inter-VXLAN unicast routing and forwarding with IRB interfaces	VXLAN 1: irb.0; 10.20.20.1/24; associated with routing interface vx1, and bridge domain or VLAN 28805c1d-0122-495d-85df-19abd647d772 VXLAN 2: irb.1; 10.10.10.3/24; associated with routing interface vx1, and bridge domain or VLAN 96a382cd-a570-4ac8-a77a-8bb8b16bde70
Handling of BUM traffic in each VXLAN	Service node **NOTE**: By default, one or more service nodes handle Layer 2 BUM traffic in a VXLAN; therefore, no configuration is required.
NSX controller	IP address: 10.94.184.1
Hardware VTEP source identifier	Source interface: loopback (lo0.0) Source IP address: 10.19.19.19/32
OVSDB tracing operations	Filename: /var/log/ovsdb File size: 50 MB Flag: All

Configuration

IN THIS SECTION

An MX Series router or an EX9200 switch can function as hardware VTEP 1 in this example. Because the configuration for each device is slightly different, a separate configuration is provided for each device.

To configure inter-VXLAN unicast routing and OVSDB connections in a data center topology, you need to perform one of these tasks:

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your configuration (for example, IP addresses, interface names, and UUIDs), copy and paste the commands into the CLI at the `[edit]` hierarchy level, and then enter `commit` from configuration mode.

> **NOTE**: After completing this configuration, you must configure a gateway, which is the NSX-equivalent of a hardware VTEP. This example implements one hardware VTEP; therefore, you must configure one gateway, a gateway service, and a logical switch port using NSX Manager or the NSX API. For more information about the tasks you must perform and key NSX Manager configuration details, see "VMware NSX Configuration for Juniper Networks Devices Functioning as Virtual Tunnel Endpoints" on page 28.

MX Series router configuration:

```
set chassis network-services enhanced-ip
set interfaces xe-0/0/3 unit 0 family inet address 10.50.50.2/24
set interfaces ge-1/0/0 unit 0 family inet address 10.100.100.99/24
set routing-options router-id 10.19.19.19
set protocols ospf area 0.0.0.0 interface xe-0/0/3.0
set protocols ospf area 0.0.0.0 interface ge-1/0/0.0
set protocols ospf area 0.0.0.0 interface lo0.0
set interfaces xe-0/0/2 unit 0 family bridge interface-mode access
set interfaces xe-0/0/2 unit 0 family bridge vlan-id 100
set interfaces xe-1/2/0 unit 0 family bridge interface-mode access
set interfaces xe-1/2/0 unit 0 family bridge vlan-id 200
set interfaces irb unit 0 family inet address 10.20.20.1/24
set interfaces irb unit 1 family inet address 10.10.10.3/24
set routing-instances vx1 vtep-source-interface lo0.0
set routing-instances vx1 instance-type virtual-switch
set routing-instances vx1 interface xe-0/0/2.0
set routing-instances vx1 interface xe-1/2/0.0
set routing-instances vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 vlan-id 100
set routing-instances vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 routing-interface
```

```
irb.0
set routing-instances vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 vxlan ovsdb-managed
set routing-instances vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 vxlan vni 100
set routing-instances vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vlan-id 200
set routing-instances vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 routing-interface
irb.1
set routing-instances vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan ovsdb-managed
set routing-instances vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan vni 200
set interfaces lo0 unit 0 family inet address 10.19.19.19/32 primary
set interfaces lo0 unit 0 family inet address 10.19.19.19/32 preferred
set protocols ovsdb traceoptions file ovsdb
set protocols ovsdb traceoptions file size 50m
set protocols ovsdb traceoptions flag all
set protocols ovsdb controller 10.94.184.1
set protocols ovsdb interfaces xe-0/0/2.0
set protocols ovsdb interfaces xe-1/2/0.0
```

EX9200 switch configuration:

```
set interfaces xe-0/0/3 unit 0 family inet address 10.50.50.2/24
set interfaces ge-1/0/0 unit 0 family inet address 10.100.100.99/24
set routing-options router-id 10.19.19.19
set protocols ospf area 0.0.0.0 interface xe-0/0/3.0
set protocols ospf area 0.0.0.0 interface ge-1/0/0.0
set protocols ospf area 0.0.0.0 interface lo0.0
set interfaces xe-0/0/2 unit 0 family ethernet-switching interface-mode access
set interfaces xe-0/0/2 unit 0 family ethernet-switching vlan-id 100
set interfaces xe-1/2/0 unit 0 family ethernet-switching interface-mode access
set interfaces xe-1/2/0 unit 0 family ethernet-switching vlan-id 200
set interfaces irb unit 0 family inet address 10.20.20.1/24
set interfaces irb unit 1 family inet address 10.10.10.3/24
set routing-instances vx1 vtep-source-interface lo0.0
set routing-instances vx1 instance-type virtual-switch
set routing-instances vx1 interface xe-0/0/2.0
set routing-instances vx1 interface xe-1/2/0.0
set routing-instances vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 vlan-id 100
set routing-instances vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 routing-interface irb.0
set routing-instances vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 vxlan ovsdb-managed
set routing-instances vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 vxlan vni 100
set routing-instances vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vlan-id 200
set routing-instances vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 routing-interface irb.1
set routing-instances vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan ovsdb-managed
```

```
set routing-instances vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan vni 200
set interfaces lo0 unit 0 family inet address 10.19.19.19/32 preferred
set interfaces lo0 unit 0 family inet address 10.19.19.19/32 primary
set protocols ovsdb traceoptions file ovsdb
set protocols ovsdb traceoptions file size 50m
set protocols ovsdb traceoptions flag all
set protocols ovsdb controller 10.94.184.1
set protocols ovsdb interfaces xe-0/0/2.0
set protocols ovsdb interfaces xe-1/2/0.0
```

Configuring an MX Series Router as a Hardware VTEP with an OVSDB Connection

Step-by-Step Procedure

To configure an MX Series router as hardware VTEP 1 with an OVSDB connection to an NSX controller, follow these steps:

1. Create the Layer 3 network.

```
[edit chassis]
user@router# set network-services enhanced-ip
[edit interfaces]
user@router# set xe-0/0/3 unit 0 family inet address 10.50.50.2/24
user@router# set ge-1/0/0 unit 0 family inet address 10.100.100.99/24
[edit routing-options]
user@router# set router-id 10.19.19.19
[edit protocols]
user@router# set ospf area 0.0.0.0 interface xe-0/0/3.0
user@router# set ospf area 0.0.0.0 interface ge-1/0/0.0
user@router# set ospf area 0.0.0.0 interface lo0.0
```

2. Create an access interface for VXLAN 1, and associate the interface with the VXLAN.

```
[edit interfaces]
user@router# set xe-0/0/2 unit 0 family bridge interface-mode access
user@router# set xe-0/0/2 unit 0 family bridge vlan-id 100
```

3. Create an access interface for VXLAN 2, and associate the interface with the VXLAN.

```
[edit interfaces]
user@router# set xe-1/2/0 unit 0 family bridge interface-mode access
user@router# set xe-1/2/0 unit 0 family bridge vlan-id 200
```

4. Create an IRB interface to handle inter-VXLAN unicast traffic for VXLAN 1.

```
[edit interfaces]
user@router# set irb unit 0 family inet address 10.20.20.1/24
```

5. Create an IRB interface to handle inter-VXLAN unicast traffic for VXLAN 2.

```
[edit interfaces]
user@router# set irb unit 1 family inet address 10.10.10.3/24
```

6. Set up the virtual switch routing instance.

```
[edit routing-instances]
user@router# set vx1 vtep-source-interface lo0.0
user@router# set vx1 instance-type virtual-switch
user@router# set vx1 interface xe-0/0/2.0
user@router# set vx1 interface xe-1/2/0.0
user@router# set vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 vlan-id 100
user@router# set vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 routing-interface
irb.0
user@router# set vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 vxlan ovsdb-
managed
user@router# set vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 vxlan vni 100
user@router# set vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vlan-id 200
user@router# set vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 routing-interface
irb.1
user@router# set vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan ovsdb-
managed
user@router# set vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan vni 200
```

7. Specify an IP address for the loopback interface. This IP address serves as the source IP address in the outer header of any VXLAN-encapsulated packets.

```
[edit interfaces]
user@router# set lo0 unit 0 family inet address 10.19.19.19/32 primary
user@router# set lo0 unit 0 family inet address 10.19.19.19/32 preferred
```

8. Set up OVSDB tracing operations.

```
[edit protocols]
user@router# set ovsdb traceoptions file ovsdb
user@router# set ovsdb traceoptions file size 50m
user@router# set ovsdb traceoptions flag all
```

9. Configure a connection with an NSX controller.

```
[edit protocols]
user@router# set ovsdb controller  10.94.184.1
```

10. Configure interfaces xe-0/0/2.0 and xe-1/2/0.0 to be managed by OVSDB.

```
[edit protocols]
user@router# set ovsdb interfaces xe-0/0/2.0
user@router# set ovsdb interfaces xe-1/2/0.0
```

NOTE: After completing this configuration, you must configure a gateway, which is the NSX-equivalent of a hardware VTEP. This example implements one hardware VTEP; therefore, you must configure one gateway, a gateway service, and a logical switch port by using NSX Manager or the NSX API. For more information about the tasks you must perform and key NSX Manager configuration details, see "VMware NSX Configuration for Juniper Networks Devices Functioning as Virtual Tunnel Endpoints" on page 28.

Configuring an EX9200 Switch as a Hardware VTEP with an OVSDB Connection

Step-by-Step Procedure

To configure an EX9200 switch as hardware VTEP 1 with an OVSDB connection to an NSX controller, follow these steps:

1. Create the Layer 3 network.

```
[edit chassis]
[edit interfaces]
user@switch# set xe-0/0/3 unit 0 family inet address 10.50.50.2/24
user@switch# set ge-1/0/0 unit 0 family inet address 10.100.100.99/24
[edit routing-options]
user@switch# set router-id 10.19.19.19
[edit protocols]
user@switch# set ospf area 0.0.0.0 interface xe-0/0/3.0
user@switch# set ospf area 0.0.0.0 interface ge-1/0/0.0
user@switch# set ospf area 0.0.0.0 interface lo0.0
```

2. Create an access interface for VXLAN 1, and associate the interface with the VXLAN.

```
[edit interfaces]
user@switch# set xe-0/0/2 unit 0 family ethernet-switching interface-mode access
user@switch# set xe-0/0/2 unit 0 family ethernet-switching vlan-id 100
```

3. Create an access interface for VXLAN 2, and associate the interface with the VXLAN.

```
[edit interfaces]
user@switch# set xe-1/2/0 unit 0 family ethernet-switching interface-mode access
user@switch# set xe-1/2/0 unit 0 family ethernet-switching vlan-id 200
```

4. Create an IRB interface to handle inter-VXLAN unicast traffic for VXLAN 1.

```
[edit interfaces]
user@switch# set irb unit 0 family inet address 10.20.20.1/24
```

5. Create an IRB interface to handle inter-VXLAN unicast traffic for VXLAN 2.

```
[edit interfaces]
user@switch# set irb unit 1 family inet address 10.10.10.3/24
```

6. Set up the virtual switch routing instance.

```
[edit routing-instances]
user@switch# set vx1 vtep-source-interface lo0.0
user@switch# set vx1 instance-type virtual-switch
user@switch# set vx1 interface xe-0/0/2.0
user@switch# set vx1 interface xe-1/2/0.0
user@switch# set vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 vlan-id 100
user@switch# set vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 routing-interface irb.0
user@switch# set vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 vxlan ovsdb-managed
user@switch# set vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 vxlan vni 100
user@switch# set vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vlan-id 200
user@switch# set vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 routing-interface irb.1
user@switch# set vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan ovsdb-managed
user@switch# set vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan vni 200
```

7. Specify an IP address for the loopback interface. This IP address serves as the source IP address in the outer header of any VXLAN-encapsulated packets.

```
[edit interfaces]
user@switch# set lo0 unit 0 family inet address 10.19.19.19/32 primary
user@switch# set lo0 unit 0 family inet address 10.19.19.19/32 preferred
```

8. Set up tracing operations to be performed for the OVSDB management protocol.

```
[edit protocols]
user@switch# set ovsdb traceoptions file ovsdb
user@switch# set ovsdb traceoptions file size 50m
user@switch# set ovsdb traceoptions flag all
```

9. Configure a connection with an NSX controller.

```
[edit protocols]
user@switch# set ovsdb controller  10.94.184.1
```

10. Configure interfaces xe-0/0/2.0 and xe-1/2/0.0 to be managed by OVSDB.

```
[edit protocols]
user@router# set ovsdb interfaces xe-0/0/2.0
user@router# set ovsdb interfaces xe-1/2/0.0
```

NOTE: After completing this configuration, you must configure a gateway, which is the NSX-equivalent of a hardware VTEP. This example implements one hardware VTEP; therefore, you must configure one gateway, a gateway service, and a logical switch port by using NSX Manager or the NSX API. For more information about the tasks you must perform and key NSX Manager configuration details, see "VMware NSX Configuration for Juniper Networks Devices Functioning as Virtual Tunnel Endpoints" on page 28.

Verification

IN THIS SECTION

Verifying the Logical Switches

Purpose

Verify that logical switches with the UUIDs of 28805c1d-0122-495d-85df-19abd647d772 and 96a382cd-a570-4ac8-a77a-8bb8b16bde70 are configured in NSX Manager or in the NSX API, and that information about the logical switches is published in the OVSDB schema.

Action

Issue the `show ovsdb logical-switch` operational mode command.

```
user@host> show ovsdb logical-switch
Logical switch information:
Logical Switch Name: 28805c1d-0122-495d-85df-19abd647d772
Flags: Created by both
VNI: 100
Num of Remote MAC: 1
Num of Local MAC: 0
Logical Switch Name: 96a382cd-a570-4ac8-a77a-8bb8b16bde70
Flags: Created by both
VNI: 200
Num of Remote MAC: 1
Num of Local MAC: 1
```

Meaning

The output verifies that information about the logical switches is published in the OVSDB schema. The `Created by both` state indicates that the logical switches are configured in NSX Manager or the NSX API, and the corresponding VXLANs are configured on the Juniper Networks device. In this state, the logical switches and VXLANs are operational.

If the state of the logical switches is something other than `Created by both`, see "Troubleshooting a Nonoperational Logical Switch and Corresponding Junos OS OVSDB-Managed VXLAN" on page 117.

Verifying the MAC Addresses of VM 1 and VM 3

Purpose

Verify that the MAC addresses of VM 1 and VM 3 are present in the OVSDB schema.

Action

Issue the `show ovsdb mac remote` operational mode command to verify that the MAC addresses for VM 1 and VM 3 are present.

```
user@host> show ovsdb mac remote
Logical Switch Name: 28805c1d-0122-495d-85df-19abd647d772
```

```
  Mac                   IP                 Encapsulation      Vtep
  Address               Address                               Address
  08:33:9d:5f:a7:f1     0.0.0.0            Vxlan over Ipv4    10.19.19.19
Logical Switch Name: 96a382cd-a570-4ac8-a77a-8bb8b16bde70
  Mac                   IP                 Encapsulation      Vtep
  Address               Address                               Address
  a8:59:5e:f6:38:90     0.0.0.0            Vxlan over Ipv4    10.19.19.10
```

Meaning

The output shows that the MAC addresses for VM 1 and VM 3 are present and are associated with logical switches with the UUIDs of 28805c1d-0122-495d-85df-19abd647d772 and 96a382cd-a570-4ac8-a77a-8bb8b16bde70, respectively. Given that the MAC addresses are present, VM 1 and VM 3 are reachable through hardware VTEP 1.

Verifying the NSX Controller Connection

Purpose

Verify that the connection with the NSX controller is up.

Action

Issue the `show ovsdb controller` operational mode command, and verify that the controller connection state is `up`.

```
user@host> show ovsdb controller
VTEP controller information:
Controller IP address: 10.94.184.1
Controller protocol: ssl
Controller port: 6632
Controller connection: up
Controller seconds-since-connect: 542325
Controller seconds-since-disconnect: 542346
Controller connection status: active
```

Meaning

The output shows that the connection state of the NSX controller is `up`, in addition to other information about the controller. When this connection is up, OVSDB is enabled on the Juniper Networks device.

RELATED DOCUMENTATION

OVSDB Schema for Physical Devices

Example: Setting Up Inter-VXLAN Unicast and Multicast Routing and OVSDB Connections in a Data Center

IN THIS SECTION

This example shows how to set up a data center in which virtual machines (VMs) in different Virtual Extensible LANs (VXLANs) need to communicate. The Juniper Networks device that is integrated into this environment functions as a hardware virtual tunnel endpoint (VTEP) that can route VM traffic from one VXLAN (Layer 2) environment to another.

The Juniper Networks device implements the Open vSwitch Database (OVSDB) management protocol and has a connection with a VMware NSX controller, both of which enable the device and the NSX controller to exchange MAC routes to and from VMs in the physical and virtual networks.

This example explains how to configure a Juniper Networks device as a hardware VTEP, set up the routing of unicast and multicast packets between VXLANs, and set up an OVSDB connection with an NSX controller. For information about setting up the routing of unicast packets only between VXLANs, see "Example: Setting Up Inter-VXLAN Unicast Routing and OVSDB Connections in a Data Center" on page 32.

Requirements

The topology for this example includes the following hardware and software components:

- A cluster of five NSX controllers.
- NSX Manager.
- A service node that handles broadcast, unknown unicast, and multicast (BUM) traffic within each of the two VXLANs.

- Two hosts, each of which includes VMs managed by a hypervisor. Each hypervisor includes a software VTEP. The VMs on each of the hosts belong to different VXLANs.
- A Juniper Networks device that routes VM traffic between the two VXLANs. For example, an MX Series router running Junos OS Release 14.1R2 or later, or an EX9200 switch running Junos OS release 14.2 or later. The Juniper Networks device must also run an OVSDB software package, and the release of this package must be the same as the Junos OS release running on the device. This device is configured to function as a hardware VTEP.

Before you begin the configuration of the Juniper Networks device, you need to perform the following tasks:

- In NSX Manager or the NSX API, specify the IP address of the service node.
- In NSX Manager or the NSX API, configure a logical switch for each VXLAN that OVSDB will manage. This example implements two OVSDB-managed VXLANs; therefore, you must configure two logical switches. After the configuration of each logical switch, NSX automatically generates a universally unique identifier (UUID) for the logical switch. If you have not already, retrieve the UUID for each logical switch. A sample UUID is 28805c1d-0122-495d-85df-19abd647d772. When configuring the equivalent VXLANs on the Juniper Networks device, you must use the UUID of the logical switch as the bridge domain or VLAN name.

  For more information about logical switches and VXLANs, see "Understanding How to Manually Configure OVSDB-Managed VXLANs" on page 10.
- Create an SSL private key and certificate, and install them in the **/var/db/certs** directory of the Juniper Networks device. For more information, see "Creating and Installing an SSL Key and Certificate on a Juniper Networks Device for Connection with SDN Controllers" on page 22.

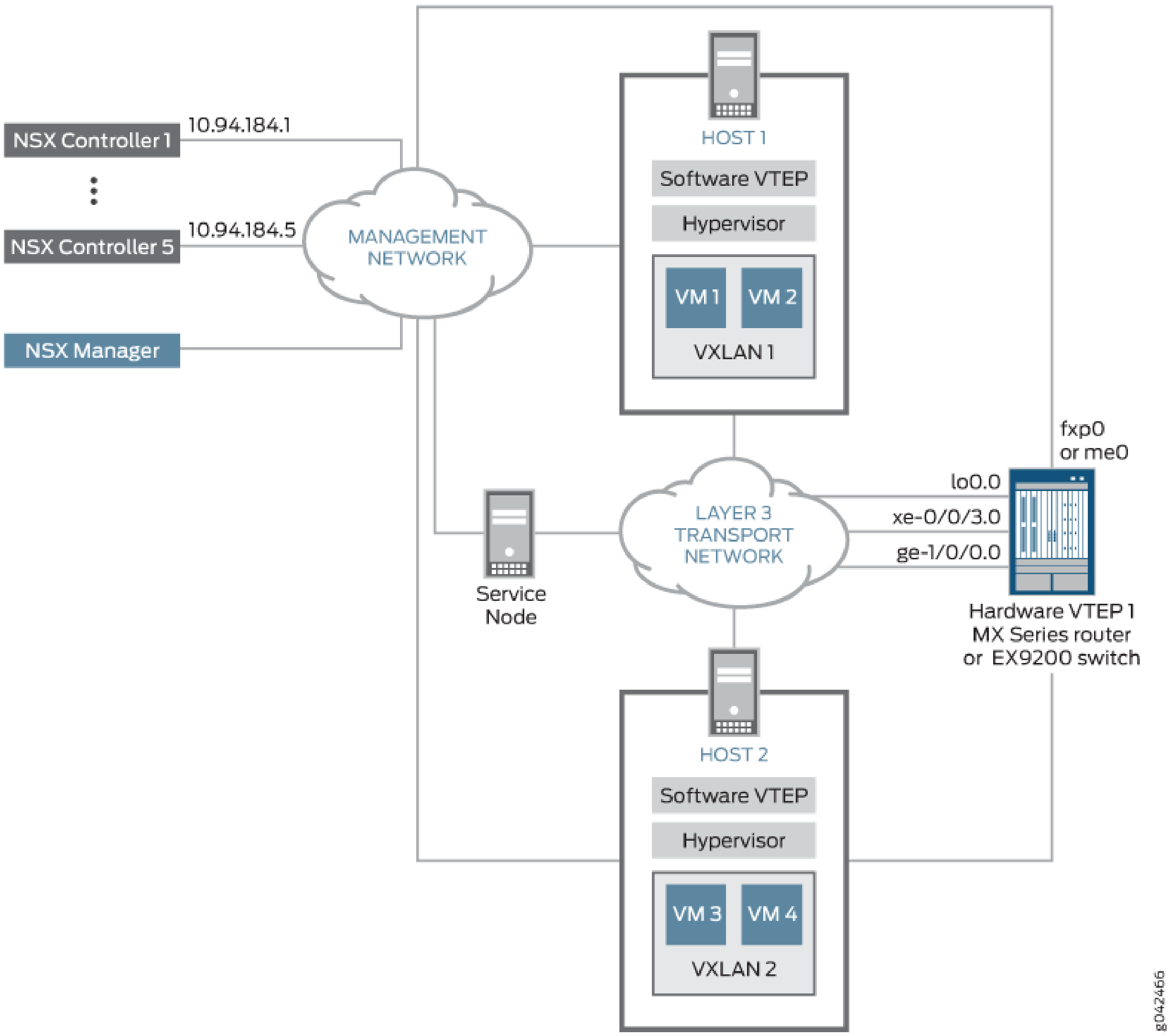
For information about using NSX Manager or the NSX API to perform these configuration tasks, see the documentation that accompanies the respective products.

Overview and Topology

IN THIS SECTION

In the topology shown in Figure 4 on page 49, VM 1 in VXLAN 1 needs to communicate with VM 3 in VXLAN 2. To enable this communication, hardware VTEP 1, which can be an MX Series router or an EX9200 switch, is configured to route VM traffic between the two VXLANs.

Figure 4: Inter-VXLAN Unicast and Multicast Routing and OVSDB Topology



On hardware VTEP 1, a routing instance (virtual switch) is set up. Within the routing instance, two VXLANs are configured: VXLAN 1 and VXLAN 2. Each VXLAN has an integrated routing and bridging (IRB) interface associated with it. The IRB interfaces handle the routing of VM unicast traffic between the VXLANs,

To handle multicast traffic between the VXLANs, each IRB interface is configured as a member of an Internet Group Management Protocol (IGMP) static group, and the MX Series router or EX9200 switch is configured to function as a PIM rendezvous point (RP) that forwards multicast traffic to each VXLAN through its associated IRB interface.

In this topology, when a multicast packet is received by a VXLAN, for example, VXLAN 1, the following packet handling occurs:

- Within VXLAN 1, the packet is handled as a Layer 2 multicast packet, which means that it is sent to the service node. The service node replicates Layer 2 multicast, as well as Layer 2 broadcast and unknown unicast, packets then forwards the replicas to all interfaces in VXLAN 1. Having the service node handle the Layer 2 BUM traffic is the default behavior, and no configuration is required for the MX Series router or the EX9200 switch.

- The IRB interface associated with VXLAN 1 sends the packet to the PIM RP, which forwards the packet to the IRB associated with VXLAN 2. The IRB interface associated with VXLAN 2 then replicates the packet and forwards the replicas to all hardware and software VTEPs that host VMs, but not to service nodes, in VXLAN 2. The ability of an IRB interface to replicate the Layer 3 multicast packets and forward the replicas to hardware and software VTEPs in a VXLAN is known as *ingress node replication*. This feature is automatically implemented and does not need to be configured.

On hardware VTEP 1, a connection with an NSX controller is configured on the management interface (fxp0 for an MX Series router and me0 for an EX9200 switch). This configuration enables the NSX controller to push MAC routes for VM 1 and VM 3 to the hardware VTEP by way of the table for remote unicast MAC addresses in the OVSDB schema for physical devices.

Each VXLAN-encapsulated packet must include a source IP address, which identifies the source hardware or software VTEP, in the outer IP header. In this example, for hardware VTEP 1, the IP address of the loopback interface (lo0.0) is used.

In this example, the tracing of all OVSDB events is configured. The output of the OVSDB events are placed in a file named **ovsdb**, which is stored in the **/var/log** directory. By default, a maximum of 10 trace files can exist, and the configured maximum size of each file is 50 MB.

Topology

Table 10 on page 50 describes the components for setting up inter-VXLAN routing and an OVSDB connection.

Table 10: Components for Setting Up Inter-VXLAN Unicast and Multicast Routing and OVSDB Connections in a Data Center

Property	Settings
Routing instance	Name: vx1 Type: virtual switch OVSDB-managed VXLANs included: VXLAN 1 and VXLAN 2

Table 10: Components for Setting Up Inter-VXLAN Unicast and Multicast Routing and OVSDB Connections in a Data Center *(Continued)*

Property	Settings
VXLAN 1	Bridge domain or VLAN associated with: 28805c1d-0122-495d-85df-19abd647d772 Interface: xe-0/0/2.0 VLAN ID: 100 VNI: 100
VXLAN 2	Bridge domain or VLAN associated with: 96a382cd-a570-4ac8-a77a-8bb8b16bde70 Interface: xe-1/2/0.0 VLAN ID: 200 VNI: 200
Inter-VXLAN unicast routing and forwarding with IRB interfaces	VXLAN 1: irb.0; 10.20.20.1/24; associated with routing interface vx1, and bridge domain or VLAN 28805c1d-0122-495d-85df-19abd647d772 VXLAN 2: irb.1; 10.10.10.3/24; associated with routing interface vx1, and bridge domain or VLAN 96a382cd-a570-4ac8-a77a-8bb8b16bde70
Inter-VXLAN multicast routing and forwarding with IRB interfaces	PIM RP: 10.19.19.19 VXLAN 1: PIM interface irb.0; IGMP static group 233.252.0.100 VXLAN 2: PIM interface irb.1; IGMP static groups 233.252.0.100 **NOTE**: On IRB interfaces that forward Layer 3 multicast traffic from one OVSDB-managed VXLAN to another, ingress node replication is automatically implemented; therefore, no configuration is required.

Table 10: Components for Setting Up Inter-VXLAN Unicast and Multicast Routing and OVSDB Connections in a Data Center *(Continued)*

Property	Settings
Handling of Layer 2 BUM traffic in each VXLAN	Service node **NOTE**: By default, one or more service nodes handle Layer 2 BUM traffic in a VXLAN; therefore, no configuration is required.
NSX controller	IP address: 10.94.184.1
Hardware VTEP source identifier	Source interface: loopback (lo0.0) Source IP address: 10.19.19.19/32
OVSDB tracing operations	Filename: /var/log/ovsdb File size: 50 MB Flag: All

Configuration

IN THIS SECTION

An MX Series router or an EX9200 switch can function as hardware VTEP 1 in this example. Because the configuration for each device is slightly different, a separate configuration is provided for each device.

To configure inter-VXLAN unicast and multicast routing and OVSDB connections in a data center topology, you need to perform one of these tasks:

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your configuration (for example, IP addresses, interface names, and UUIDs), copy and paste the commands into the CLI at the `[edit]` hierarchy level, and then enter `commit` from configuration mode.

> **NOTE**: After completing this configuration, you must configure a gateway, which is the NSX-equivalent of a hardware VTEP. This example implements one hardware VTEP; therefore, you must configure one gateway, a gateway service, and a logical switch port using NSX Manager or the NSX API. For more information about the tasks you must perform and key NSX Manager configuration details, see "VMware NSX Configuration for Juniper Networks Devices Functioning as Virtual Tunnel Endpoints" on page 28.

MX Series router configuration:

```
set chassis network-services enhanced-ip
set interfaces xe-0/0/3 unit 0 family inet address 10.50.50.2/24
set interfaces ge-1/0/0 unit 0 family inet address 10.100.100.99/24
set routing-options router-id 10.19.19.19
set protocols ospf area 0.0.0.0 interface xe-0/0/3.0
set protocols ospf area 0.0.0.0 interface ge-1/0/0.0
set protocols ospf area 0.0.0.0 interface lo0.0
set interfaces xe-0/0/2 unit 0 family bridge interface-mode access
set interfaces xe-0/0/2 unit 0 family bridge vlan-id 100
set interfaces xe-1/2/0 unit 0 family bridge interface-mode access
set interfaces xe-1/2/0 unit 0 family bridge vlan-id 200
set interfaces irb unit 0 family inet address 10.20.20.1/24
set interfaces irb unit 1 family inet address 10.10.10.3/24
set protocols igmp interface irb.0 static group 233.252.0.100
set protocols igmp interface irb.1 static group 233.252.0.100
set protocols pim rp local address 10.19.19.19
set protocols pim interface irb.0
set protocols pim interface irb.1
set routing-instances vx1 vtep-source-interface lo0.0
set routing-instances vx1 instance-type virtual-switch
set routing-instances vx1 interface xe-0/0/2.0
set routing-instances vx1 interface xe-1/2/0.0
set routing-instances vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 vlan-id 100
set routing-instances vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 routing-interface
irb.0
```

```
set routing-instances vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 vxlan ovsdb-managed
set routing-instances vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 vxlan vni 100
set routing-instances vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vlan-id 200
set routing-instances vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 routing-interface
irb.1
set routing-instances vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan ovsdb-managed
set routing-instances vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan vni 200
set interfaces lo0 unit 0 family inet address 10.19.19.19/32 primary
set interfaces lo0 unit 0 family inet address 10.19.19.19/32 preferred
set protocols ovsdb traceoptions file ovsdb
set protocols ovsdb traceoptions file size 50m
set protocols ovsdb traceoptions flag all
set protocols ovsdb controller 10.94.184.1
set protocols ovsdb interfaces xe-0/0/2.0
set protocols ovsdb interfaces xe-1/2/0.0
```

EX9200 switch configuration:

```
set interfaces xe-0/0/3 unit 0 family inet address 10.50.50.2/24
set interfaces ge-1/0/0 unit 0 family inet address 10.100.100.99/24
set routing-options router-id 10.19.19.19
set protocols ospf area 0.0.0.0 interface xe-0/0/3.0
set protocols ospf area 0.0.0.0 interface ge-1/0/0.0
set protocols ospf area 0.0.0.0 interface lo0.0
set interfaces xe-0/0/2 unit 0 family ethernet-switching interface-mode access
set interfaces xe-0/0/2 unit 0 family ethernet-switching vlan-id 100
set interfaces xe-1/2/0 unit 0 family ethernet-switching interface-mode access
set interfaces xe-1/2/0 unit 0 family ethernet-switching vlan-id 200
set interfaces irb unit 0 family inet address 10.20.20.1/24
set interfaces irb unit 1 family inet address 10.10.10.3/24
set protocols igmp interface irb.0 static group 225.1.1.100
set protocols igmp interface irb.1 static group 225.1.1.100
set protocols pim rp local address 10.19.19.19
set protocols pim interface irb.0
set protocols pim interface irb.1
set routing-instances vx1 vtep-source-interface lo0.0
set routing-instances vx1 instance-type virtual-switch
set routing-instances vx1 interface xe-0/0/2.0
set routing-instances vx1 interface xe-1/2/0.0
set routing-instances vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 vlan-id 100
set routing-instances vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 routing-interface irb.0
set routing-instances vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 vxlan ovsdb-managed
```

```
set routing-instances vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 vxlan vni 100
set routing-instances vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vlan-id 200
set routing-instances vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 routing-interface irb.1
set routing-instances vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan ovsdb-managed
set routing-instances vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan vni 200
set interfaces lo0 unit 0 family inet address 10.19.19.19/32 preferred
set interfaces lo0 unit 0 family inet address 10.19.19.19/32 primary
set protocols ovsdb traceoptions file ovsdb
set protocols ovsdb traceoptions file size 50m
set protocols ovsdb traceoptions flag all
set protocols ovsdb controller 10.94.184.1
set protocols ovsdb interfaces xe-0/0/2.0
set protocols ovsdb interfaces xe-1/2/0.0
```

Configuring an MX Series Router as a Hardware VTEP with an OVSDB Connection

Step-by-Step Procedure

To configure an MX Series router as hardware VTEP 1 with an OVSDB connection to an NSX controller, follow these steps:

1. Create the Layer 3 network.

```
[edit chassis]
user@router# set network-services enhanced-ip
[edit interfaces]
user@router# set xe-0/0/3 unit 0 family inet address 10.50.50.2/24
user@router# set ge-1/0/0 unit 0 family inet address 10.100.100.99/24
[edit routing-options]
user@router# set router-id 10.19.19.19
[edit protocols]
user@router# set ospf area 0.0.0.0 interface xe-0/0/3.0
user@router# set ospf area 0.0.0.0 interface ge-1/0/0.0
user@router# set ospf area 0.0.0.0 interface lo0.0
```

2. Create an access interface for VXLAN 1, and associate the interface with the VXLAN.

```
[edit interfaces]
user@router# set xe-0/0/2 unit 0 family bridge interface-mode access
user@router# set xe-0/0/2 unit 0 family bridge vlan-id 100
```

3. Create an access interface for VXLAN 2, and associate the interface with the VXLAN.

```
[edit interfaces]
user@router# set xe-1/2/0 unit 0 family bridge interface-mode access
user@router# set xe-1/2/0 unit 0 family bridge vlan-id 200
```

4. Create an IRB interface to handle inter-VXLAN unicast traffic for VXLAN 1.

```
[edit interfaces]
user@router# set irb unit 0 family inet address 10.20.20.1/24
```

5. Create an IRB interface to handle inter-VXLAN unicast traffic for VXLAN 2.

```
[edit interfaces]
user@router# set irb unit 1 family inet address 10.10.10.3/24
```

6. Configure PIM and IGMP to handle inter-VXLAN multicast traffic.

```
[edit protocols]
user@router# set pim rp local address 10.19.19.19
user@router# set pim interface irb.0
user@router# set pim interface irb.1
user@router# set igmp interface irb.0 static group 225.1.1.100
user@router# set igmp interface irb.1 static group 225.1.1.100
```

7. Set up the virtual switch routing instance.

```
[edit routing-instances]
user@router# set vx1 vtep-source-interface lo0.0
user@router# set vx1 instance-type virtual-switch
user@router# set vx1 interface xe-0/0/2.0
user@router# set vx1 interface xe-1/2/0.0
user@router# set vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 vlan-id 100
user@router# set vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 routing-interface
irb.0
user@router# set vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 vxlan ovsdb-
managed
user@router# set vx1 bridge-domains 28805c1d-0122-495d-85df-19abd647d772 vxlan vni 100
```

```
user@router# set vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vlan-id 200
user@router# set vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 routing-interface
irb.1
user@router# set vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan ovsdb-
managed
user@router# set vx1 bridge-domains 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan vni 200
```

8. Specify an IP address for the loopback interface. This IP address serves as the source IP address in the outer header of any VXLAN-encapsulated packets.

```
[edit interfaces]
user@router# set lo0 unit 0 family inet address 10.19.19.19/32 primary
user@router# set lo0 unit 0 family inet address 10.19.19.19/32 preferred
```

9. Set up OVSDB tracing operations.

```
[edit protocols]
user@router# set ovsdb traceoptions file ovsdb
user@router# set ovsdb traceoptions file size 50m
user@router# set ovsdb traceoptions flag all
```

10. Configure a connection with an NSX controller.

```
[edit protocols]
user@router# set ovsdb controller  10.94.184.1
```

11. Configure interfaces xe-0/0/2.0 and xe-1/2/0.0 to be managed by OVSDB.

```
[edit protocols]
user@router# set ovsdb interfaces xe-0/0/2.0
user@router# set ovsdb interfaces xe-1/2/0.0
```

NOTE: After completing this configuration, you must configure a gateway, which is the NSX-equivalent of a hardware VTEP. This example implements one hardware VTEP; therefore, you must configure one gateway, a gateway service, and a logical switch port by using NSX Manager or the NSX API. For more information about the tasks you must perform and key NSX Manager configuration details, see "VMware NSX Configuration for Juniper Networks Devices Functioning as Virtual Tunnel Endpoints" on page 28.

Configuring an EX9200 Switch as a Hardware VTEP with an OVSDB Connection

Step-by-Step Procedure

To configure an EX9200 switch as hardware VTEP 1 with an OVSDB connection to an NSX controller, follow these steps:

1. Create the Layer 3 network.

```
[edit chassis]
[edit interfaces]
user@switch# set xe-0/0/3 unit 0 family inet address 10.50.50.2/24
user@switch# set ge-1/0/0 unit 0 family inet address 10.100.100.99/24
[edit routing-options]
user@switch# set router-id 10.19.19.19
[edit protocols]
user@switch# set ospf area 0.0.0.0 interface xe-0/0/3.0
user@switch# set ospf area 0.0.0.0 interface ge-1/0/0.0
user@switch# set ospf area 0.0.0.0 interface lo0.0
```

2. Create an access interface for VXLAN 1, and associate the interface with the VXLAN.

```
[edit interfaces]
user@switch# set xe-0/0/2 unit 0 family ethernet-switching interface-mode access
user@switch# set xe-0/0/2 unit 0 family ethernet-switching vlan-id 100
```

3. Create an access interface for VXLAN 2, and associate the interface with the VXLAN.

```
[edit interfaces]
user@switch# set xe-1/2/0 unit 0 family ethernet-switching interface-mode access
user@switch# set xe-1/2/0 unit 0 family ethernet-switching vlan-id 200
```

4. Create an IRB interface to handle inter-VXLAN unicast traffic for VXLAN 1.

```
[edit interfaces]
user@switch# set irb unit 0 family inet address 10.20.20.1/24
```

5. Create an IRB interface to handle inter-VXLAN unicast traffic for VXLAN 2.

```
[edit interfaces]
user@switch# set irb unit 1 family inet address 10.10.10.3/24
```

6. Configure PIM and IGMP to handle inter-VXLAN multicast traffic.

```
[edit protocols]
user@switch# set pim rp local address 10.19.19.19
user@switch# set pim interface irb.0
user@switch# set pim interface irb.1
user@switch# set igmp interface irb.0 static group 225.1.1.100
user@switch# set igmp interface irb.1 static group 225.1.1.100
```

7. Set up the virtual switch routing instance.

```
[edit routing-instances]
user@switch# set vx1 vtep-source-interface lo0.0
user@switch# set vx1 instance-type virtual-switch
user@switch# set vx1 interface xe-0/0/2.0
user@switch# set vx1 interface xe-1/2/0.0
user@switch# set vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 vlan-id 100
user@switch# set vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 routing-interface irb.0
user@switch# set vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 vxlan ovsdb-managed
user@switch# set vx1 vlans 28805c1d-0122-495d-85df-19abd647d772 vxlan vni 100
user@switch# set vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vlan-id 200
user@switch# set vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 routing-interface irb.1
user@switch# set vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan ovsdb-managed
user@switch# set vx1 vlans 96a382cd-a570-4ac8-a77a-8bb8b16bde70 vxlan vni 200
```

8. Specify an IP address for the loopback interface. This IP address serves as the source IP address in the outer header of any VXLAN-encapsulated packets.

```
[edit interfaces]
user@switch# set lo0 unit 0 family inet address 10.19.19.19/32 primary
user@switch# set lo0 unit 0 family inet address 10.19.19.19/32 preferred
```

9. Set up tracing operations to be performed for the OVSDB management protocol.

```
[edit protocols]
user@switch# set ovsdb traceoptions file ovsdb
user@switch# set ovsdb traceoptions file size 50m
user@switch# set ovsdb traceoptions flag all
```

10. Configure a connection with an NSX controller.

```
[edit protocols]
user@switch# set ovsdb controller  10.94.184.1
```

11. Configure interfaces xe-0/0/2.0 and xe-1/2/0.0 to be managed by OVSDB.

```
[edit protocols]
user@router# set ovsdb interfaces xe-0/0/2.0
user@router# set ovsdb interfaces xe-1/2/0.0
```

NOTE: After completing this configuration, you must configure a gateway, which is the NSX-equivalent of a hardware VTEP. This example implements one hardware VTEP; therefore, you must configure one gateway, a gateway service, and a logical switch port by using NSX Manager or the NSX API. For more information about the tasks you must perform and key NSX Manager configuration details, see "VMware NSX Configuration for Juniper Networks Devices Functioning as Virtual Tunnel Endpoints" on page 28.

Verification

IN THIS SECTION

Verifying the Logical Switches

Purpose

Verify that logical switches with the UUIDs of 28805c1d-0122-495d-85df-19abd647d772 and 96a382cd-a570-4ac8-a77a-8bb8b16bde70 are configured in NSX Manager or in the NSX API, and that information about the logical switches is published in the OVSDB schema.

Action

Issue the `show ovsdb logical-switch` operational mode command.

```
user@host> show ovsdb logical-switch
Logical switch information:
Logical Switch Name: 28805c1d-0122-495d-85df-19abd647d772
Flags: Created by both
VNI: 100
Num of Remote MAC: 1
Num of Local MAC: 0
Logical Switch Name: 96a382cd-a570-4ac8-a77a-8bb8b16bde70
Flags: Created by both
VNI: 200
Num of Remote MAC: 1
Num of Local MAC: 1
```

Meaning

The output verifies that information about the logical switches is published in the OVSDB schema. The `Created by both` state indicates that the logical switches are configured in NSX Manager or the NSX API, and the corresponding VXLANs are configured on the Juniper Networks device. In this state, the logical switches and VXLANs are operational.

If the state of the logical switches is something other than `Created by both`, see "Troubleshooting a Nonoperational Logical Switch and Corresponding Junos OS OVSDB-Managed VXLAN" on page 117.

Verifying the MAC Addresses of VM 1 and VM 3

Purpose

Verify that the MAC addresses of VM 1 and VM 3 are present in the OVSDB schema.

Action

Issue the `show ovsdb mac remote` operational mode command to verify that the MAC addresses for VM 1 and VM 3 are present.

```
user@host> show ovsdb mac remote
Logical Switch Name: 28805c1d-0122-495d-85df-19abd647d772
  Mac                   IP                 Encapsulation      Vtep
  Address               Address                               Address
  08:33:9d:5f:a7:f1     0.0.0.0            Vxlan over Ipv4    10.19.19.19
Logical Switch Name: 96a382cd-a570-4ac8-a77a-8bb8b16bde70
  Mac                   IP                 Encapsulation      Vtep
  Address               Address                               Address
  a8:59:5e:f6:38:90     0.0.0.0            Vxlan over Ipv4    10.19.19.10
```

Meaning

The output shows that the MAC addresses for VM 1 and VM 3 are present and are associated with logical switches with the UUIDs of `28805c1d-0122-495d-85df-19abd647d772` and `96a382cd-a570-4ac8-a77a-8bb8b16bde70`, respectively. Given that the MAC addresses are present, VM 1 and VM 3 are reachable through hardware VTEP 1.

Verifying the NSX Controller Connection

Purpose

Verify that the connection with the NSX controller is up.

Action

Issue the `show ovsdb controller` operational mode command, and verify that the controller connection state is `up`.

```
user@host> show ovsdb controller
VTEP controller information:
Controller IP address: 10.94.184.1
Controller protocol: ssl
Controller port: 6632
Controller connection: up
Controller seconds-since-connect: 542325
Controller seconds-since-disconnect: 542346
Controller connection status: active
```

Meaning

The output shows that the connection state of the NSX controller is `up`, in addition to other information about the controller. When this connection is up, OVSDB is enabled on the Juniper Networks device.

RELATED DOCUMENTATION

Understanding How Layer 2 BUM and Layer 3 Routed Multicast Traffic Are Handled with OVSDB | 8

OVSDB Schema for Physical Devices

Example: Configuring VXLAN to VPLS Stitching with OVSDB

IN THIS SECTION

Virtual Extensible LAN (VXLAN) can be utilized with the Open vSwitch Database (OVSDB) management protocol in a VPLS-enabled network to stitch a virtualized data center into a Layer 2 VPN network. This configuration allows for seamless interconnection between different data centers using Layer 2 VPN regardless of whether it is virtualized, physical, or both.

Requirements

This example uses the following hardware and software components:

- Two MX Series routers running Junos OS 14.1R2 or later
- Two MX Series routers running Junos OS 14.1R2 or later with an OVSDB software package. The release of this package must be the same as the Junos OS release running on the device.
- One EX9200 switch
- One VMware NSX controller
- NSX Manager

Before you start the configuration, you must perform the following tasks:

- In NSX Manager or the NSX API, configure a logical switch for each VXLAN that OVSDB will manage. This example implements two OVSDB-managed VXLANs, so you must configure two logical switches. After the configuration of each logical switch, NSX automatically generates a universally unique identifier (UUID) for the logical switch. If you have not done so already, retrieve the UUID for each logical switch. A sample UUID is 28805c1d-0122-495d-85df-19abd647d772. When configuring the equivalent VXLANs on the Juniper Networks device, you must use the UUID of the logical switch as the bridge domain name.

  For more information about logical switches and VXLANs, see "Understanding How to Manually Configure OVSDB-Managed VXLANs" on page 10.

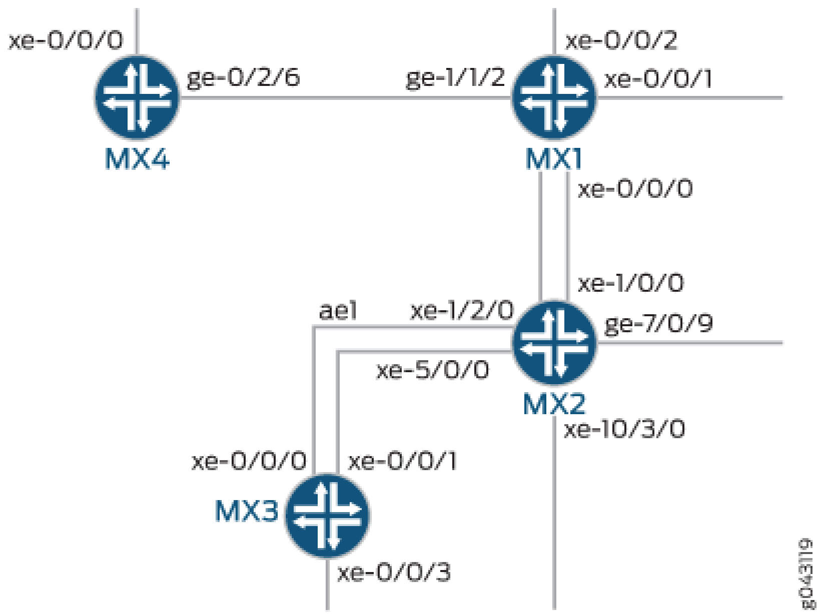
- Create an SSL private key and certificate, and install them in the `/var/db/certs` directory of the Juniper Networks device. For more information, see "Creating and Installing an SSL Key and Certificate on a Juniper Networks Device for Connection with SDN Controllers" on page 22.

Overview

IN THIS SECTION

In this example, four MX Series routers are configured to function together for VXLAN to virtual private LAN service (VPLS) stitching. Each router performs a different role in the configuration. The following diagram shows the topology of these MX Series routers. MX1 is the core router that handles Layer 3 traffic and protocols. MX2 is the VXLAN gateway router that functions as a virtual tunnel endpoint (VTEP) and handles switching for Layer 2, VPLS, and VXLAN. The MX3 router is configured to handle VPLS traffic. The MX4 router is configured as a VTEP to accept and decapsulate VXLAN packets.

Topology



Configuration

IN THIS SECTION

To configure VXLAN to VPLS stitching with OVSDB:

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your configuration, copy and paste the commands into the CLI at the [edit] hierarchy level, and then enter commit from configuration mode.

MX1

```
set interfaces lo0 unit 0 family inet address 10.255.181.13/32 primary
set interfaces ge-1/1/2 unit 0 family inet address 10.30.30.2/30
set interfaces xe-0/0/0 unit 0 family inet address 10.20.20.2/30
set protocols ospf area 0.0.0.0 interface all
```

MX2

```
set interfaces lo0 unit 0 family inet address 10.255.181.72/32 primary
set lag-options interfaces <ae*> mtu 9192
set lag-options interfaces <ae*> aggregated ether-options minimum-links 1
set chassis aggregated-devices ethernet device-count 40
set chassis fpc 1 pic 0 tunnel-services bandwidth 10g
set chassis network-services enhanced-ip
set interfaces xe-1/2/0 gigether-options 802.3ad ae1
set interfaces xe-0/0/0 unit 0 family inet address 10.20.20.1/30
set interfaces ge-7/0/9 vlan tagging
set interfaces ge-7/0/9 unit 1 vlan-id 3
set interfaces ge-7/0/9 unit 1 family vpls
set interfaces xe-10/3/0 vlan tagging
set interfaces xe-10/3/0 unit 1 vlan-id 3
set interfaces xe-10/3/0 unit 0 family vpls
set interfaces ae1 unit 0 family inet address 10.1.1.1/30
set interfaces ae1 unit 0 family mpls
set routing-options autonomous-system 100
set protocols rsvp interface all
set protocols mpls no cspf
set protocols mpls label-switched-path-to-mx3 to 10.255.181.98
set protocols mpls interface all
set protocols bgp family l2vpn signaling
set protocols bgp group ibgp type internal
set protocols bgp group ibgp neighbor 10.255.181.98 local-address 10.255.181.72
set protocols ospf area 0.0.0.0 interface xe-0/0/0.0
```

```
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ospf area 0.0.0.0 interface ae1.0
set protocols ovsdb traceoptions file ovsdb.log size 100m files 10
set protocols ovsdb traceoptions file ovsdb.level all
set protocols ovsdb traceoptions file ovsdb.flag all
set protocols ovsdb interfaces xe-10/3/0.1
set protocols ovsdb interfaces ge-7/0/9.1
set protocols ovsdb controller 192.168.182.45 protocol ssl port 6632
set routing-instances 24a76aff-7e61-4520-a78d-3eca26ad7510 vtep-source-interface lo0.0
set routing-instances 24a76aff-7e61-4520-a78d-3eca26ad7510 instance-type vpls
set routing-instances 24a76aff-7e61-4520-a78d-3eca26ad7510 vlan-id 3
set routing-instances 24a76aff-7e61-4520-a78d-3eca26ad7510 interface ge-7/0/9.1
set routing-instances 24a76aff-7e61-4520-a78d-3eca26ad7510 interface xe-10/3/0.1
set routing-instances 24a76aff-7e61-4520-a78d-3eca26ad7510 routing-interface irb.3
set routing-instances 24a76aff-7e61-4520-a78d-3eca26ad7510 vxlan ovsdb-managed
set routing-instances 24a76aff-7e61-4520-a78d-3eca26ad7510 vxlan vni 3
set routing-instances 24a76aff-7e61-4520-a78d-3eca26ad7510 route-distinguisher 10.255.181.72:3
set routing-instances 24a76aff-7e61-4520-a78d-3eca26ad7510 vrf-target target:3:3
set routing-instances 24a76aff-7e61-4520-a78d-3eca26ad7510 protocols vpls site mx2 site-
identifier 1
```

MX3

```
set interfaces lo0 unit 0 family inet address 127.0.0.1/32
set interfaces lo0 unit 0 family inet address 10.255.181.98/32 primary
set lag-options interfaces <ae*> mtu 9192
set lag-options interfaces <ae*> aggregated-ether-options minimum-links 1
set lag-options interfaces <ae*> aggregated-ether-options lacp active
set interfaces xe-0/0/0 gigether-options 802.3ad ae1
set interfaces xe-0/0/1 gigether-options 802.3ad ae1
set interfaces xe-0/0/3 vlan tagging
set interfaces xe-0/0/3 unit 1 vlan-id 3
set interfaces xe-0/0/3 unit 1 family vpls
set interfaces ae1 unit 0 family inet address 10.1.1.2/30
set interfaces ae1 unit 0 family mpls
set routing-options autonomous-system 100
set protocols rsvp interface all
set protocols mpls no-cspf
set protocols mpls label-switched-path-to-mx2 to 10.255.181.72
set protocols mpls interface all
set protocols bgp family l2vpn signaling
```

```
set protocols bgp group ibgp type internal
set protocols bgp group ibgp neighbor 10.255.181.72 local-address 10.255.181.98
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ospf area 0.0.0.0 interface ae1.0
set routing-instances vpls3 instance-type vpls
set routing-instances vpls3 vlan-id 3
set routing-instances vpls3 interface xe-0/0/3.1
set routing-instances vpls3 route-distinguisher 10.255.181.98:3
set routing-instances vpls3 vrf-target target:3:3
set routing-instances vpls3 protocols vpls no-tunnel-services
set routing-instances vpls3 protocols vpls site mx3 site-identifier 2
```

MX4

```
set interfaces lo0 unit 0 family inet address 10.255.181.43/32 primary
set interfaces xe-0/0/0 vlan-tagging
set interfaces xe-0/0/0 encapsulation flexible-ethernet-services
set interfaces xe-0/0/0 unit 0 family bridge interface-mode trunk
set interfaces xe-0/0/0 unit 0 family bridge vlan-id-list 1-10
set interfaces ge-0/2/6 unit 0 family inet address 10.30.30.1/30
set protocols ospf area 0.0.0.0 interface ge-0/2/6.0
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ovsdb traceoptions file ovsdb.log size 100m files 10
set protocols ovsdb traceoptions level all
set protocols ovsdb traceoptions flag all
set protocols ovsdb interfaces xe-0/0/0.0
set protocols ovsdb controller 192.168.182.45 protocol ssl port 6632
set routing-instances default-vs1 vtep-source-interface lo0.0
set routing-instances default-vs1 instance-type virtual-switch
set routing-instances default-vs1 interface xe-0/0/0.1
set bridge-domains 24a76aff-7e61-4520-a78d-3eca26ad7510 vlan-id 3
set bridge-domains 24a76aff-7e61-4520-a78d-3eca26ad7510 vxlan ovsdb-managed
set bridge-domains 24a76aff-7e61-4520-a78d-3eca26ad7510 vxlan vni 3
set bridge-domains 24a76aff-7e61-4520-a78d-3eca26ad7510 vxlan ingress-node-replication
set switch-options vtep-source-interface lo0.0
```

Configuring MX1

Step-by-Step Procedure

The first router to be configured is the core router. This MX Series router handles Layer 3 traffic and protocols for the rest of the network.

To configure the MX1 router:

1. Specify the IPv4 address for the loopback interface.

```
[edit interfaces]
user@MX1# set lo0 unit 0 family inet address 10.255.181.13/32 primary
```

2. Configure the Layer 3 network.

```
[edit interfaces]
user@MX1# set ge-1/1/2 unit 0 family inet address 10.30.30.2/30
user@MX1# set xe-0/0/0 unit 0 family inet address 10.20.20.2/30
```

3. Enable OSPF on all interfaces.

```
[edit protocols]
user@MX1# set ospf area 0.0.0.0 interface all
```

Configuring MX2

Step-by-Step Procedure

The second router to be configured is the VXLAN gateway router. This MX Series router is configured as a VTEP, and it handles switching for Layer 2, VPLS, and VXLAN.

To configure the MX2 router:

1. Configure interfaces for the VXLAN gateway.

```
[edit interfaces]
user@MX2# set lo0 unit 0 family inet address 10.255.181.72/32 primary
user@MX2# set xe-1/2/0 gigether-options 802.3ad ae1
user@MX2# set xe-0/0/0 unit 0 family inet address 10.20.20.1/30
```

```
user@MX2# set ge-7/0/9 vlan tagging
user@MX2# set ge-7/0/9 unit 1 vlan-id 3
user@MX2# set ge-7/0/9 unit 1 family vpls
user@MX2# set xe-10/3/0 vlan tagging
user@MX2# set xe-10/3/0 unit 1 vlan-id 3
user@MX2# set xe-10/3/0 unit 0 family vpls
user@MX2# set ae1 unit 0 family inet address 10.1.1.1/30
user@MX2# set ae1 unit 0 family mpls
```

2. Set up LAG options

```
[edit lag-options]
user@MX2# set interfaces <ae*> mtu 9192
user@MX2# set interfaces <ae*> aggregated ether-options minimum-links 1
```

3. Configure chassis settings.

```
[edit chassis]
user@MX2# set aggregated-devices ethernet device-count 40
user@MX2# set fpc 1 pic 0 tunnel-services bandwidth 10g
user@MX2# set network-services enhanced-ip
```

4. Configure routing options.

```
[edit routing-options]
user@MX2# set autonomous-system 100
```

5. Set up RSVP, MPLS, and BGP protocols.

```
[edit protocols]
user@MX2# set rsvp interface all
user@MX2# set mpls no cspf
user@MX2# set mpls label-switched-path-to-mx3 to 10.255.181.98
user@MX2# set mpls interface all
user@MX2# set bgp family l2vpn signaling
user@MX2# set bgp group ibgp type internal
user@MX2# set bgp group ibgp neighbor 10.255.181.98 local-address 10.255.181.72
```

6. Configure OSPF interface settings.

```
[edit protocols]
user@MX2# set ospf area 0.0.0.0 interface xe-0/0/0.0
user@MX2# set ospf area 0.0.0.0 interface fxp0.0 disable
user@MX2# set ospf area 0.0.0.0 interface lo0.0 passive
user@MX2# set ospf area 0.0.0.0 interface ae1.0
```

7. Set up OVSDB tracing operations.

```
[edit protocols]
user@MX2# set ovsdb traceoptions file ovsdb.log size 100m files 10
user@MX2# set ovsdb traceoptions file ovsdb.level all
user@MX2# set ovsdb traceoptions file ovsdb.flag all
```

8. Specify that interfaces xe-10/3/0.1 and ge-7/0/9.1 are managed by OVSDB.

```
[edit protocols]
user@MX2# set ovsdb interfaces xe-10/3/0.1
user@MX2# set ovsdb interfaces ge-7/0/9.1
```

9. Configure a connection with an NSX controller.

```
[edit protocols]
user@MX2# set ovsdb controller 192.168.182.45 protocol ssl port 6632
```

10. Create a VPLS routing instance with VXLAN functionality.

```
[edit routing-instances]
user@MX2# set 24a76aff-7e61-4520-a78d-3eca26ad7510 vtep-source-interface lo0.0
user@MX2# set 24a76aff-7e61-4520-a78d-3eca26ad7510 instance-type vpls
user@MX2# set 24a76aff-7e61-4520-a78d-3eca26ad7510 vlan-id 3
user@MX2# set 24a76aff-7e61-4520-a78d-3eca26ad7510 interface ge-7/0/9.1
user@MX2# set 24a76aff-7e61-4520-a78d-3eca26ad7510 interface xe-10/3/0.1
user@MX2# set 24a76aff-7e61-4520-a78d-3eca26ad7510 routing-interface irb.3
user@MX2# set 24a76aff-7e61-4520-a78d-3eca26ad7510 vxlan ovsdb-managed
user@MX2# set 24a76aff-7e61-4520-a78d-3eca26ad7510 vxlan vni 3
user@MX2# set 24a76aff-7e61-4520-a78d-3eca26ad7510 route-distinguisher 10.255.181.72:3
```

```
user@MX2# set 24a76aff-7e61-4520-a78d-3eca26ad7510 vrf-target target:3:3
user@MX2# set 24a76aff-7e61-4520-a78d-3eca26ad7510 protocols vpls site mx2 site-identifier 1
```

NOTE: After completing this configuration, you must configure a gateway, which is the NSX equivalent of a hardware VTEP. This configuration implements one hardware VTEP, so you must configure one gateway, a gateway service, and a logical switch port using NSX Manager or the NSX API. For more information about the tasks you must perform as well as key NSX Manager configuration details, see "VMware NSX Configuration for Juniper Networks Devices Functioning as Virtual Tunnel Endpoints" on page 28.

Configuring MX3

Step-by-Step Procedure

The third MX Series router must be configured to handle VPLS traffic.

To configure the MX3 router:

1. Specify the IPv4, IPv6, and ISO addresses for the loopback interface.

```
[edit interfaces]
user@MX3# set lo0 unit 0 family inet address 127.0.0.1/32
user@MX3# set lo0 unit 0 family inet address 10.255.181.98/32 primary
```

2. Configure the network interfaces.

```
[edit interfaces]
user@MX3# set xe-0/0/0 gigether-options 802.3ad ae1
user@MX3# set xe-0/0/1 gigether-options 802.3ad ae1
user@MX3# set xe-0/0/3 vlan tagging
user@MX3# set xe-0/0/3 unit 1 vlan-id 3
user@MX3# set xe-0/0/3 unit 1 family vpls
user@MX3# set ae1 unit 0 family inet address 10.1.1.2/30
user@MX3# set ae1 unit 0 family mpls
```

3. Set up LAG options

```
[edit lag-options]
user@MX3# set interfaces <ae*> mtu 9192
user@MX3# set interfaces <ae*> aggregated-ether-options minimum-links 1
user@MX3# set interfaces <ae*> aggregated-ether-options lacp active
```

4. Configure routing options.

```
[edit routing-options]
user@MX3# set autonomous-system 100
```

5. Set up RSVP, MPLS, and BGP protocols.

```
[edit protocols]
user@MX3# set rsvp interface all
user@MX3# set mpls no cspf
user@MX3# set mpls label-switched-path-to-mx2 to 10.255.181.72
user@MX3# set mpls interface all
user@MX3# set bgp family l2vpn signaling
user@MX3# set bgp group ibgp type internal
user@MX3# set bgp group ibgp neighbor 10.255.181.72 local-address 10.255.181.98
```

6. Configure OSPF interface settings.

```
[edit protocols]
user@MX3# set ospf area 0.0.0.0 interface lo0.0 passive
user@MX3# set ospf area 0.0.0.0 interface ae1.0
```

7. Create a VPLS routing instance.

```
[edit routing-instances]
set vpls3 instance-type vpls
set vpls3 vlan-id 3
set vpls3 interface xe-0/0/3.1
set vpls3 route-distinguisher 10.255.181.98:3
set vpls3 vrf-target target:3:3
```

```
set vpls3 protocols vpls no-tunnel-services
set vpls3 protocols vpls site mx3 site-identifier 2
```

Configuring MX4

Step-by-Step Procedure

The fourth MX Series router is configured as a VTEP to accept and decapsulate VXLAN packets.

To configure the MX4 router:

1. Specify the IPv4, IPv6, and ISO addresses for the loopback interface.

```
[edit interfaces]
user@MX4# set lo0 unit 0 family inet address 10.255.181.43/32 primary
```

2. Configure the interfaces.

```
[edit interfaces]
user@MX4# set xe-0/0/0 vlan-tagging
user@MX4# set xe-0/0/0 encapsulation flexible-ethernet-services
user@MX4# set xe-0/0/0 unit 0 family bridge interface-mode trunk
user@MX4# set xe-0/0/0 unit 0 family bridge vlan-id-list 1-10
user@MX4# set ge-0/2/6 unit 0 family inet address 10.30.30.1/30
```

3. Configure OSPF interface settings.

```
[edit protocols]
user@MX4# set ospf area 0.0.0.0 interface ge-0/2/6.0
user@MX4# set ospf area 0.0.0.0 interface fxp0.0 disable
user@MX4# set ospf area 0.0.0.0 interface lo0.0 passive
```

4. Set up OVSDB tracing operations.

```
[edit protocols]
user@MX4# set ovsdb traceoptions file ovsdb.log size 100m files 10
user@MX4# set ovsdb traceoptions level all
user@MX4# set ovsdb traceoptions flag all
```

5. Specify that the xe-0/0/0.0 interface is managed by OVSDB.

```
[edit protocols]
user@MX4# set ovsdb interfaces xe-0/0/0.0
```

6. Configure a connection with an NSX controller.

```
[edit protocols]
user@MX4# set ovsdb controller 192.168.182.45 protocol ssl port 6632
```

7. Configure the VPLS interface.

```
[edit routing-instances]
user@MX4# set default-vs1 vtep-source-interface lo0.0
user@MX4# set default-vs1 instance-type virtual-switch
user@MX4# set default-vs1 interface xe-0/0/0.1
```

8. Configure a set of VXLAN-enabled bridge domains.

```
[edit bridge-domains]
user@MX4# set 24a76aff-7e61-4520-a78d-3eca26ad7510 vlan-id 3
user@MX4# set 24a76aff-7e61-4520-a78d-3eca26ad7510 vxlan ovsdb-managed
user@MX4# set 24a76aff-7e61-4520-a78d-3eca26ad7510 vxlan vni 3
user@MX4# set 24a76aff-7e61-4520-a78d-3eca26ad7510 vxlan ingress-node-replication
```

9. Configure the loopback interface to be used as the tunnel source address.

```
[edit switch-options]
user@MX4# set vtep-source-interface lo0.0
```

NOTE: After completing this configuration, you must configure a gateway, which is the NSX equivalent of a hardware VTEP. This configuration implements one hardware VTEP, so you must configure one gateway, a gateway service, and a logical switch port using NSX Manager or the NSX API. For more information about the tasks you must perform as well as key NSX Manager configuration details, see “"VMware NSX Configuration for Juniper Networks Devices Functioning as Virtual Tunnel Endpoints" on page 28”.

Results

From configuration mode, confirm your configuration by entering the following commands on each router. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

Verification

IN THIS SECTION

Confirm that the configuration is working properly.

Verifying MX1

Purpose

Verify your configuration on MX1.

Action

Verify that the interfaces are configured properly.

```
user@MX1# show interface
```

```
    lo0 {
        unit 0 {
            family inet {
                address 10.255.181.13/32 {
                    primary;
                }
            }
        }
```

```
    }
ge-1/1/2 {
    unit 0 {
        family inet {
            address 10.30.30.2/30;
        }
    }
}
xe-0/0/0 {
    unit 0 {
        family inet {
            address 10.20.20.2/30;
        }
    }
}
```

Verify that OSPF is configured correctly.

```
user@MX1# show protocols
```

```
    ospf {
        area 0.0.0.0 {
            interface all;
        }
    }
```

Verifying MX2

Purpose

Verify your configuration on MX2.

Action

Verify that the interfaces are configured properly.

```
user@MX2# show interfaces
```

```
        lo0 {
            unit 0 {
                family inet {
                    address 10.255.181.72/32 {
                        primary;
                    }
                }
            }
        }
    xe-1/2/0 {
        gigether-options {
            802.3ad ae1;
        }
    }
    xe-0/0/0 {
        unit 0 {
            family inet {
                address 10.20.20.1/30;
            }
        }
    }
    ge-7/0/9 {
        vlan-tagging;
        unit 0 {
            family vpls;
        }
        unit 1 {
            vlan-id 3;
        }
    }
    xe-10/3/0 {
        vlan-tagging;
        unit 0 {
            family vpls;
        }
```

```
        unit 1 {
            vlan-id 3;
        }
    }
    ae1 {
        unit 0 {
            family inet {
                address 10.1.1.1/30;
            }
            family mpls;
        }
    }
```

Verify that OSPF is configured properly.

```
user@MX2# show protocols ospf
```

```
ospf {
    area 0.0.0.0 {
        interface xe-0/0/0.0;
        interface fxp0.0 {
            disable;
        }
        interface lo0.0 {
            passive;
        }
        interface ae1.0;
    }
}
```

Verify that OVSDB is configured properly.

```
user@MX2# show protocols ovsdb
```

```
ovsdb {
    traceoptions {
        file ovsdb.log size 100m files 10;
        level all;
        flag all;
```

```
    }
    interfaces {
        xe-10/3/0.1;
        ge-7/0/9.0;
        ge-7/0/9.1;
    }
    controller 192.168.182.45 {
        protocol {
            ssl port 6632;
        }
    }
}
```

Verify the `default-VS1` routing instance configuration.

```
user@MX2# show routing-instances
```

```
routing-instances {
    24a76aff-7e61-4520-a78d-3eca26ad7510 {
        vtep-source-interface lo0.0;
        instance-type vpls;
        vlan-id 3;
        interface ge-7/0/9.1;
        interface xe-10/3/0.1;
        routing-interface irb.3;
        vxlan {
            ovsdb-managed;
            vni 3;
            encapsulate-inner-vlan;
            decapsulate-accept-inner-vlan;
            ingress-node-replication;
        }
        route-distinguisher 10.255.181.72:3;
        vrf-target target:3:3;
        protocols {
            vpls {
                traceoptions {
                    file vpls.log;
                    flag all;
                }
                site MX2 {
```

```
                site-identifier 1;
            }
        }
    }
}
cadbc185-f60f-48a6-93fd-dc14a6420c60 {
    vtep-source-interface lo0.0;
    instance-type vpls;
    vlan-id 2;
    interface ge-7/0/9.0;
    interface xe-10/3/0.0;
    routing-interface irb.2;
    vxlan {
        ovsdb-managed;
        vni 2;
        encapsulate-inner-vlan;
        decapsulate-accept-inner-vlan;
        ingress-node-replication;
    }
    route-distinguisher 10.255.181.72:10;
    vrf-target target:10:10;
    protocols {
        vpls {
            traceoptions {
                file vpls.log;
                flag all;
            }
            site MX2 {
                site-identifier 1;
            }
        }
    }
}
vpls11 {
    vtep-source-interface lo0.1;
    instance-type vpls;
    vlan-id 11;
    interface ge-7/0/9.11;
    interface xe-10/3/0.11;
    routing-interface irb.11;
    vxlan {
        ovsdb-managed;
        vni 11;
```

```
            ingress-node-replication;
        }
        route-distinguisher 10.255.181.72:11;
        vrf-target target:11:11;
        protocols {
            vpls {
                traceoptions {
                    file vpls.log;
                    flag all;
                }
                site MX2 {
                    site-identifier 1;
                }
            }
        }
    }
    vpls12 {
        vtep-source-interface lo0.1;
        instance-type vpls;
        vlan-id 12;
        interface ge-7/0/9.12;
        interface xe-10/3/0.12;
        routing-interface irb.12;
        vxlan {
            ovsdb-managed;
            vni 12;
            ingress-node-replication;
        }
        route-distinguisher 10.255.181.72:12;
        vrf-target target:12:12;
        protocols {
            vpls {
                traceoptions {
                    file vpls.log;
                    flag all;
                }
                site mx2 {
                    site-identifier 1;
                }
            }
        }
    }
    vpls13 {
```

```
        vtep-source-interface lo0.1;
        instance-type vpls;
        vlan-id 13;
        interface ge-7/0/9.13;
        interface xe-10/3/0.13;
        routing-interface irb.13;
        vxlan {
            vni 13;
            multicast-group 233.252.0.13;
        }
        route-distinguisher 10.255.181.72:13;
        vrf-target target:13:13;
        protocols {
            vpls {
                traceoptions {
                    file vpls.log;
                    flag all;
                }
                site mx2 {
                    site-identifier 1;
                }
            }
        }
    }
    vpls14 {
        vtep-source-interface lo0.1;
        instance-type vpls;
        vlan-id 14;
        interface ge-7/0/9.14;
        interface xe-10/3/0.14;
        routing-interface irb.14;
        vxlan {
            vni 14;
            multicast-group 233.252.0.14;
        }
        route-distinguisher 10.255.181.72:14;
        vrf-target target:14:14;
        protocols {
            vpls {
                traceoptions {
                    file vpls.log;
                    flag all;
                }
```

```
                site mx2 {
                    site-identifier 1;
                }
            }
        }
    }
    vpls15 {
        vtep-source-interface lo0.1;
        instance-type vpls;
        vlan-id 15;
        interface ge-7/0/9.15;
        interface xe-10/3/0.15;
        routing-interface irb.15;
        vxlan {
            vni 15;
            multicast-group 233.252.0.15;
        }
        route-distinguisher 10.255.181.72:15;
        vrf-target target:15:15;
        protocols {
            vpls {
                traceoptions {
                    file vpls.log;
                    flag all;
                }
                site mx2 {
                    site-identifier 1;
                }
            }
        }
    }
    vpls4 {
        vtep-source-interface lo0.0;
        instance-type vpls;
        vlan-id 4;
        interface ge-7/0/9.4;
        interface xe-10/3/0.4;
        routing-interface irb.4;
        vxlan {
            vni 4;
            multicast-group 233.252.0.4;
        }
        route-distinguisher 10.255.181.72:4;
```

```
        vrf-target target:4:4;
        protocols {
            vpls {
                traceoptions {
                    file vpls.log;
                    flag all;
                }
                site mx2 {
                    site-identifier 1;
                }
            }
        }
    }
    vpls5 {
        vtep-source-interface lo0.0;
        instance-type vpls;
        vlan-id 5;
        interface ge-7/0/9.5;
        interface xe-10/3/0.5;
        routing-interface irb.5;
        vxlan {
            vni 5;
            multicast-group 233.252.0.5;
        }
        route-distinguisher 10.255.181.72:5;
        vrf-target target:5:5;
        protocols {
            vpls {
                traceoptions {
                    file vpls.log;
                    flag all;
                }
                site mx2 {
                    site-identifier 1;
                }
            }
        }
    }
    vrf1 {
        instance-type vrf;
        interface ae2.0;
        interface lo0.1;
        route-distinguisher 100:100;
```

```
        vrf-target target:100:100;
        protocols {
            ospf {
                area 0.0.0.0 {
                    interface ae2.0;
                    interface lo0.1 {
                        passive;
                    }
                }
            }
            pim {
                rp {
                    static {
                        address 10.255.181.13;
                    }
                }
                interface all;
            }
        }
    }
}
```

Verify the `vrf1` routing instance configuration.

```
user@MX2# show routing-instances
```

```
24a76aff-7e61-4520-a78d-3eca26ad7510 {
    vtep-source-interface lo0.0;
    instance-type vpls;
    vlan-id 3;
    interface ge-7/0/9.1;
    interface xe-10/3/0.1;
    routing-interface irb.3;
    vxlan {
        ovsdb-managed;
        vni 3;
    }
    route-distinguisher 10.255.181.72:3;
    vrf-target target:3:3;
    protocols {
        vpls {
```

```
            site mx2 {
                site-identifier 1;
            }
        }
    }
}
```

Verifying MX3

Purpose

Verify your configuration on MX3.

Action

Verify that the interfaces are configured properly.

```
user@MX3# show interfaces
```

```
xe-0/0/0 {
    gigether-options {
        802.3ad ae1;
    }
}
xe-0/0/1 {
    gigether-options {
        802.3ad ae1;
    }
}
xe-0/0/3 {
    vlan-tagging;
    unit 1 {
        vlan-id 3;
        family vpls;
    }
}
ae1 {
    unit 0 {
        family inet {
            address 10.1.1.2/30;
```

```
        }
        family mpls;
    }
}
```

Verify the RSVP, MPLS, BGP and OSPF protocols are configured properly.

```
user@MX3# show protocols
```

```
protocols {
    rsvp {
        interface all;
    }
    mpls {
        no-cspf;
        label-switched-path to-mx2 {
            to 10.255.181.72;
        }
        interface all;
    }
    bgp {
        family l2vpn {
            signaling;
        }
        group ibgp {
            type internal;
            neighbor 10.255.181.72 {
                local-address 10.255.181.98;
            }
        }
    }
    ospf {
        area 0.0.0.0 {
            interface lo0.0 {
                passive;
            }
            interface ae1.0;
        }
    }
}
```

Verify the VPLS routing instance configuration.

```
user@MX3# show routing-instances
```

```
routing-instances {
    vpls3 {
        instance-type vpls;
        vlan-id 3;
        interface xe-0/0/3.1;
        route-distinguisher 10.255.181.98:3;
        vrf-target target:3:3;
        protocols {
            vpls {
                no-tunnel-services;
                site mx3 {
                    site-identifier 2;
                }
            }
        }
    }
}
```

Verifying MX4

Purpose

Verify your configuration on MX4.

Action

Verify that the global group interfaces are configured properly.

```
user@MX4# show groups global interfaces
```

Verify that the interfaces are configured properly.

```
user@MX4# show interfaces
```

```
    lo0 {
        unit 0 {
            family inet {
                address 10.255.181.43/32 {
                    primary;
                }
            }
        }
    }
xe-0/0/0 {
    vlan-tagging;
    encapsulation flexible-ethernet-services;
    unit 0 {
        family bridge {
            interface-mode trunk;
            vlan-id-list 1-10;
        }
    }
}
ge-0/2/6 {
    unit 0 {
        family inet {
            address 30.30.30.1/30;
        }
    }
}
```

Verify that the OSPF interface settings are configured properly.

```
user@MX4# show protocols ospf
        area 0.0.0.0 {
            interface ge-0/2/6.0;
            interface fxp0.0 {
                disable;
            }
            interface lo0.0 {
```

```
                passive;
            }
        }
```

Verify that OVSDB is configured properly.

```
user@MX4# show protocols ovsdb
        traceoptions {
            file ovsdb.log size 100m files 10;
            level all;
            flag all;
        }
        interfaces {
            xe-0/0/0.0;
        }
        controller 192.168.182.45 {
            protocol {
                ssl port 6632;
            }
        }
```

Verify the `default-VS1` routing instance configuration and bridge domains.

```
user@MX4# show routing-instances default-VS1
        vtep-source-interface lo0.0;
        instance-type virtual-switch;
        interface xe-0/0/0.1;
```

Verify that the bridge domains are configured properly.

```
user@MX4# show bridge-domains
    24a76aff-7e61-4520-a78d-3eca26ad7510 {
        vlan-id 3;
        vxlan {
            ovsdb-managed;
            vni 3;
            ingress-node-replication;
        }
    }
```

Verify that the loopback interface is used as the tunnel source address.

```
user@MX4# show switch-options
    vtep-source-interface lo0.0;
```

RELATED DOCUMENTATION

Understanding How to Manually Configure OVSDB-Managed VXLANs | 10

Creating and Installing an SSL Key and Certificate on a Juniper Networks Device for Connection with SDN Controllers | 22

Example: Configuring Inter-VXLAN Traffic Routing from One Bridge Domain to Another Using an MX Series Router as a Layer 3 Gateway

IN THIS SECTION

You can configure an MX Series router to act as a Layer 3 gateway to route traffic in a Virtual Extensible LAN (VXLAN) domain managed by an Open vSwitch Database (OVSDB) controller such as a VMware NSX controller. Using this configuration, you can route traffic from one bridge domain to another.

Requirements

This example uses the following hardware and software components:

- An MX Series router
- Junos OS Release 17.2R1 or later
- A VMware vSphere Distributed Switch (VDS)

- Five virtual machines (VMs)
- An NSX controller
- An NSX manager
- Three servers

Overview and Topology

IN THIS SECTION

Figure 5 on page 94 shows a data center topology is shown in . A VDS provides the centralized interface for configuring, monitoring and administering virtual machine access switching. A VDS is a software switch present in the NSX compute node. Logical switches represent VXLAN in the NSX-V solution. Two logical switches are connected to this VDS. Each logical switch has its own bridge domain in the MX Series router. The logical switches support five VMs. Logical Switch 5000 supports VM4 and VM 5. Logical Switch 5001 supports VM1, VM2, and VM3. Each logical switch has its own bridge domain. Two integrated routing and bridging (IRB) interfaces are associated with these bridge domains and assist in the transfer of packets from one bridge domain to the other through the MX Series router, acting as the Layer 3 gateway. Logical Switch 5000 uses `irb.1`, and Logical Switch 5001 uses `irb.2`.

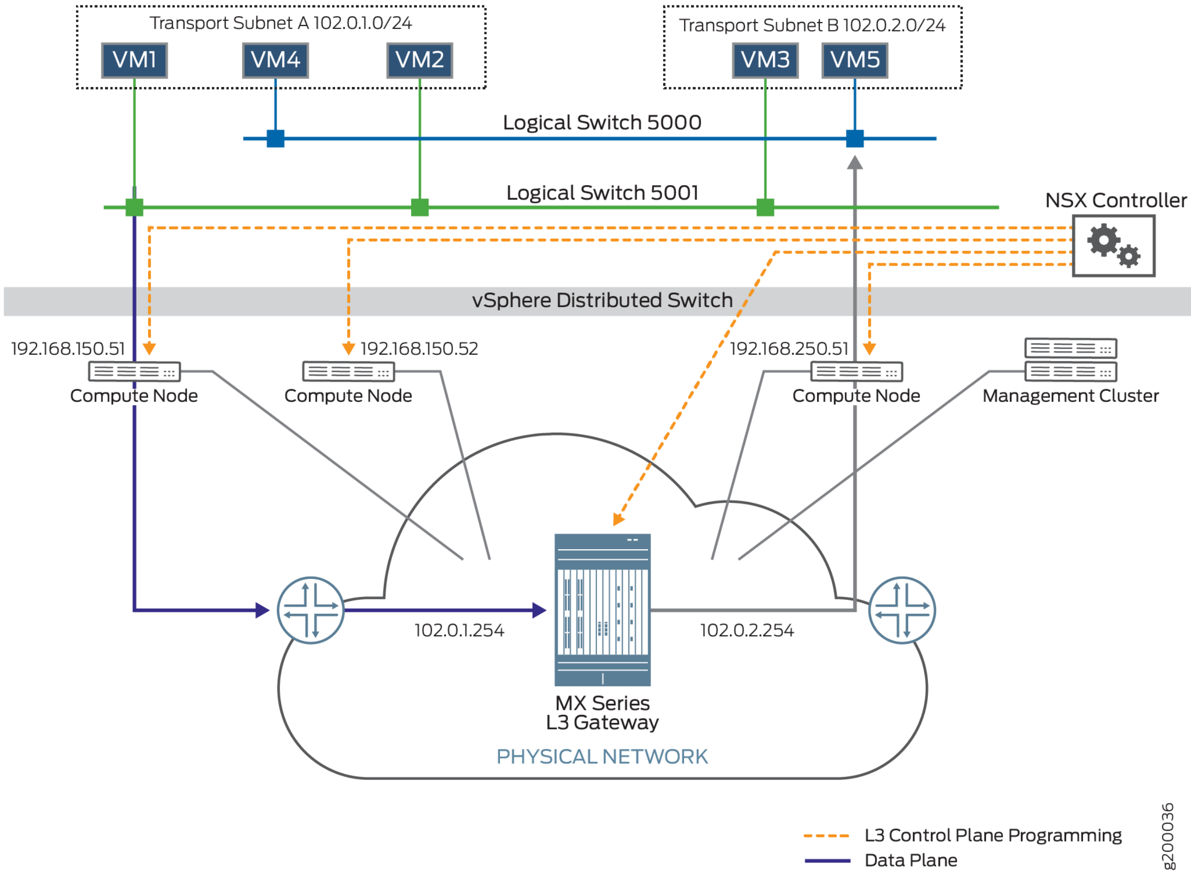
There are three servers in this data center:

- Server 192.168.150.51 supports VM1 and VM4
- Server 192.168.150.52 supports VM2
- Server 192.168.250.51 supports VM3 and VM5

The management cluster contains an NSX controller and an NSX manager. The NSX controller maintains the runtime space and distributes information to the compute nodes. When a VM is brought up on a compute node, the compute node sends information about the VM, such as MAC and IP addresses, to the NSX controller. The NSX controller then pushes this information to all the servers. The NSX manager handles the management plane, supporting the API and the configuration. The NSX manager provisions and manages the network, network services, and VXLAN preparation.

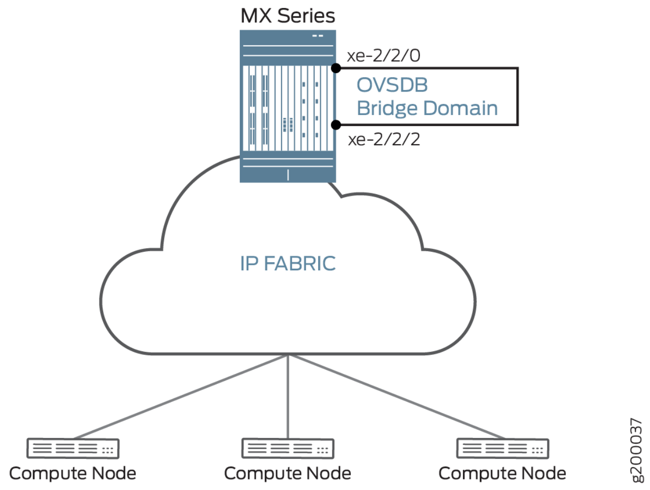
Topology

Figure 5: MX Series Router Acting as a Layer 3 Gateway



In Figure 6 on page 95, a Layer 2 port is created and looped on the MX Series router. This is done in order to bring up the IRB interfaces that map the MX Series router to the NSX controller.

Figure 6: L2 Port is Created and Looped on the MX router



In this example, VM1 will send packets to VM5 using the MX Series router to do the inter-VXLAN translation. The router removes the VXLAN5001 header, encapsulates the packet with VXLAN 5000 header information, then sends the packet to VM5. VM1 uses the router to send a packet to VM5 (in another bridge domain) because it learns this information comes from the NSX controller. All hosts learn from the NSX Controller that VM5 is in the bridge domain of Logical Switch 5000 and therefore, must go through the gateway to reach that bridge domain.

Configuration

IN THIS SECTION

Procedure

CLI Quick Configuration

To quickly configure an MX Series router to act as a Layer 3 gateway, copy the following commands and paste them into the switch terminal window:

```
set bridge-domains a35fe7f7-fe82-37b4-b69a-0af4244d1fca vlan-id 1
set bridge-domains a35fe7f7-fe82-37b4-b69a-0af4244d1fca routing-interface irb.1
set bridge-domains a35fe7f7-fe82-37b4-b69a-0af4244d1fca vxlan ovsdb-managed
```

```
set bridge-domains a35fe7f7-fe82-37b4-b69a-0af4244d1fca vxlan vni 5000
set bridge-domains 03b264c5-9540-3666-a34a-c75d828439bc vlan-id 2
set bridge-domains 03b264c5-9540-3666-a34a-c75d828439bc routing-interface irb.2
set bridge-domains 03b264c5-9540-3666-a34a-c75d828439bc ovsdb-managed
set bridge-domains 03b264c5-9540-3666-a34a-c75d828439bc vni 5001
set interfaces xe-2/0/2 flexible-vlan-tagging
set interfaces xe-2/0/2 encapsulation flexible-ethernet-services
set interfaces xe-2/0/2 unit 1 family bridge interface-mode trunk
set interfaces xe-2/0/2 unit 1 family bridge vlan-id-list 1
set interfaces xe-2/0/2 unit 2 family bridge interface-mode trunk
set interfaces xe-2/0/2 unit 2 family bridge vlan-id-list 2
set interfaces irb unit 1 family inet address 102.0.1.254/24
set interfaces irb unit 2 family inet address 102.0.2.254/24
set protocols ovsdb interfaces xe-2/0/2.1
set protocols ovsdb interfaces xe-2/0/2.2
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure an MX Series router to act as a Layer 3 gateway:

1. Specify the bridge domain configuration. The bridge domain name must be the universally unique identifier (UUID) of the logical switch created in the NSX manager (in this topology, logical switches 5000 and 5001). Use the **routing-interface** statement to specify a routing interface to include in the bridge domain. Include the Virtual Extensible LAN (VXLAN) identifier number using the **vni** statement. Add the **ovsdb-managed** statement to specify that MX router will use the *Open vSwitch Database (OVSDB)* management protocol to learn about the hardware VTEPs in the VXLAN and the MAC addresses learned by the hardware VTEPs.

   To locate the UUID number, issue the **show ovsdb logical-switch** command. The UUID number is found in the `Logical Switch Name` field:

   ```
   user@host> show ovsdb logical-switch
   Logical switch information:
   Logical Switch Name: a35fe7f7-fe82-37b4-b69a-0af4244d1fca
   Flags: Created by both
   VNI: 5000

   Logical switch information:
   ```

```
Logical Switch Name: 03b264c5-9540-3666-a34a-c75d828439bc
Flags: Created by both
VNI: 5001
```

```
[edit bridge-domains]
user@switch# set a35fe7f7-fe82-37b4-b69a-0af4244d1fca vlan-id 1
user@switch# set a35fe7f7-fe82-37b4-b69a-0af4244d1fca routing-interface irb.1
user@switch# set a35fe7f7-fe82-37b4-b69a-0af4244d1fca ovsdb-managed
user@switch# set a35fe7f7-fe82-37b4-b69a-0af4244d1fca vni 5000

[edit bridge-domains]
user@switch# set 03b264c5-9540-3666-a34a-c75d828439bc vlan-id 2
user@switch# set 03b264c5-9540-3666-a34a-c75d828439bc routing-interface irb.2
user@switch# set 03b264c5-9540-3666-a34a-c75d828439bc vxlan ovsdb-managed
user@switch# set 03b264c5-9540-3666-a34a-c75d828439bc vxlan vni 5001
```

2. Configure the Layer 2 port.

```
[edit interfaces]
user@switch# set xe-2/0/2 flexible-vlan-tagging
user@switch# set xe-2/0/2 encapsulation flexible-ethernet-services
user@switch# set xe-2/0/2 unit 1 family bridge interface-mode trunk
user@switch# set xe-2/0/2 unit 1 family bridge vlan-id-list1
user@switch# set xe-2/0/2 unit 2family bridge interface-mode trunk
user@switch# set xe-2/0/2 unit 2family bridge vlan-id-list2
```

3. Configure the IRB interfaces to route traffic between VXLAN domains

```
[edit interfaces]
user@switch# set irb unit 1 family inet address 102.0.1.254/24
user@switch# set irb unit 2family inet address 102.0.2.254/24
```

4. Configure the interfaces for the OVSDB protocol:

NOTE: The interfaces must also be configured on the NSX controller.

```
[edit protocols]
user@switch# set ovsdb interfaces xe-2/0/2.1
user@switch# set ovsdb interfaces xe-2/0/2.2
```

Results

From configuration mode, confirm your configuration by entering the `show bridge domain` command for bridge domains **a35fe7f7-fe82-37b4-b69a-0af4244d1fca** and **03b264c5-9540-3666-a34a-c75d828439bc**i:

```
[edit]
user@switch# show bridge domain a35fe7f7-fe82-37b4-b69a-0af4244d1fca
May 04 16:28:04
domain-type bridge;
vlan-id 1;
routing-interface irb.1;
vxlan {
    ovsdb-managed;
    decapsulate-accept-inner-vlan;
    vni 5000;
}

user@switch# show bridge domain 03b264c5-9540-3666-a34a-c75d828439bc
May 04 16:28:04
domain-type bridge;
vlan-id 2;
routing-interface irb.2;
vxlan {
    ovsdb-managed;
    decapsulate-accept-inner-vlan;
    vni 5001;
}
```

If you are done configuring the devices, enter **commit** from configuration mode.

Verification

IN THIS SECTION

Confirm that the configuration is working properly.

Checking the Server IP Address and the VM MAC Address

Purpose

Verify that the server IP address and the VM MAC address are correct.

Action

Issue the `show ovsdb mac logical-switch` command, and verify the server IP address and the VM MAC address being used by the bridge domain.

```
user@switch> show ovsdb mac logical-switch a35fe7f7-fe82-37b4-b69a-0af4244d1fca
May 04 16:30:01
Logical Switch Name: a35fe7f7-fe82-37b4-b69a-0af4244d1fca
  Mac                    IP                  Encapsulation      Vtep
  Address                Address                                Address
  ff:ff:ff:ff:ff:ff      0.0.0.0             Vxlan over Ipv4    10.255.178.171
  00:21:59:ad:27:f0      0.0.0.0             Vxlan over Ipv4    10.255.178.171
  00:50:56:83:cb:b3      0.0.0.0             Vxlan over Ipv4    192.168.150.51
  ff:ff:ff:ff:ff:ff      0.0.0.0             Vxlan over Ipv4    10.10.0.2
    -                                                           11.11.0.2
```

Meaning

The results displayed by the `show ovsdb mac logical-switch a35fe7f7-fe82-37b4-b69a-0af4244d1fca`, command output show the server IP address is `192.168.150.51` and the VM MAC address is `00:50:56:83:cb:b3`.

Checking the NSX Controller Connection

Purpose

Verify that the connection with the NSX controller is up.

Action

Issue the `show ovsdb controller` command, and verify that the controller connection state is `up`.

```
user@switch> show ovsdb controller
May 04 16:32:21
VTEP controller information:
Controller IP address: 25.25.25.25
Controller protocol: ssl
Controller port: 6640
Controller connection: up
Controller seconds-since-connect: 253770
Controller seconds-since-disconnect: 167262
Controller connection status: backoff

Controller IP address: 25.25.25.26
Controller protocol: ssl
Controller port: 6640
Controller connection: up
Controller seconds-since-connect: 253767
Controller seconds-since-disconnect: 167293
Controller connection status: backoff
```

Meaning

The output shows that the connection state of the NSX controller is `up`, in addition to other information about the controller. When this connection is up, OVSDB is enabled on the Juniper Networks device.

Checking the OVSDB-Managed Interfaces

Purpose

Verify the interfaces mapped to OVSDB.

Action

Issue the `show ovsdb interface` command, and verify the interfaces managed by OVSDB.

```
user@switch> show ovsdb interface
May 04 16:33:23
Interface              VLAN ID         Bridge-domain
evpn
irb.1                  0               a35fe7f7-fe82-37b4-b69a-0af4244d1fca
irb.2                  0               03b264c5-9540-3666-a34a-c75d828439bc
l3
vpls
xe-2/0/2.1             1               a35fe7f7-fe82-37b4-b69a-0af4244d1fca
xe-2/0/2.2             2               03b264c5-9540-3666-a34a-c75d828439bc
```

Meaning

The `show ovsdb interface` command shows that `irb.1` and `xe-2/0/2.1` are being managed in the `a35fe7f7-fe82-37b4-b69a-0af4244d1fca` bridge domain, and `irb.2` and `xe-2/0/2.2` are being managed in the `03b264c5-9540-3666-a34a-c75d828439bc` bridge domain.

RELATED DOCUMENTATION

OVSDB Support on Juniper Networks Devices | 2

Configuring OVSDB-Managed VXLANs | 25

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Example: Setting Up Inter-VXLAN Unicast Routing and OVSDB Connections in a Data Center | 32

Example: Setting Up Inter-VXLAN Unicast and Multicast Routing and OVSDB Connections in a Data Center | 47

Example: Passing Traffic Between Data Centers with DCI in an OVSDB-Managed Network with MX Series Routers | 102

Example: Passing Traffic Between Data Centers with DCI in an OVSDB-Managed Network with MX Series Routers

IN THIS SECTION

You can configure an MX Series 5G Universal Routing Platform to route Virtual Extensible LAN (VXLAN) traffic from a local data center in an OVSDB-managed network to a remote data center using Data Center Interconnect (DCI). DCI connects data centers in an enterprise IT environment to share resources or pass traffic between one another.

In this example, an MX Series router is used as the DCI for traffic to pass from a bridge domain in a local data center to a remote data center.

Requirements

This example uses the following hardware and software components:

- An MX Series router
- Junos OS Release 17.2R1 or later
- A VMware vSphere Distributed Switch (VDS)
- Five virtual machines (VMs)
- An NSX controller
- An NSX manager
- Three servers

Overview and Topology

IN THIS SECTION

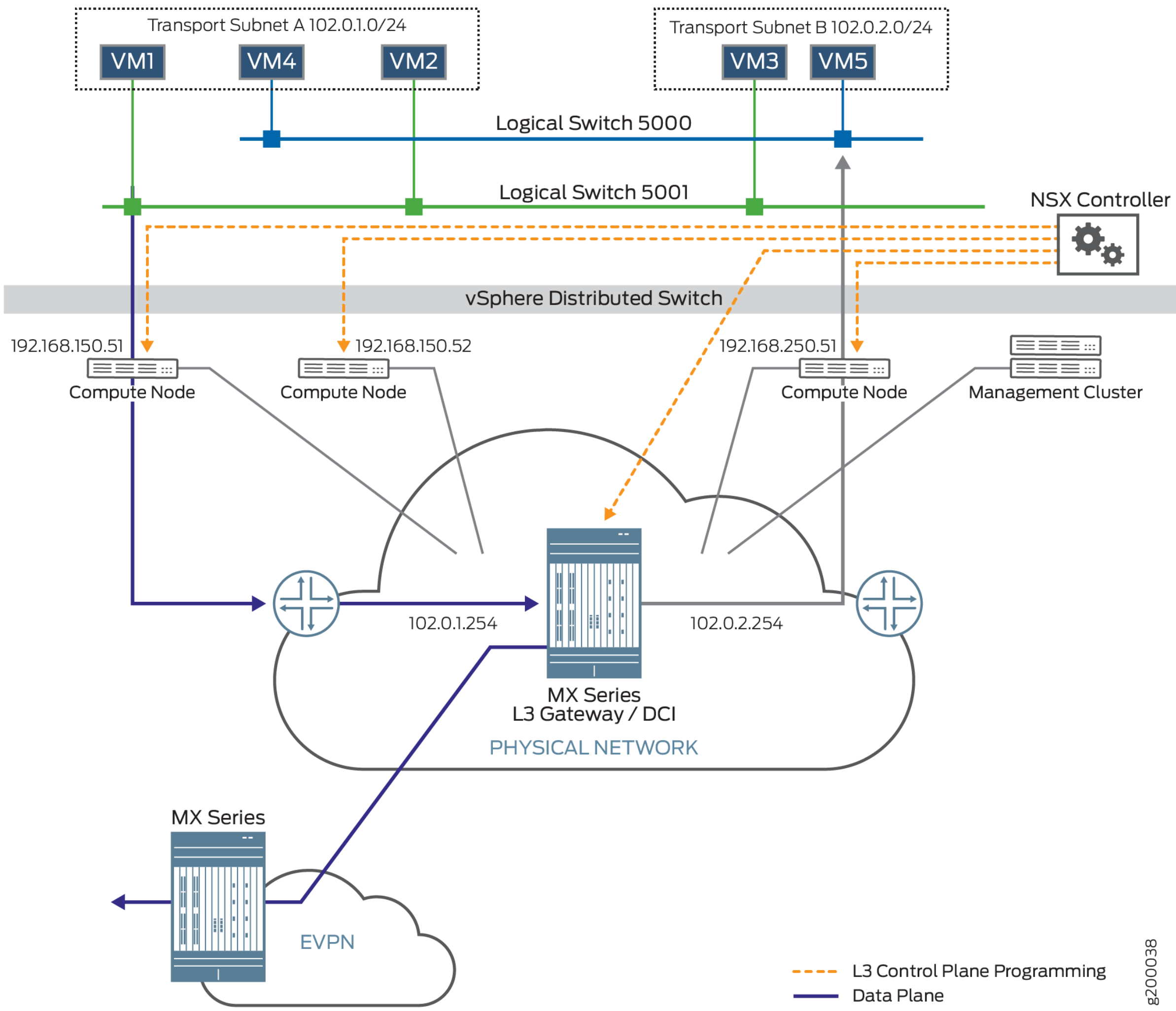
Figure 7 on page 104 shows a data center topology. A VDS provides the centralized interface for configuring, monitoring, and administering virtual machine access switching. Two logical switches are connected to this VDS. The logical switches support five VMs. Logical Switch 5000 supports VM4 and VM5. Logical Switch 5001 supports VM1, VM2, and VM3. Each logical switch has its own bridge domain. Two integrated routing and bridging (IRB) interfaces are associated with these bridge domains and assist in the transfer of packets from one bridge domain to the other through the MX Series router, acting as the Layer 3 gateway. Logical Switch 5000 uses `irb.1`, and Logical Switch 5001 uses `irb.2`.

There are three servers in this data center:

- Server 192.168.150.51 supports VM1 and VM4
- Server 192.168.150.52 supports VM2
- Server 192.168.250.51 supports VM3 and VM5

Topology

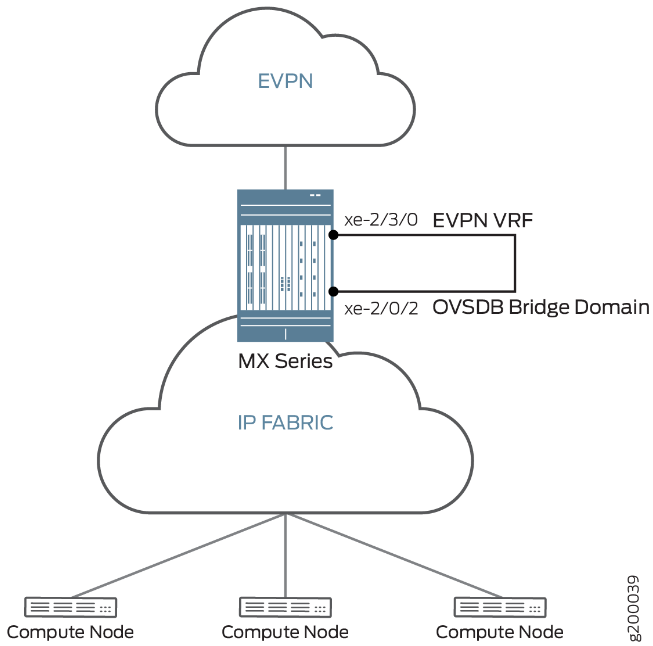
Figure 7: MX Series Router Acting as DCI



The management cluster contains an NSX controller and an NSX manager. The NSX controller maintains the runtime space and distributes information to the compute nodes. When a VM is brought up on a compute node, the compute node sends information about the VM, such as MAC and IP addresses, to the NSX controller. The NSX controller then pushes this information to all the servers. The NSX manager handles the management plane, supporting the API and the configuration. It provisions and manages the network, network services, and VXLAN preparation.

In this topology, a Layer 2 port is created and looped on the MX Series router. One end of the Layer 2 port is in the VXLAN bridge domain and the other end is in the EVPN routing instance. Figure 8 on page 105 shows interface xe-2/0/2 looped to interface xe-2/3/0. Interface xe-2/0/2 is part of the VXLAN bridge domain and interface xe-2/3/0 is part of the EVPN routing instance. Interface xe-2/0/2 ifls are also added in the NSX manager. Using this topology and configuration, the IRB interfaces that map the MX Series router to the NSX controller are brought up. Traffic travels from the local data center to the remote data center by means of a virtual routing instance.

Figure 8: Layer 2 Port Straddling VXLAN Bridge Domain and EVPN Routing Instance



In this example, VM1 sends packets from the local data center for delivery to the remote data center. The packets go through the Layer 3 gateway on the MX Series router. There the router de-encapsulates the VXLAN5001 header from the packet and sends the packet out through an EVPN to the remote data center.

Configuration

IN THIS SECTION

Procedure

CLI Quick Configuration

To quickly configure an MX Series router to act as a DCI and enable VXLAN traffic to travel from a local data center to a remote data center, copy the following commands and paste them into the switch terminal window:

```
[edit]
set bridge-domains a35fe7f7-fe82-37b4-b69a-0af4244d1fca vlan-id 1
set bridge-domains a35fe7f7-fe82-37b4-b69a-0af4244d1fca vxlan ovsdb-managed
set bridge-domains a35fe7f7-fe82-37b4-b69a-0af4244d1fca vxlan vni 5000
set bridge-domains 03b264c5-9540-3666-a34a-c75d828439bc vlan-id 2
set bridge-domains 03b264c5-9540-3666-a34a-c75d828439bc ovsdb-managed
set bridge-domains 03b264c5-9540-3666-a34a-c75d828439bc vni 5001
set interfaces xe-2/3/0 flexible-vlan-tagging
set interfaces xe-2/3/0 encapsulation flexible-ethernet-services
set interfaces xe-2/3/0 unit 1 family bridge interface-mode trunk
set interfaces xe-2/3/0 unit 1 family bridge vlan-id-list 1
set interfaces xe-2/3/0 unit 2 family bridge interface-mode trunk
set interfaces xe-2/3/0 unit 2 family bridge vlan-id-list 2
set interfaces xe-2/0/2 flexible-vlan-tagging
set interfaces xe-2/0/2 encapsulation flexible-ethernet-services
set interfaces xe-2/0/2 unit 1 family bridge interface-mode trunk
set interfaces xe-2/0/2 unit 1 family bridge vlan-id-list 1
set interfaces xe-2/0/2 unit 2 family bridge interface-mode trunk
set interfaces xe-2/0/2 unit 2 family bridge vlan-id-list 2
set interfaces irb unit 1 family inet address 102.0.1.254/24
set interfaces irb unit 2 family inet address 102.0.2.254/24
set routing-instances evpn1 instance-type virtual-switch
set routing-instances evpn1 interface xe-2/3/0.1
set routing-instances evpn1 interface xe-2/3/0.2
set routing-instances evpn1 route-distinguisher 64512:1
set routing-instances evpn1 vrf-target target:64512:1
set routing-instances evpn1 protocols evpnextended-vlan-list 1-2
set routing-instances evpn1 bridge-domains vlan1 domain-type bridge
set routing-instances evpn1 bridge-domains vlan1 vlan-id 1
set routing-instances evpn1 bridge-domains vlan1 routing-interface irb.1
set routing-instances evpn1 bridge-domains vlan2 domain-type bridge
set routing-instances evpn1 bridge-domains vlan2 vlan-id 2
set routing-instances evpn1 bridge-domains vlan2 routing-interface irb.2
```

```
set protocols ovsdb interfaces xe-2/0/2.1
set protocols ovsdb interfaces xe-2/0/2.2
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure an MX Series router as a DCI to transport traffic from a local data center to a remote data center:

1. Specify the bridge domain configuration. The bridge domain name must be the universally unique identifier (UUID) of the logical switch created in NSX manager (in this topology, logical switches 5000 and 5001). Include the VXLAN identifier number using the **vni** statement. Add the **ovsdb-managed** statement to specify that the MX Series router will use the *Open vSwitch Database (OVSDB)* management protocol to learn about the hardware VTEPs in the VXLAN and the MAC addresses learned by the hardware VTEPs.

   To locate the UUID number, issue the **show ovsdb logical-switch** command. The UUID number is found in the Logical Switch Name field.

   ```
   user@host> show ovsdb logical-switch
   Logical switch information:
   Logical Switch Name: a35fe7f7-fe82-37b4-b69a-0af4244d1fca
   Flags: Created by both
   VNI: 5000

   Logical switch information:
   Logical Switch Name: 03b264c5-9540-3666-a34a-c75d828439bc
   Flags: Created by both
   VNI: 5001

   [edit bridge-domains]
   user@switch# set a35fe7f7-fe82-37b4-b69a-0af4244d1fca vlan-id 1
   user@switch# set a35fe7f7-fe82-37b4-b69a-0af4244d1fca vxlan ovsdb-managed
   user@switch# set a35fe7f7-fe82-37b4-b69a-0af4244d1fca vxlan vni 5000
   user@switch# set 03b264c5-9540-3666-a34a-c75d828439bc vlan-id 2
   user@switch# set 03b264c5-9540-3666-a34a-c75d828439bc vxlan ovsdb-managed
   user@switch# set 03b264c5-9540-3666-a34a-c75d828439bc vxlan vni 5001
   ```

2. Configure the looped Layer 2 port.

```
[edit interfaces]
user@switch# set xe-2/3/0 flexible-vlan-tagging
user@switch# set xe-2/3/0 encapsulation flexible-ethernet-services
user@switch# set xe-2/3/0 unit 1 family bridge interface-mode trunk
user@switch# set xe-2/3/0 unit 1 family bridge vlan-id-list1
user@switch# set xe-2/3/0 unit 2family bridge interface-mode trunk
user@switch# set xe-2/3/0 unit 2family bridge vlan-id-list2
```

3. Configure the MX Series router port that is connected to the VXLAN bridge.

```
[edit interfaces]
user@switch# set xe-2/0/2 flexible-vlan-tagging
user@switch# set xe-2/0/2 encapsulation flexible-ethernet-services
user@switch# set xe-2/0/2 unit 1 family bridge interface-mode trunk
user@switch# set xe-2/0/2 unit 1 family bridge vlan-id-list1
user@switch# set xe-2/0/2 unit 2family bridge interface-mode trunk
user@switch# set xe-2/0/2 unit 2family bridge vlan-id-list2
```

4. Configure the IRB interfaces to route traffic between the VXLAN domains.

```
[edit interfaces]
user@switch# set irb unit 1 family inet address 102.0.1.254/24
user@switch# set irb unit 2family inet address 102.0.2.254/24
```

5. Configure the virtual switch routing instance to the remote data center.

```
[edit routing-instances]
user@switch# set evpn1 instance-type virtual-switch
user@switch# set evpn1 interface xe-2/3/0.1
user@switch# set evpn1 interface xe-2/3/0.2
user@switch# set evpn1 route-distinguisher 64512:1
user@switch# set evpn1 vrf-target target:64512:1
user@switch# set evpn1 protocols evpnextended-vlan-list 1-2
user@switch# set evpn1 bridge-domains vlan1 domain-type bridge
user@switch# set evpn1 bridge-domains vlan1 vlan-id 1
user@switch# set evpn1 bridge-domains vlan1 routing-interface irb.1
user@switch# set evpn1 bridge-domains vlan2 domain-type bridge
```

```
user@switch# set evpn1 bridge-domains vlan2 vlan-id 2
user@switch# set evpn1 bridge-domains vlan2 routing-interface irb.2
```

6. Configure the OVSDB protocol on the ports. You must also add these same ports as part of the logical switch in NSX manager. When they are added, NSX manager identifies which port on the MX Series router is mapped to the respective VXLAN VNI. In this case VXLAN VNI 5000 is mapped to xe-2/0/2.1 and VXLAN VNI 5001 is mapped to xe-2/0/2.2.

```
[edit protocols]
user@switch# set ovsdb interfaces xe-2/0/2.1
user@switch# set ovsdb interfaces xe-2/0/2.2
```

Results

From configuration mode, confirm your configuration by entering the `show bridge domain` command for bridge domains **a35fe7f7-fe82-37b4-b69a-0af4244d1fca** and **03b264c5-9540-3666-a34a-c75d828439bc**

```
user@switch# show bridge domain a35fe7f7-fe82-37b4-b69a-0af4244d1fca
May 04 16:27:35
domain-type bridge;
vlan-id 1;
routing-interface irb.1;
vxlan {
    ovsdb-managed;
    vni 5000;
    decapsulate-accept-inner-vlan;
    vni 5000;
}

user@switch# show bridge domain 03b264c5-9540-3666-a34a-c75d828439bc
May 04 16:28:04
domain-type bridge;
vlan-id 2;
routing-interface irb.2;
vxlan {
    ovsdb-managed;
    vni 5001;
    decapsulate-accept-inner-vlan;
```

```
    vni 5000;
}
```

If you are done configuring the devices, enter **commit** from configuration mode.

Verification

IN THIS SECTION

To confirm that the configuration is working properly, perform these tasks:

Checking the Server IP Address and the VM MAC Address

Purpose

Verify that the server IP address and the VM MAC address are correct.

Action

Issue the `show ovsdb mac logical-switch` command, and verify the server IP address and the VM MAC address being used by the bridge domain.

```
user@switch> show ovsdb mac logical-switch a35fe7f7-fe82-37b4-b69a-0af4244d1fca
May 04 16:30:01
Logical Switch Name: a35fe7f7-fe82-37b4-b69a-0af4244d1fca
  Mac                    IP                 Encapsulation      Vtep
  Address                Address                               Address
  ff:ff:ff:ff:ff:ff      0.0.0.0            Vxlan over Ipv4    10.255.178.171
  00:21:59:ad:27:f0      0.0.0.0            Vxlan over Ipv4    10.255.178.171
  00:50:56:83:cb:b3      0.0.0.0            Vxlan over Ipv4    192.168.150.51
```

```
ff:ff:ff:ff:ff:ff      0.0.0.0           Vxlan over Ipv4    10.10.0.2
  -                                                         11.11.0.2
```

Meaning

The results displayed by the `show ovsdb mac logical-switch a35fe7f7-fe82-37b4-b69a-0af4244d1fca`, command output show the server IP address is `192.168.150.51` and the VM MAC address is `00:50:56:83:cb:b3`.

Checking the NSX Controller Connection

Purpose

Verify that the connection with the NSX controller is up.

Action

Issue the `show ovsdb controller` command, and verify that the controller connection state is `up`.

```
user@switch> show ovsdb controller
May 04 16:32:21
VTEP controller information:
Controller IP address: 25.25.25.25
Controller protocol: ssl
Controller port: 6640
Controller connection: up
Controller seconds-since-connect: 253770
Controller seconds-since-disconnect: 167262
Controller connection status: backoff

Controller IP address: 25.25.25.26
Controller protocol: ssl
Controller port: 6640
Controller connection: up
Controller seconds-since-connect: 253767
Controller seconds-since-disconnect: 167293
Controller connection status: backoff
```

Meaning

The output shows that the connection state of the NSX controller is `up`, in addition to other information about the controller. When this connection is up, OVSDB is enabled on the Juniper Networks device.

Checking the OVSDB-Managed Interfaces

Purpose

Verify the interfaces mapped to OVSDB.

Action

Issue the `show ovsdb interface` command, and verify the interfaces managed by OVSDB.

```
user@switch> show ovsdb interface
May 04 16:33:23
Interface               VLAN ID         Bridge-domain
evpn
irb.1                   0               a35fe7f7-fe82-37b4-b69a-0af4244d1fca
irb.2                   0               03b264c5-9540-3666-a34a-c75d828439bc
l3
vpls
xe-2/0/2.1              1               a35fe7f7-fe82-37b4-b69a-0af4244d1fca
xe-2/0/2.2              2               03b264c5-9540-3666-a34a-c75d828439bc
```

Meaning

The `show ovsdb interface` command shows that `irb.1` and `xe-2/0/2.1` are being managed in the `a35fe7f7-fe82-37b4-b69a-0af4244d1fca` bridge domain, and `irb.2` and `xe-2/0/2.2` are being managed in the `03b264c5-9540-3666-a34a-c75d828439bc` bridge domain.

Checking the Routing Instance for the EVPN

Purpose

Verify that the IRB interfaces are configured and active for the EVPN.

Action

Issue the `show evpn instance` command, and verify the EVPN routing instance information.

```
user@switch> show evpn instance evpn1
May 11 10:56:45
                            Intfs       IRB intfs         MH      MAC addresses
Instance                    Total    Up  Total    Up  Nbrs  ESIs    Local   Remote
evpn1                           2     2      2     2     0     0        2        0
```

Issue the `show evpn database instance evpn1` command, and verify the `Active Source` information.

```
user@switch> show evpn database instance evpn1
May 11 10:58:24
Instance: evpn1
VLAN  DomainId  MAC address        Active source                  Timestamp        IP address
3               00:21:59:ad:27:f0  irb.1                          May 09 16:43:54  102.0.1.254
4               00:21:59:ad:27:f0  irb.2                          May 09 16:43:54  102.0.2.254
```

Meaning

The results displayed by the `show evpn instance evpn1` command verify the routing instance and the field `IRB intfs` shows that two IRB interfaces are up. The results displayed by the `show evpn database instance evpn1` command show that under the Active Source field, `irb.1` and `irb.2` are traffic sources.

Checking the IRBs for the EVPN Routing Instance

Purpose

Verify the IRB interfaces for the EVPN.

Action

Issue the `show evpn database instance` command, and verify the EVPN routing instance information.

```
user@switch> show evpn database instance evpn1
May 11 10:58:24
Instance: evpn1
```

```
VLAN  DomainId  MAC address        Active source                Timestamp        IP address
3               00:21:59:ad:27:f0  irb.1                        May 09 16:43:54  102.0.1.254
4               00:21:59:ad:27:f0  irb.2                        May 09 16:43:54  102.0.2.254
```

Meaning

The results displayed by the `show evpn database instance evpn1` command show the EVPN1 instance and verifies under `IRB intfs` that two IRB interfaces are up and running.

RELATED DOCUMENTATION

OVSDB Support on Juniper Networks Devices | 2

Configuring OVSDB-Managed VXLANs | 25

VMware NSX Configuration for Juniper Networks Devices Functioning as Virtual Tunnel Endpoints | 28

Example: Configuring Inter-VXLAN Traffic Routing from One Bridge Domain to Another Using an MX Series Router as a Layer 3 Gateway | 92

Example: Setting Up Inter-VXLAN Unicast Routing and OVSDB Connections in a Data Center | 32

Example: Setting Up Inter-VXLAN Unicast and Multicast Routing and OVSDB Connections in a Data Center | 47

CHAPTER 3

OVSDB Monitoring Commands

IN THIS CHAPTER

Verifying That a Logical Switch and Corresponding Junos OS OVSDB-Managed VXLAN Are Working Properly

IN THIS SECTION

Purpose

Verify the following:

- A logical switch, which is configured in an NSX environment, or a virtual network, which is configured in a Contrail environment, is learning MAC addresses in their respective environments.
- The corresponding OVSDB-managed Virtual Extensible LAN (VXLAN), which is configured on a Juniper Networks device, is learning MAC addresses in the Junos OS environment.
- The logical switch or virtual network and OVSDB-managed VXLAN are exchanging the MAC addresses learned in their respective environments so that virtual and physical servers can communicate.

Action

To verify that a logical switch or virtual network and its corresponding OVSDB-managed VXLAN are learning and exchanging MAC addresses in their respective environments, enter the `show ovsdb logical-switch` operational mode command.

```
user@device> show ovsdb logical-switch
Logical switch information:
Logical Switch Name: 28805c1d-0122-495d-85df-19abd647d772
Flags: Created by both
VNI: 100
Num of Remote MAC: 1
Num of Local MAC: 0
```

NOTE: In the Open vSwitch Database (OVSDB) schema for physical devices, the logical switch table stores information about the Layer 2 broadcast domain that you configured in a VMware NSX or Contrail environment. In the NSX environment, the Layer 2 broadcast domain is known as a *logical switch*, while in the Contrail environment, the domain is known as a *virtual network*.

In the context of the `show ovsdb logical-switch` command, the term *logical switch* refers to the logical switch or virtual network that was configured in the NSX or Contrail environments, respectively, and the corresponding configuration that was pushed to the OVSDB schema.

Meaning

The output in the Flags field (`Created by both`) indicates that the logical switch or virtual network and its corresponding OVSDB-managed VXLAN are both properly configured. In this state, the logical switch or virtual network and the VXLAN are learning and exchanging MAC addresses in their respective environments.

If the output in the Flags field displays a state other than `Created by both`, see "Troubleshooting a Nonoperational Logical Switch and Corresponding Junos OS OVSDB-Managed VXLAN" on page 117.

RELATED DOCUMENTATION

show ovsdb logical-switch

CHAPTER 4

Troubleshooting OVSDB

IN THIS CHAPTER

Troubleshooting a Nonoperational Logical Switch and Corresponding Junos OS OVSDB-Managed VXLAN

IN THIS SECTION

Problem

Description

The Flags field in the `show ovsdb logical-switch` operational mode command output is one of the following:

- `Created by Controller`
- `Created by L2ALD`
- `Tunnel key mismatch`

Cause

- If the Flags field displays `Created by Controller`, a logical switch is configured in the NSX environment or a virtual network is configured in the Contrail environment. However, an equivalent VXLAN is not configured or is improperly configured on the Juniper Networks device.
- If the Flags field displays `Created by L2ALD`, a VXLAN is configured on the Juniper Networks device. However, an equivalent logical switch is not configured in the NSX environment or an equivalent virtual network is not configured in the Contrail environment.
- If the Flags field displays `Tunnel key mismatch`, the VXLAN network identifier (VNI) specified in the logical switch configuration or the VXLAN identifier specified in the virtual network configuration do not match the VNI in the equivalent VXLAN configuration.

Solution

If the Flags field displays `Created by Controller`, take the following action:

- On a QFX Series switch, verify that the `set switch-options ovsdb-managed` configuration command was issued in the Junos OS CLI. Issuing this command and committing the configuration enable the Juniper Networks device to dynamically create OVSDB-managed VXLANs.

  Another possible cause is that the L2ALD daemon has become nonfunctional. If this is the case, wait for a few seconds, reissue the `show ovsdb logical-switch` operational mode command, and recheck the setting of the Flags field.

  Another possible cause is that the Juniper Networks device dynamically configured the VXLAN and its associated logical interface, but there is an error in the configuration of these entities themselves or in an entity that was committed in the same transaction. If there is an issue with one or more of the configurations in a transaction, all configurations in the transaction, even the ones that are correctly configured, remain uncommitted and in a queue until you troubleshoot and resolve the configuration issues. As a result, the Juniper Networks device was unable to commit all configurations in the transaction. Starting with Junos OS Release 14.1X53-D26 for QFX5100 switches, Junos OS Release 15.1X53-D210 for QFX5110 and QFX5200 switches, and 18.1R1 for QFX5210 switches, you can enter the `show ovsdb commit failures` operational mode command to determine which configurations in a transaction are erroneous. After resolving the errors, enter the `clear ovsdb commit failures` command to remove the transaction from the queue and then retry committing all configurations in the transaction. Issues that can cause commitment errors include but are not limited to the detection of the same VXLAN name or VXLAN network identifier (VNI) in a dynamically configured VXLAN and in a VXLAN that was previously configured using the Junos OS CLI.
- On all other Juniper Networks devices that support VXLAN and OVSDB, determine whether a VXLAN equivalent to the logical switch configuration or virtual network configuration exists on the

device. If the VXLAN is not configured, configure it using the procedure in "Configuring OVSDB-Managed VXLANs" on page 25. If a VXLAN is configured, check the VXLAN name to make sure that it is the same as the universally unique identifier (UUID) of the logical switch (NSX) or virtual network (Contrail) configuration. Also, check the VNI to make sure that the value is the same as the value in the logical switch (NSX) or virtual network (Contrail) configuration.

If the Flags field displays `Created by L2ALD`, take the following action:

- On a QFX Series switch, two issues exist. First, despite the fact that the Juniper Networks device dynamically creates OVSDB-managed VXLANs, this VXLAN was configured by using the Junos OS CLI. Second, a corresponding logical switch (NSX) or virtual network (Contrail) was not configured. To resolve both issues, configure a logical switch in the NSX environment or a virtual network in the Contrail environment. After the software-defined networking (SDN) controller pushes relevant logical switch or virtual network information to the Juniper Networks device, the device dynamically creates a corresponding VXLAN and deletes the VXLAN configured using the Junos OS CLI.

- On all other Juniper Networks devices that support VXLAN and OVSDB, determine whether an equivalent logical switch is configured in the NSX environment or a virtual network is configured in the Contrail environment. If a logical switch or virtual network is not configured, configure one, keeping in mind that a UUID is automatically generated for the logical switch or virtual network and that this UUID must be used as the name of the VXLAN. That is, the VXLAN name must be reconfigured with the logical switch or virtual network UUID.

  Another possibility is that the logical switch or virtual network configuration might exist, but the UUID of the entity might not match the VXLAN name. In the NSX or Contrail environment, check for a logical switch or virtual network, respectively, that has the same configuration as the VXLAN but has a different UUID.

If the Flags field displays `Tunnel key mismatch`, take the following action:

- For a QFX Series switch, check the configuration of the VNI in the NSX environment or the VXLAN identifier in the Contrail environment to see whether it was changed after the Juniper Networks device dynamically created the equivalent VXLAN. If it was changed, update the VNI on the QFX Series switch using the Junos OS CLI.

- On all other Juniper Networks devices that support VXLAN and OVSDB, check the value of the VNI in the NSX environment or the VXLAN identifier in the Contrail environment and the Junos OS CLI. Change the incorrect value.

Change History Table

Feature support is determined by the platform and release you are using. Use Feature Explorer to determine if a feature is supported on your platform.

Release	Description
14.1X53-D26	Starting with Junos OS Release 14.1X53-D26 for QFX5100 switches, Junos OS Release 15.1X53-D210 for QFX5110 and QFX5200 switches, and 18.1R1 for QFX5210 switches, you can enter the `show ovsdb commit failures` operational mode command to determine which configurations in a transaction are erroneous.

RELATED DOCUMENTATION

Understanding Dynamically Configured VXLANs in an OVSDB Environment

Understanding How to Manually Configure OVSDB-Managed VXLANs | **10**

show ovsdb logical-switch

show ovsdb commit failures

clear ovsdb commit failures

2

PART

VXLAN (Without a Controller)

CHAPTER 5

Using VXLAN Without a Controller

IN THIS CHAPTER

Understanding VXLANs

IN THIS SECTION

Virtual Extensible LAN protocol (VXLAN) technology allows networks to support more VLANs. According to the IEEE 802.1Q standard, traditional VLAN identifiers are 12 bits long—this naming limits networks to 4094 VLANs. The VXLAN protocol overcomes this limitation by using a longer logical network identifier that allows more VLANs and, therefore, more logical network isolation for large networks such as clouds that typically include many virtual machines.

VXLAN Benefits

VXLAN technology allows you to segment your networks (as VLANs do), but it provides benefits that VLANs cannot. Here are the most important benefits of using VXLANs:

- You can theoretically create as many as 16 million VXLANs in an administrative domain (as opposed to 4094 VLANs on a Juniper Networks device).
  - MX Series routers and EX9200 switches support as many as 32,000 VXLANs, 32,000 multicast groups, and 8000 virtual tunnel endpoints (VTEPs). This means that VXLANs based on MX Series routers provide network segmentation at the scale required by cloud builders to support very large numbers of tenants.
  - QFX10000 Series switches support 4000 VXLANs and 2000 remote VTEPs.
  - QFX5100, QFX5110, QFX5200, QFX5210, and EX4600 switches support 4000 VXLANs, 4000 multicast groups, and 2000 remote VTEPs.
  - EX4300-48MP switches support 4000 VXLANs.
- You can enable migration of virtual machines between servers that exist in separate Layer 2 domains by tunneling the traffic over Layer 3 networks. This functionality allows you to dynamically allocate resources within or between data centers without being constrained by Layer 2 boundaries or being forced to create large or geographically stretched Layer 2 domains.

Using VXLANs to create smaller Layer 2 domains that are connected over a Layer 3 network means that you do not need to use Spanning Tree Protocol (STP) to converge the topology but can use more robust routing protocols in the Layer 3 network instead. In the absence of STP, none of your links are blocked, which means you can get full value from all the ports that you purchase. Using routing protocols to connect your Layer 2 domains also allows you to load-balance the traffic to ensure that you get the best use of your available bandwidth. Given the amount of east-west traffic that often flows within or between data centers, maximizing your network performance for that traffic is very important.

The video *Why Use an Overlay Network in a Data Center?* presents a brief overview of the advantages of using VXLANs.

Video: Why Use an Overlay Network in a Data Center?

How Does VXLAN Work?

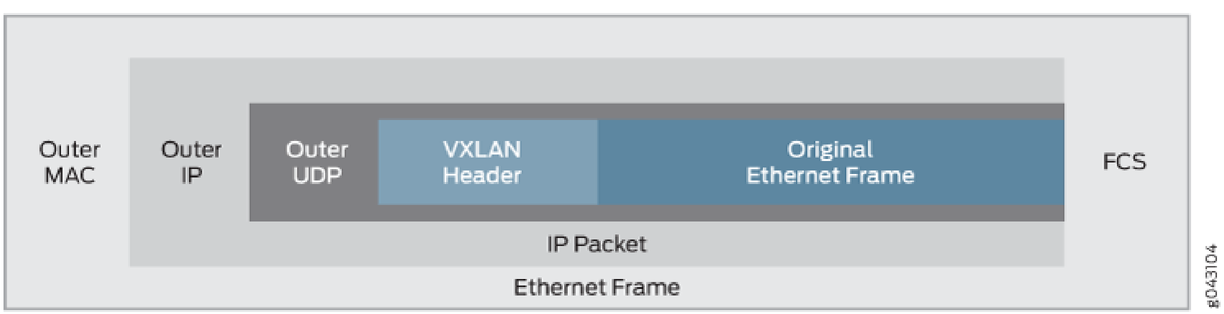
VXLAN is often described as an overlay technology because it allows you to stretch Layer 2 connections over an intervening Layer 3 network by encapsulating (tunneling) Ethernet frames in a VXLAN packet that includes IP addresses. Devices that support VXLANs are called *virtual tunnel endpoints (VTEPs)*—they can be end hosts or network switches or routers. VTEPs encapsulate VXLAN traffic and de-encapsulate that traffic when it leaves the VXLAN tunnel. To encapsulate an Ethernet frame, VTEPs add a number of fields, including the following fields:

- Outer media access control (MAC) destination address (MAC address of the tunnel endpoint VTEP)
- Outer MAC source address (MAC address of the tunnel source VTEP)
- Outer IP destination address (IP address of the tunnel endpoint VTEP)
- Outer IP source address (IP address of the tunnel source VTEP)
- Outer UDP header
- A VXLAN header that includes a 24-bit field—called the *VXLAN network identifier (VNI)*—that is used to uniquely identify the VXLAN. The VNI is similar to a VLAN ID, but having 24 bits allows you to create many more VXLANs than VLANs.

> **NOTE**: Because VXLAN adds 50 to 54 bytes of additional header information to the original Ethernet frame, you might want to increase the MTU of the underlying network. In this case, configure the MTU of the physical interfaces that participate in the VXLAN network, not the MTU of the logical VTEP source interface, which is ignored.

Figure 9 on page 124 shows the VXLAN packet format.

Figure 9: VXLAN Packet Format



VXLAN Implementation Methods

Junos OS supports implementing VXLANs in the following environments:

- Manual VXLAN—In this environment, a Juniper Networks device acts as a transit device for downstream devices acting as VTEPs, or a gateway that provides connectivity for downstream servers that host virtual machines (VMs), which communicate over a Layer 3 network. In this environment, software-defined networking (SDN) controllers are not deployed.

> **NOTE**: QFX10000 switches do not support manual VXLANs.

- OVSDB-VXLAN—In this environment, SDN controllers use the Open vSwitch Database (OVSDB) management protocol to provide a means through which controllers (such as a VMware NSX or Juniper Networks Contrail controller) and Juniper Networks devices that support OVSDB can communicate.

- EVPN-VXLAN—In this environment, Ethernet VPN (EVPN) is a control plane technology that enables hosts (physical servers and VMs) to be placed anywhere in a network and remain connected to the same logical Layer 2 overlay network, and VXLAN creates the data plane for the Layer 2 overlay network.

Using QFX5100, QFX5110, QFX5120, QFX5200, QFX5210, EX4300-48MP, and EX4600 Switches with VXLANs

You can configure the switches to perform all of the following roles:

- (All switches except EX4300-48MP) In an environment without an SDN controller, act as a transit Layer 3 switch for downstream hosts acting as VTEPs. In this configuration, you do not need to configure any VXLAN functionality on the switch. You do need to configure IGMP and PIM so that the switch can form the multicast trees for the VXLAN multicast groups. (See "Manual VXLANs Require PIM " on page 128 for more information.)

- (All switches except EX4300-48MP) In an environment with or without an SDN controller, act as a Layer 2 gateway between virtualized and nonvirtualized networks in the same data center or between data centers. For example, you can use the switch to connect a network that uses VXLANs to one that uses VLANs.

- (EX4300-48MP switches) Act as a Layer 2 gateway between virtualized and nonvirtualized networks in a campus network. For example, you can use the switch to connect a network that uses VXLANs to one that uses VLANs.

- (All switches except EX4300-48MP) Act as a Layer 2 gateway between virtualized networks in the same or different data centers and allow virtual machines to move (VMotion) between those networks and data centers. For example, if you want to allow VMotion between devices in two different networks, you can create the same VLAN in both networks and put both devices on that VLAN. The switches connected to these devices, acting as VTEPs, can map that VLAN to the same VXLAN, and the VXLAN traffic can then be routed between the two networks.

- (QFX5110 and QFX5120 switches with EVPN-VXLAN) Act as a Layer 3 gateway to route traffic between different VXLANs in the same data center.
- (QFX5110 and QFX5120 switches with EVPN-VXLAN) Act as a Layer 3 gateway to route traffic between different VXLANs in different data centers over a WAN or the Internet using standard routing protocols or virtual private LAN service (VPLS) tunnels.

NOTE: If you want a QFX5110 or QFX5120 switch to be a Layer 3 VXLAN gateway in an EVPN-VXLAN environment, you must configure integrated routing and bridging (IRB) interfaces to connect the VXLANs, just as you do if you want to route traffic between VLANs.

Because the additional headers add 50 to 54 bytes, you might need to increase the MTU on a VTEP to accommodate larger packets. For example, if the switch is using the default MTU value of 1514 bytes and you want to forward 1500-byte packets over the VXLAN, you need to increase the MTU to allow for the increased packet size caused by the additional headers.

Changing the UDP Port on QFX5100, QFX5110, QFX5200, QFX5210, and EX4600 Switches

Starting with Junos OS Release 14.1X53-D25 on QFX5100 switches, Junos OS Release 15.1X53-D210 on QFX5110 and QFX5200 switches, Junos OS Release 18.1R1 on QFX5210 switches, and Junos OS Release 18.2R1 on EX4600 switches, you can configure the UDP port used as the destination port for VXLAN traffic. To configure the VXLAN destination port to be something other than the default UDP port of 4789, enter the following statement:

```
set protocols l2-learning destination-udp-port port-number
```

The port you configure will be used for all VXLANs configured on the switch.

NOTE: If you make this change on one switch in a VXLAN, you must make the same change on all the devices that terminate the VXLANs configured on your switch. If you do not do so, traffic will be disrupted for all the VXLANs configured on your switch. When you change the UDP port, the previously learned remote VTEPs and remote MACs are lost and VXLAN traffic is disrupted until the switch relearns the remote VTEPs and remote MACs.

Controlling Transit Multicast Traffic on QFX5100, QFX5110, QFX5200, QFX5210, and EX4600 Switches

When the switch acting as a VTEP receives a broadcast, unknown unicast, or multicast packet, it performs the following actions on the packet:

1. It de-encapsulates the packet and delivers it to the locally attached hosts.

2. It then adds the VXLAN encapsulation again and sends the packet to the other VTEPs in the VXLAN.

These actions are performed by the loopback interface used as the VXLAN tunnel address and can, therefore, negatively impact the bandwidth available to the VTEP. Starting with Junos OS Release 14.1X53-D30 for QFX5100 switches, Junos OS Release 15.1X53-D210 for QFX5110 and QFX5200 switches, Junos OS Release 18.1R1 for QFX5210 switches, and Junos OS Release 18.2R1 for EX4600 switches, if you know that there are no multicast receivers attached to other VTEPs in the VXLAN that want traffic for a specific multicast group, you can reduce the processing load on the loopback interface by entering the following statement:

```
set protocols l2-learning disable-vxlan-multicast-transit vxlan-multicast-group multicast-group
```

In this case, no traffic will be forwarded for the specified group but all other multicast traffic will be forwarded. If you do not want to forward any multicast traffic to other VTEPs in the VXLAN, enter the following statement:

```
set protocols l2-learning disable-vxlan-multicast-transit vxlan-multicast-group all
```

Using an MX Series Router, EX9200 Switch, or QFX10000 Switch as a VTEP

You can configure an MX Series router, EX9200 switch, or QFX10000 switch to act as a VTEP and perform all of the following roles:

- Act as a Layer 2 gateway between virtualized and nonvirtualized networks in the same data center or between data centers. For example, you can use an MX Series router to connect a network that uses VXLANs to one that uses VLANs.

- Act as a Layer 2 gateway between virtualized networks in the same or different data centers and allow virtual machines to move (VMotion) between those networks and data centers.

- Act as a Layer 3 gateway to route traffic between different VXLANs in the same data center.

- Act as a Layer 3 gateway to route traffic between different VXLANs in different data centers over a WAN or the Internet using standard routing protocols or virtual private LAN service (VPLS) tunnels.

NOTE: If you want one of the devices described in this section to be a VXLAN Layer 3 gateway, you must configure integrated routing and bridging (IRB) interfaces to connect the VXLANs, just as you do if you want to route traffic between VLANs.

Manual VXLANs Require PIM

In an environment with a controller (such as a VMware NSX or Juniper Networks Contrail controller), you can provision VXLANs on a Juniper Networks device. A controller also provides a control plane that VTEPs use to advertise their reachability and learn about the reachability of other VTEPs. You can also manually create VXLANs on Juniper Networks devices instead of using a controller. If you use this approach, you must also configure Protocol Independent Multicast (PIM) on the VTEPs so that they can create VXLAN tunnels between themselves.

You must also configure each VTEP in a given VXLAN to be a member of the same multicast group. (If possible, you should assign a different multicast group address to each VXLAN, although this is not required. Multiple VXLANs can share the same multicast group.) The VTEPs can then forward ARP requests they receive from their connected hosts to the multicast group. The other VTEPs in the group de-encapsulate the VXLAN information, and (assuming they are members of the same VXLAN) they forward the ARP request to their connected hosts. When the target host receives the ARP request, it responds with its MAC address, and its VTEP forwards this ARP reply back to the source VTEP. Through this process, the VTEPs learn the IP addresses of the other VTEPs in the VXLAN and the MAC addresses of the hosts connected to the other VTEPs.

The multicast groups and trees are also used to forward broadcast, unknown unicast, and multicast (BUM) traffic between VTEPs. This prevents BUM traffic from being unnecessarily flooded outside the VXLAN.

NOTE: Multicast traffic that is forwarded through a VXLAN tunnel is sent only to the remote VTEPs in the VXLAN. That is, the encapsulating VTEP does not copy and send copies of the packets according to the multicast tree—it only forwards the received multicast packets to the remote VTEPs. The remote VTEPs de-encapsulate the encapsulated multicast packets and forward them to the appropriate Layer 2 interfaces.

Load Balancing VXLAN Traffic

The Layer 3 routes that form VXLAN tunnels use per-packet load balancing by default, which means that load balancing is implemented if there are ECMP paths to the remote VTEP. This is different from normal routing behavior in which per-packet load balancing is not used by default. (Normal routing uses per-prefix load balancing by default.)

The source port field in the UDP header is used to enable ECMP load balancing of the VXLAN traffic in the Layer 3 network. This field is set to a hash of the inner packet fields, which results in a variable that ECMP can use to distinguish between tunnels (flows).

None of the other fields that flow-based ECMP normally uses are suitable for use with VXLANs. All tunnels between the same two VTEPs have the same outer source and destination IP addresses, and the UDP destination port is set to port 4789 by definition. Therefore, none of these fields provide a sufficient way for ECMP to differentiate flows.

Enabling QFX5120 Switches to Tunnel Traffic on Core-Facing Layer 3 Tagged and IRB Interfaces

NOTE: This section applies only to QFX5120 switches running Junos OS Releases 18.4R1, 18.4R2, 18.4R2-S1 through 18.4R2-S3, 19.1R1, 19.1R2, 19.2R*x*, and 19.3R*x*.

When a QFX5120 switch attempts to tunnel traffic on core-facing Layer 3 tagged interfaces or IRB interfaces, the switch drops the packets. To avoid this issue, you can configure a simple two-term filter-based firewall on the Layer 3 tagged or IRB interface.

NOTE: QFX5120 switches support a maximum of 256 two-term filter-based firewalls.

For example:

```
set interfaces et-0/0/3 unit 0 family inet filter input vxlan100
set firewall family inet filter vxlan100 term 1 from destination-address 192.168.0.1/24 then
accept
set firewall family inet filter vxlan100 term 2 then routing-instance route1
```

Term 1 matches and accepts traffic that is destined for the QFX5210 switch, which is identified by the source VTEP IP address (192.168.0.1/24) assigned to the switch's loopback interface. For term 1, note that when specifying an action, you can alternatively count traffic instead of accepting it.

Term 2 matches and forwards all other data traffic to a routing instance (route 1), which is configured interface et-0/0/3.

In this example, note that interface et-0/0/3 is referenced by routing instance route1. As a result, you must include the `set firewall family inet filter vxlan100 term 2 then routing-instance route1` command. Without this command, the firewall filter will not work properly.

Using ping and traceroute with a VXLAN

On QFX5100 and QFX5110 switches, you can use the `ping` and `traceroute` commands to troubleshoot traffic flow through a VXLAN tunnel by including the `overlay` parameter and various options. You use these options to force the `ping` or `traceroute` packets to follow the same path as data packets through the VXLAN tunnel. In other words, you make the underlay packets (`ping` and `traceroute`) take the same route as the overlay packets (data traffic). See *ping overlay* and *traceroute overlay* for more information.

Supported VXLAN Standards

RFCs and Internet drafts that define standards for VXLAN:

- RFC 7348, *Virtual eXtensible Local Area Network (VXLAN): A Framework for Overlaying Virtualized Layer 2 Networks over Layer 3 Networks*
- Internet draft draft-ietf-nvo3-vxlan-gpe, *Generic Protocol Extension for VXLAN*

Change History Table

Feature support is determined by the platform and release you are using. Use Feature Explorer to determine if a feature is supported on your platform.

Release	Description
14.1X53-D30	Starting with Junos OS Release 14.1X53-D30 for QFX5100 switches, Junos OS Release 15.1X53-D210 for QFX5110 and QFX5200 switches, Junos OS Release 18.1R1 for QFX5210 switches, and Junos OS Release 18.2R1 for EX4600 switches, if you know that there are no multicast receivers attached to other VTEPs in the VXLAN that want traffic for a specific multicast group, you can reduce the processing load on the loopback interface
14.1X53-D25	Starting with Junos OS Release 14.1X53-D25 on QFX5100 switches, Junos OS Release 15.1X53-D210 on QFX5110 and QFX5200 switches, Junos OS Release 18.1R1 on QFX5210 switches, and Junos OS Release 18.2R1 on EX4600 switches, you can configure the UDP port used as the destination port for VXLAN traffic.

RELATED DOCUMENTATION

Examples: Manually Configuring VXLANs on QFX Series and EX4600 Switches

Understanding EVPN with VXLAN Data Plane Encapsulation

OVSDB Support on Juniper Networks Devices | 2

mtu (QFX Series)

PIM NSR and Unified ISSU Support for VXLAN Overview

Starting in Junos OS Release 16.2R1, Protocol Independent Multicast (PIM) nonstop active routing (NSR) support for Virtual Extensible LAN (VXLAN) is supported on MX Series routers.

The Layer 2 address learning daemon (l2ald) passes VXLAN parameters (VXLAN multicast group addresses and the source interface for a VXLAN tunnel [`vtep-source-interface`]) to the routing protocol process on the primary Routing Engine. The routing protocol process forms PIM joins with the multicast routes through the pseudo-VXLAN interface based on these configuration details.

Because the l2ald daemon does not run on the backup Routing Engine, the configured parameters are not available to the routing protocol process in the backup Routing Engine when NSR is enabled. The PIM NSR mirroring mechanism provides the VXLAN configuration details to the backup Routing Engine, which enables creation of the required states. The routing protocol process matches the multicast routes on the backup Routing Engine with PIM states, which maintains the multicast routes in the Forwarding state.

In response to Routing Engine switchover, the multicast routes remain in the Forwarding state on the new primary Routing Engine. This prevents traffic loss during Routing Engine switchover. When the l2ald process becomes active, it refreshes VXLAN configuration parameters to PIM.

> **NOTE**: For this feature, NSR support is available for VXLAN in PIM sparse mode.

This feature does not introduce any new CLI commands. You can issue the following `show` commands on the backup Routing Engine to monitor the PIM joins and multicast routes on the backup Routing Engine:

- `show pim join extensive`
- `show multicast route extensive`

Unified ISSU Support

Starting in Junos OS Release 17.2 R1, unified in-service software upgrade is supported for VXLAN using PIM on MX Series routers. ISSU enables you to upgrade your Junos OS software on your MX Series router with no disruption on the control plane and with minimal disruption of traffic. Unified ISSU is supported only on dual Routing Engine platforms. The graceful Routing Engine switchover (GRES) and nonstop active routing (NSR) features must both be enabled. Unified ISSU allows you to eliminate network downtime, reduce operating costs, and deliver higher levels of services. See Getting Started with Unified In-Service Software Upgrade.

> **NOTE**: Unified ISSU is not supported on the QFX series switches.

To enable GRES, include the `graceful-switchover` statement at the `[edit chassis redundancy]` hierarchy level.

To enable NSR, include the `nonstop-routing` statement at the `[edit routing-options]` hierarchy level and the `commit synchronize` statement at the `[edit system]` hierarchy level.

Change History Table

Feature support is determined by the platform and release you are using. Use Feature Explorer to determine if a feature is supported on your platform.

Release	Description
17.2R1	Starting in Junos OS Release 17.2 R1, unified in-service software upgrade is supported for VXLAN using PIM on MX Series routers.
16.2R1	Starting in Junos OS Release 16.2R1, Protocol Independent Multicast (PIM) nonstop active routing (NSR) support for Virtual Extensible LAN (VXLAN) is supported on MX Series routers.

RELATED DOCUMENTATION

show pim join

show multicast route

Understanding Graceful Routing Engine Switchover

Example: Manually Configuring VXLANs on MX Series Routers

IN THIS SECTION

Virtual Extensible Local Area Network (VXLAN) is a Layer 3 encapsulation protocol that enables MX Series routers to push Layer 2 or Layer 3 packets through a VXLAN tunnel to a virtualized data center or the Internet. Communication is established between two virtual tunnel endpoints (VTEPs). VTEPs encapsulate the virtual machine traffic into a VXLAN header and strip off the encapsulation.

This example shows how to configure VXLAN on MX Series routers using switch options in a default bridge domain.

Requirements

This example uses the following hardware and software components:

- An MX Series router
- A VXLAN capable peer router
- Junos OS Release 14.1

Overview

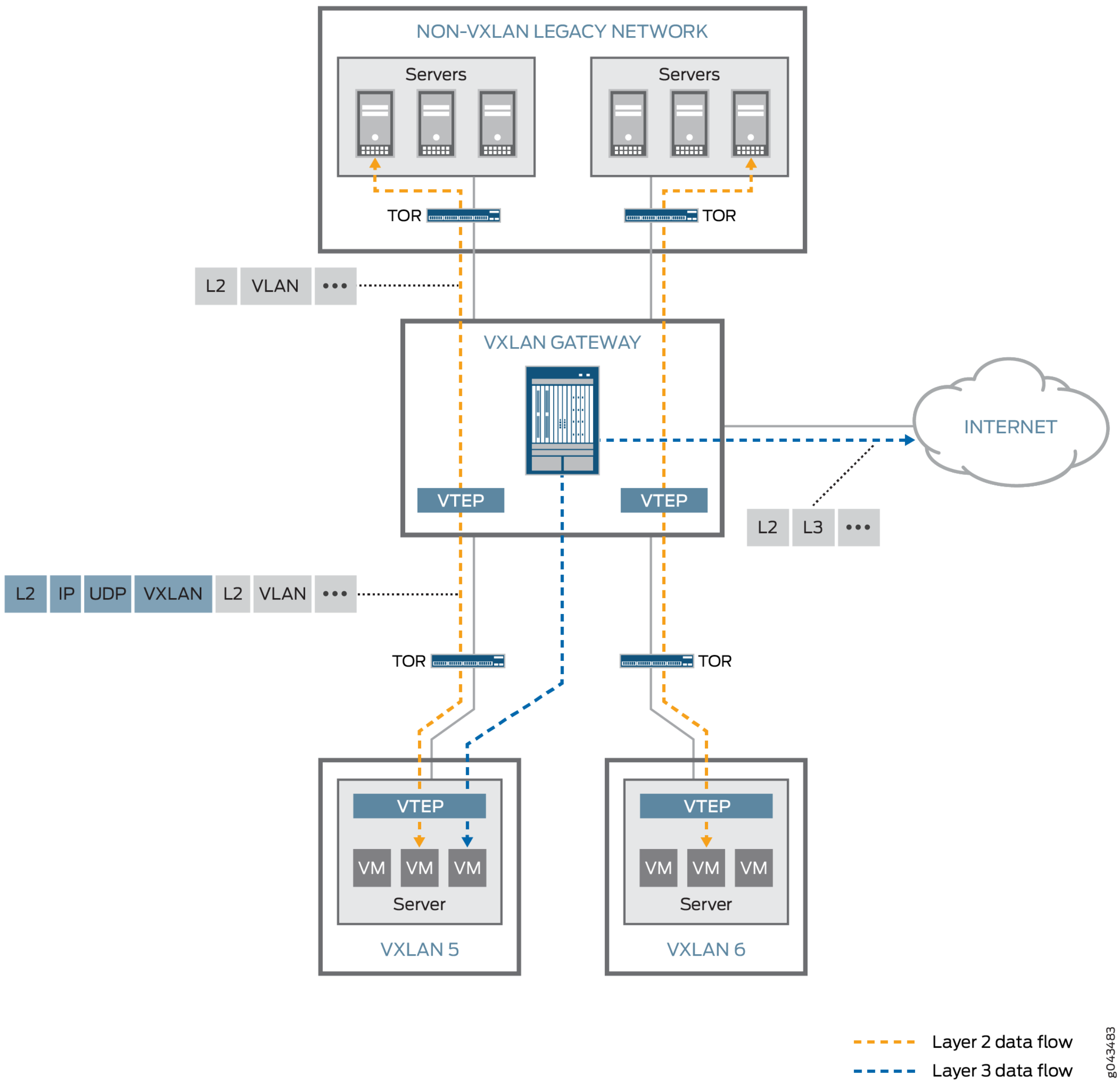
IN THIS SECTION

In this example, VXLAN is configured to run on a default bridge domain. VTEP interfaces sources are configured to the loopback address, and VLAN groups are configured under bridge domains with VXLAN enabled. Interfaces are configured for VLAN tagging and encapsulation, and IRB is enabled. OSPF and PIM protocols are configured to facilitate unicast and multicast routing. The chassis is configured for GRES and enhanced IP services.

NOTE: We support static VXLAN and OVSDB-VXLAN with an IPv4 underlay. You configure the VTEP source interface as the loopback interface with an IPv4 address. We support an IPv6 underlay (the VTEP source interface as the loopback interface with an IPv6 address) only with EVPN-VXLAN configurations.

Topology

Figure 10: VXLAN Topology



Configuring VXLAN on MX Series Routers

IN THIS SECTION

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the `[edit]` hierarchy level.

```
set switch-options vtep-source-interface lo0.0
set bridge-domains vlan-5 vxlan vni 100
set bridge-domains vlan-5 vxlan multicast-group 233.252.0.1
set bridge-domains vlan-5 vlan-id 100
set bridge-domains vlan-5 routing-interface irb.0
set bridge-domains vlan-5 interface xe-1/0/0.0
set bridge-domains vlan-6 vxlan vni 200
set bridge-domains vlan-6 vxlan multicast-group 233.252.0.1
set bridge-domains vlan-6 vlan-id 200
set bridge-domains vlan-6 routing-interface irb.1
set bridge-domains vlan-6 interface xe-2/0/0.0
set interfaces xe-1/0/0 vlan-tagging
set interfaces xe-1/0/0 encapsulation flexible-ethernet-services
set interfaces xe-1/0/0 unit 0 encapsulation vlan-bridge
set interfaces xe-1/0/0 unit 0 vlan-id 100
set interfaces xe-2/0/0 vlan-tagging
set interfaces xe-2/0/0 encapsulation flexible-ethernet-services
set interfaces xe-2/0/0 unit 0 encapsulation vlan-bridge
set interfaces xe-2/0/0 unit 0 vlan-id 200
set interface irb unit 0 family inet address 10.5.5.1/24
set interface irb unit 1 family inet address 10.6.6.1/24
set interfaces lo0 unit 0 family inet address 10.3.3.3/32
set protocols ospf area 0.0.0.0 interface ge-8/3/8.0
set protocols ospf area 0.0.0.0 interface lo0.0
```

```
set protocols ospf area 0.0.0.0 interface xe-0/1/3.0
set protocols ospf area 0.0.0.0 interface ge-8/3/2.0
set protocols pim rp static address 10.2.1.3
set protocols pim interface lo0.0 mode bidirectional-sparse
set protocols pim interface ge-8/3/8.0 mode bidirectional-sparse
set protocols pim interface xe-0/1/3.0 mode bidirectional-sparse
set protocols pim interface ge-8/3/2.0 mode bidirectional-sparse
set chassis redundancy graceful-switchover
set chassis aggregated-devices ethernet device-count 10
set chassis fpc 1 pic 0 tunnel-services bandwidth 10g
set chassis network-services enhanced-ip
```

Configuring VXLAN

Step-by-Step Procedure

The following example show how to set up a basic VXLAN configuration with default bridge domains and switch options. To configure VXLAN on an MX Series router, follow these steps:

1. Configure VTEP interface sources under `switch-options` for the default-switch.

```
[edit]
user@router# set switch-options vtep-source-interface lo0.0
```

2. Set up a VLAN group named `vlan-5` and set its VXLAN Network Identifier (VNI) to 100.

```
[edit]
user@router# set bridge-domains vlan-5 vxlan vni 100
```

3. Configure the `vlan-5` multicast group address for VXLAN.

```
[edit]
user@router# set bridge-domains vlan-5 vxlan multicast-group 233.252.0.1
```

4. Set the VLAN ID to 100 for `vlan-5`.

```
[edit]
user@router# set bridge-domains vlan-5 vlan-id 100
```

5. Configure integrated bridging and routing (IRB) for `vlan-5`.

```
[edit]
user@router# set bridge-domains vlan-5 routing-interface irb.0
```

6. Assign the xe-1/0/0.0 interface to `vlan-5`.

```
[edit]
user@router# set bridge-domains vlan-5 interface xe-1/0/0.0
```

7. Set up a VLAN group named `vlan-6` and set its VXLAN Network Identifier (VNI) to 200.

```
[edit]
user@router# set bridge-domains vlan-6 vxlan vni 200
```

8. Configure the `vlan-6` multicast group address for VXLAN.

```
[edit]
user@router# set bridge-domains vlan-6 vxlan multicast-group 233.252.0.1
```

9. Set the VLAN ID to 200 for `vlan-6`.

```
[edit]
user@router# set bridge-domains vlan-6 vlan-id 200
```

10. Configure IRB for `vlan-6`.

```
[edit]
user@router# set bridge-domains vlan-6 routing-interface irb.1
```

11. Assign the xe-2/0/0.0 interface to `vlan-6`.

```
[edit]
user@router# set bridge-domains vlan-6 interface xe-2/0/0.0
```

12. Set up VLAN tagging for xe-1/0/0.

```
[edit]
user@router# set interfaces xe-1/0/0 vlan-tagging
```

13. Configure flexible Ethernet service encapsulation on xe-1/0/0.

```
[edit]
user@router# set interfaces xe-1/0/0 encapsulation flexible-ethernet-services
```

14. Set up VLAN bridging encapsulation for xe-1/0/0 unit 0˙.

```
[edit]
user@router# set interfaces xe-1/0/0 unit 0 encapsulation vlan-bridge
```

15. Set the xe-1/0/0 unit 0 VLAN ID to 100.

```
[edit]
user@router# set interfaces xe-1/0/0 unit 0 vlan-id 100
```

16. Configure VLAN tagging for xe-2/0/0

```
[edit]
user@router# set interfaces xe-2/0/0 vlan-tagging
```

17. Set up flexible Ethernet service encapsulation on xe-2/0/0.

```
[edit]
user@router# set interfaces xe-2/0/0 encapsulation flexible-ethernet-services
```

18. Configure VLAN bridging encapsulation for xe-2/0/0 unit 0˙.

```
[edit]
user@router# set interfaces xe-2/0/0 unit 0 encapsulation vlan-bridge
```

19. Set the xe-2/0/0 unit 0 VLAN ID to 200.

```
[edit]
user@router# set interfaces xe-2/0/0 unit 0 vlan-id 200
```

20. Configure the IRB unit 0 family inet address.

```
[edit]
user@router# set interface irb unit 0 family inet address 10.5.5.1/24
```

21. Configure the IRB unit 1 family inet address.

```
[edit]
user@router# set interface irb unit 1 family inet address 10.6.6.1/24
```

22. Set the family inet address for the loopback unit 0.

```
[edit]
user@router# set interfaces lo0 unit 0 family inet address 10.3.3.3/32
```

23. Set up OSPF for the ge-8/3/8.0 interface.

```
[edit]
user@router# set protocols ospf area 0.0.0.0 interface ge-8/3/8.0
```

24. Configure OSPF for the loopback interface.

```
[edit]
user@router# set protocols ospf area 0.0.0.0 interface lo0.0
```

25. Set up OSPF for the xe-0/1/3.0 interface.

```
[edit]
user@router# set protocols ospf area 0.0.0.0 interface xe-0/1/3.0
```

26. Configure OSPF for the ge-8/3/2.0 interface.

```
[edit]
user@router# set protocols ospf area 0.0.0.0 interface ge-8/3/2.0
```

27. Set up the static address for the protocol independent multicast (PIM) rendezvous point (RP).

```
[edit]
user@router# set protocols pim rp static address 10.2.1.3
```

28. Configure the loopback interface to bidirectional sparse mode for the PIM protocol.

```
[edit]
user@router# set protocols pim interface lo0.0 mode bidirectional-sparse
```

29. Set the ge-8/3/8.0 interface to bidirectional sparse mode for the PIM protocol.

```
[edit]
user@router# set protocols pim interface ge-8/3/8.0 mode bidirectional-sparse
```

30. Configure the xe-0/1/3.0 interface to bidirectional sparse mode for the PIM protocol.

```
[edit]
user@router# set protocols pim interface xe-0/1/3.0 mode bidirectional-sparse
```

31. Set the ge-8/3/2.0 interface to bidirectional sparse mode for the PIM protocol.

```
[edit]
user@router# set protocols pim interface ge-8/3/2.0 mode bidirectional-sparse
```

32. Configure redundant graceful switchover on the chassis.

```
[edit]
user@router# set chassis redundancy graceful-switchover
```

33. Set the aggregated ethernet device count to 10.

```
[edit]
user@router# set chassis aggregated-devices ethernet device-count 10
```

34. Configure the tunnel services bandwidth for FPC 1/PIC 0.

```
[edit]
user@router# set chassis fpc 1 pic 0 tunnel-services bandwidth 10g
```

35. Enable enhanced IP for network services on the chassis.

```
[edit]
user@router# set chassis network-services enhanced-ip
```

Results

From configuration mode, confirm your configuration by entering the following commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@router# show switch-options
```

```
switch-options {
    vtep-source-interface lo0.0;
}
```

```
user@router# show bridge-domains
```

```
bridge-domains {
    vlan-5 {
        vxlan {
            vni              100;
            multicast-group      233.252.0.1;
        }
```

```
        vlan-id             100;
        routing-interface   irb.0;
        interface           xe-1/0/0.0;
    }
    vlan-6 {
        vxlan {
            vni             200;
            multicast-group     233.252.0.1;
        }
        vlan-id             200;
        routing-interface   irb.1;
        interface           xe-2/0/0.0;
    }
}
```

```
user@router# show interfaces
```

```
interfaces {
    xe-1/0/0 {
        vlan-tagging;
        encapsulation flexible-ethernet-services;
        unit 0 {
            encapsulation vlan-bridge;
            vlan-id 100;
        }
    }
    xe-2/0/0 {
        vlan-tagging;
        encapsulation flexible-ethernet-services;
        unit 0 {
            encapsulation vlan-bridge;
            vlan-id 200;
        }
    }
    irb {
        unit 0 {
            family inet {
                address 10.5.5.1/24;
            }
        }
```

```
        unit 1 {
            family inet {
                address 10.6.6.1/24;
            }
        }
    }
    lo0 {
        unit 0 {
            family inet {
                address 10.3.3.3/32;
            }
        }
    }
}
```

```
user@router# show protocols ospf
```

```
area 0.0.0.0 {
    interface ge-8/3/8.0;
    interface lo0.0;
    interface xe-0/1/3.0;
    interface ge-8/3/2.0;
}
```

```
user@router# show protocols pim
```

```
rp {
    static {
        address 10.2.1.3;
```

```
    }
}
```

```
user@router# show chassis
```

```
redundancy {
    graceful-switchover;
}
aggregated-devices {
    ethernet {
        device-count 10;
    }
}
fpc 1 {
    pic 0 {
        tunnel-services {
            bandwidth 10g;
        }
    }
}
network-services enhanced-ip;
```

Verification

IN THIS SECTION

Confirm that the configuration is working properly.

Verifying Reachability

Purpose

Verify that the network is up and running with the proper interfaces and routes installed.

Action

```
user@router> show interfaces terse irb
Interface               Admin Link Proto    Local                 Remote
irb                     up    up
irb.0                   up    up   inet     10.5.5.1/24
                                   multiservice
irb.1                   up    up   inet     10.6.6.1/24
                                   multiservice

user@router> ping 10.5.5.1/24
PING 10.5.5.1 (10.5.5.1): 56 data bytes
64 bytes from 10.5.5.1: icmp_seq=0 ttl=64 time=0.965 ms
64 bytes from 10.5.5.1: icmp_seq=1 ttl=64 time=0.960 ms
64 bytes from 10.5.5.1: icmp_seq=2 ttl=64 time=0.940 ms
^C
--- 10.1.1.1 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.940/0.955/0.965/0.011 ms
```

Meaning

Use the `show interfaces terse irb` command to verify that the IRB interface has been properly configured. The `irb.0` and `irb.1` interfaces should display the proper multiservice inet addresses.

Use the `ping` command to confirm that the network is connected to the IRB multiservice address.

Verifying VXLAN

Purpose

Verify that VXLAN is working and the proper protocols are enabled.

Action

```
user@router> show interfaces vtep
Physical interface: vtep, Enabled, Physical link is Up
  Interface index: 133, SNMP ifIndex: 575
  Type: Software-Pseudo, Link-level type: VxLAN-Tunnel-Endpoint, MTU: 1600, Speed: Unlimited
  Device flags   : Present Running
```

```
  Interface flags: SNMP-Traps
  Link type      : Full-Duplex
  Link flags     : None
  Last flapped   : Never
    Input packets : 0
    Output packets: 0

  Logical interface vtep.32768 (Index 334) (SNMP ifIndex 607)
    Flags: Up SNMP-Traps Encapsulation: ENET2
    VXLAN Endpoint Type: Source, VXLAN Endpoint Address: 10.255.187.32, L2 Routing Instance:
default-switch, L3 Routing Instance: default
    Input packets : 0
    Output packets: 0
```

```
user@router> show l2-learning vxlan-tunnel-end-point remote mac-table
MAC flags (S -static MAC, D -dynamic MAC, L -locally learned, C -Control MAC
           SE -Statistics enabled, NM -Non configured MAC, R -Remote PE MAC)

Logical system   : <default>
Routing instance : default-switch
 Bridging domain : vlan-5+100, VLAN : 100, VNID : 100
 Bridging domain : vlan-6+200, VLAN : 200, VNID : 200
```

```
user@router> show l2-learning vxlan-tunnel-end-point source
Logical System Name       Id  SVTEP-IP         IFL   L3-Idx
<default>                 0   10.255.187.32    lo0.0    0
    L2-RTT                   Bridge Domain              VNID     MC-Group-IP
    default-switch           vlan-5+100                 100      233.252.0.1
    default-switch           vlan-6+200                 200      233.252.0.1
```

Meaning

Use the `show interface vtep` command to displays information about VXLAN endpoint configuration. Make sure the routing instance is assigned to the default-switch..

Use the `show l2-learning vxlan-tunnel-end-point remote mac-table` command to confirm that the bridging domain VLAN groups were configured correctly.

Use the `show l2-learning vxlan-tunnel-end-point source` command to confirm the multicast IP addresses for bridging domain VLAN groups.

RELATED DOCUMENTATION

Understanding VXLANs

show bridge mac-table

show vpls mac-table

CHAPTER 6

VXLAN Monitoring Commands

IN THIS CHAPTER

Monitoring a Remote VTEP Interface

IN THIS SECTION

Purpose

Monitor traffic details for a remote VTEP interface.

Action

```
user@switch> show interface logical-name detail
```

```
M    Flags: Up SNMP-Traps Encapsulation: ENET2
    VXLAN Endpoint Type: Remote, VXLAN Endpoint Address: 10.1.1.2, L2 Routing Instance: default-
switch, L3 Routing Instance: default
    Traffic statistics:
     Input  bytes  :         228851738624
     Output bytes  :                    0
     Input  packets:            714162415
     Output packets:                    0
    Local statistics:
     Input  bytes  :                    0
     Output bytes  :                    0
     Input  packets:                    0
     Output packets:                    0
    Transit statistics:
     Input  bytes  :         228851738624                    0 bps
     Output bytes  :                    0                    0 bps
     Input  packets:            714162415                    0 pps
     Output packets:                    0                    0 pps
    Protocol eth-switch, MTU: 1600, Generation: 277, Route table: 5
```

Meaning

The output shows traffic details for the remote VTEP interface. To get this information, you must supply the logical name of the remote VTEP interface (vtep.12345 in the above output), which you can learn by using the `show ethernet-switching table` command.

RELATED DOCUMENTATION

Understanding VXLANs

Manually Configuring VXLANs on QFX Series and EX4600 Switches

Examples: Manually Configuring VXLANs on QFX Series and EX4600 Switches

Verifying VXLAN Reachability

IN THIS SECTION

Purpose

On the local VTEP, verify that there is connectivity with the remote VTEP.

Action

```
user@switch> show ethernet-switching vxlan-tunnel-end-point remote
Logical System Name       Id  SVTEP-IP         IFL   L3-Idx
<default>                 0   10.1.1.2     lo0.0    0
RVTEP-IP         IFL-Idx   NH-Id
10.1.1.2         559       1728
VNID             MC-Group-IP
100              233.252.0.1
```

Meaning

The remote VTEP is reachable because its IP address appears in the output. The output also shows that the VXLAN (VNI 100) and corresponding multicast group are configured correctly on the remote VTEP.

RELATED DOCUMENTATION

Understanding VXLANs

Manually Configuring VXLANs on QFX Series and EX4600 Switches

Examples: Manually Configuring VXLANs on QFX Series and EX4600 Switches

Verifying That a Local VXLAN VTEP Is Configured Correctly

IN THIS SECTION

Purpose

Verify that a local VTEP is correct.

Action

```
user@switch> show ethernet-switching vxlan-tunnel-end-point source

Logical System Name       Id  SVTEP-IP         IFL   L3-Idx
<default>                 0   10.1.1.1     lo0.0    0
L2-RTT                   Bridge Domain              VNID     MC-Group-IP
default-switch           VLAN1+100                  100      233.252.0.1
```

Meaning

The output shows the correct tunnel source IP address (loopback address), VLAN, and multicast group for the VXLAN.

RELATED DOCUMENTATION

Understanding VXLANs

Verifying MAC Learning from a Remote VTEP

IN THIS SECTION

Purpose

Verify that a local VTEP is learning MAC addresses from a remote VTEP.

Action

```
user@switch> show ethernet-switching table

MAC flags (S - static MAC, D - dynamic MAC, L - locally learned, P - Persistent static
           SE - statistics enabled, NM - non configured MAC, R - remote PE MAC)
Ethernet switching table : 2 entries, 2 learned
Routing instance : default-switch
    Vlan                MAC                 MAC         Age    Logical
    name                address             flags              interface
    VLAN1                00:00:00:ff:ff:ff   D             -   vtep.12345
    VLAN1                00:10:94:00:00:02   D         -       xe-0/0/0.0
```

Meaning

The output shows the MAC addresses learned from the remote VTEP (in addition to those learned on the normal Layer 2 interfaces). It also shows the logical name of the remote VTEP interface (`vtep.12345` in the above output).

RELATED DOCUMENTATION

Understanding VXLANs

Manually Configuring VXLANs on QFX Series and EX4600 Switches

Examples: Manually Configuring VXLANs on QFX Series and EX4600 Switches

Understanding Overlay ping and traceroute Packet Support

IN THIS SECTION

In a virtualized overlay network, existing ping and traceroute mechanisms do not provide enough information to determine whether or not connectivity is established throughout the network. The existing `ping` and `traceroute` commands can only verify the basic connectivity between two endpoints in the underlying physical network, but not in the overlay network. For example, you can issue the existing `ping` command on a Juniper Networks device that functions as a virtual tunnel endpoint (VTEP) to another Juniper Networks devices that also functions as a VTEP in a Virtual Extensible LAN (VXLAN) overlay. In this situation, the ping output might indicate that the connection between the source and destination VTEPs is up and running despite the fact that one of the endpoints (physical servers upon which applications directly run) is not reachable.

Starting with Junos OS Release 14.1X53-D30 for QFX5100 switches, Release 16.1 for EX9200 switches, and Release 16.2 for MX Series routers, overlay ping and traceroute are introduced as troubleshooting tools for overlay networks.

For ping and traceroute mechanisms to work in overlay networks, the ping and traceroute packets, also referred to collectively as Operations, Administration, and Management (OAM) packets, must be encapsulated with the same VXLAN UDP headers (outer headers) as the data packets forwarded over the overlay segment. This implementation ensures that transit nodes forward the OAM packets in the same way as a data packet for that particular overlay segment.

If any connectivity issues arise for a particular data flow, the overlay OAM packet corresponding to the flow would experience the same connectivity issues as the data packet for that flow.

When using ping overlay and traceroute overlay, keep the following in mind:

- The only tunnel type supported is VXLAN tunnels.
- The VTEPs in the overlay network that send and receive the overlay ping packets must be Juniper Networks devices that support overlay ping and traceroute.

Overlay ping and traceroute Functionality

Overlay ping and traceroute packets are sent as User Datagram Protocol (UDP) echo requests and replies and are encapsulated in the VXLAN header. VTEPs, which initiate and terminate overlay tunnels, send and receive overlay OAM packets. Overlay ping and traceroute are supported only in VXLAN overlay networks in which the sending and receiving VTEPs are both Juniper Networks devices.

The overlay ping functionality validates both the data plane and the MAC address and IP address of the VTEPs. This additional validation is different from the more commonly known IP ping functionality where the actual destination replies to the echo request without the overlay segment context.

While tracing a route in a VXLAN overlay network, Juniper Networks devices that are along the route that support overlay traceroute additionally provide a timestamp. Third-party devices and Juniper Networks devices that do not support overlay traceroute do not provide this timestamp.

Overlay OAM Packet Format for UDP Payloads

The format of overlay OAM packets depends on the type of payload that is carried in the tunnel. In the case of VXLAN tunnels, the inner packet is a Layer 2 packet.

NOTE: Only Layer 2 UDP payloads are supported.

Figure 11 on page 154 shows complete headers on a VXLAN-encapsulated overlay OAM packet.

Figure 11: VXLAN-Encapsulated Overlay OAM Packet

- Outer Ethernet header—Contains the source MAC (SMAC) and destination MAC (DMAC) addresses of directly connected nodes in the physical network. These addresses change at every hop.

- Outer IP header—Contains the source and destination IP addresses of the Juniper Networks devices that function as the VTEPs that initiate and terminate the tunnel.

- Outer UDP header—Contains the source port associated with the flow entropy and destination port. The source port is an internally calculated hash value. The destination port is the standard UDP port (4789) used for VXLAN.

- VXLAN header—Contains the VXLAN Network Identifier (VNI) or the segment ID of the VXLAN, and new router alert (RA) flag bits.

- Inner Ethernet header—Contains a control MAC address (00-00-5E-90-*xx*-*xx*) for both the SMAC and DMAC. This address is not forwarded out of the VTEP. Alternatively, the SMAC can be set to a non-control MAC address. However, if a non-control MAC address is used, the VTEP must not learn the SMAC from the overlay OAM packets.

- Inner IP header—Contains the source IP address that can be set to the IP address of the endpoint or source VTEP. The destination IP address can be set to the 127/8 address, which ensures that the overlay OAM packet is not forwarded out of the ports of the Juniper Networks device that is configured as a VTEP.

- Inner UDP header—Contains a new reserved value used in the destination port field in the inner UDP header. This value identifies the incoming UDP packet as an overlay OAM packet.

- Inner UDP payload—Contains all of the overlay OAM-specific message format and type, length, and value (TLV) definitions.

  The Inner UDP payload format is as follows:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Message Type  | Reply mode    | Return Code   | Return Subcode|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Originator Handle                                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Sequence Number                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| TimeStamp Sent (seconds)                                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| TimeStamp Sent (microseconds)                                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| TimeStamp Received (seconds)                                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| TimeStamp Received (microseconds)                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| TLVs ...                                                      |
.                                                               .
.                                                               .
.                                                               .
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The OAM-specific message type is one of the following:

```
Value What it means
----- -------------
1     Echo Request
2     Echo Reply

Reply Mode Values:-
Value What it means
----- --------------------------------
1     Do not reply
2     Reply via an IPv4/IPv6 UDP Packet
3     Reply via Overlay Segment
```

The TLV definition for VXLAN ping is as follows:

```
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Type = 1(VXLAN ping IPv4)   | Length                          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| VXLAN VNI                                     | Reserved      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| IPv4 Sender Address                                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Multiple Routing Instance Support

Starting in Junos OS Release 19.3R1, you can use the `ping overlay` and `traceroute overlay` commands to verify connectivity and detect fault in a static VxLAN tunnel with multiple routing instances. The ping and traceroute packets created for the `ping overlay` and `traceroute overlay` commands follow the same underlay network path as the data packets. This allow you to verify the connectivity between two VTEPs in the overlay VxLAN tunnel. The devices that are configured as the source and destination VTEP must both be running a Junos OS release that supports multiple routing instance, but the transit devices do not.

Change History Table

Feature support is determined by the platform and release you are using. Use Feature Explorer to determine if a feature is supported on your platform.

Release	Description
19.3R1	Starting in Junos OS Release 19.3R1, you can use the `ping overlay` and `traceroute overlay` commands to verify connectivity and detect fault in a static VxLAN tunnel with multiple routing instances.
14.1X53-D30	Starting with Junos OS Release 14.1X53-D30 for QFX5100 switches, Release 16.1 for EX9200 switches, and Release 16.2 for MX Series routers, overlay ping and traceroute are introduced as troubleshooting tools for overlay networks.

RELATED DOCUMENTATION

Example: Troubleshooting a VXLAN Overlay Network By Using Overlay Ping and Traceroute on QFX Series Switches

ping overlay

traceroute overlay

Example: Troubleshoot a VXLAN Overlay Network with Overlay Ping and Overlay Traceroute for MX Series Routers

IN THIS SECTION

In a Virtual Extensible LAN (VXLAN) overlay network, the existing `ping` and `traceroute` commands can verify the basic connectivity between two Juniper Networks devices that function as virtual tunnel endpoints (VTEPs) in the underlying physical network. However, in between the two VTEPs, there could be multiple routes through intermediary devices, and the ping and traceroute packets might successfully reach their destinations, while a connectivity issue exists in another route along which the data packets are typically forwarded to reach their destination.

With the introduction of the `overlay` parameter and other options in Junos OS Release 16.2 for MX Series routers, you can use the `ping` and `traceroute` commands to troubleshoot a VXLAN.

For ping and traceroute mechanisms to work in a VXLAN, the ping and traceroute packets, also referred to as Operations, Administration, and Management (OAM) packets, must be encapsulated with the same VXLAN headers (outer headers) as the data packets forwarded over the VXLAN segment with possible connectivity issues. If any connectivity issues arise, the overlay OAM packet would experience the same issues as the data packet.

This example shows how to use overlay ping and traceroute on a VTEP to verify the following in a VXLAN:

- Scenario 1—Verify that a particular VXLAN is configured on another VTEP.
- Scenario 2—Verify that the MAC address of a particular endpoint is associated with a VXLAN on the remote VTEP.
- Scenario 3—Verify that no issues exist in a particular data flow between sending and receiving endpoints.

NOTE: When issuing the `ping overlay` and `traceroute overlay` commands, the source VTEP on which you issue the command and the destination VTEP that receives the ping packet must be Juniper Networks devices that support overlay ping and traceroute.

Requirements

This example uses the following hardware and software components:

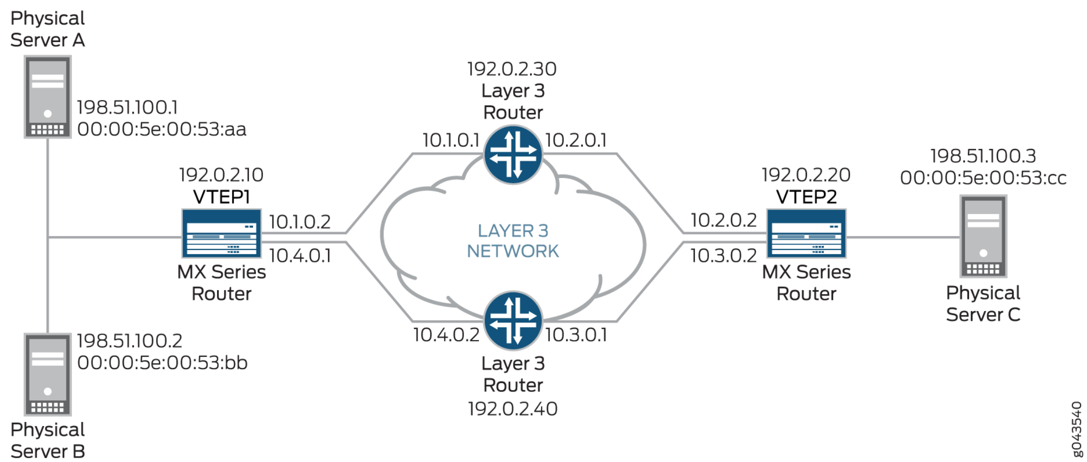
- Three physical servers on which applications directly run.
- Two MX Series routers running Junos OS Release 16.2 or later software. These routers function as VTEPs.
- Two Layer 3 routers, which can be Juniper Networks routers or routers provided by another vendor.

Before issuing the `ping overlay` and `traceroute overlay` commands, gather the information needed for each parameter— for example, IP addresses or MAC addresses— used for a particular scenario. See Table 11 on page 160 to determine which parameters are used for each scenario.

Overview and Topology

The VXLAN topology shown in Figure 12 on page 159 includes physical servers A, B, and C on which applications directly run. The applications on physical servers A and B need to communicate with the applications on physical server C. These servers are on the same subnet, so the communication between the applications occurs at the Layer 2 level, and VXLAN encapsulation or tunnels are used to transport their data packets over a Layer 3 network.

Figure 12: Using Overlay Ping and Traceroute to Troubleshoot a VXLAN



In this topology, there are two MX Series routers that function as VTEPs. VTEP1 initiates and terminates VXLAN tunnels for physical servers A and B, and VTEP2 does the same for physical server C. VTEP1 and VTEP2 are in VXLAN 100.

A data packet sent from physical server A is typically routed to the Layer 3 router with the IP address of 192.0.2.30 to reach physical server C.

In this VXLAN topology, a communication issue arises between physical servers A and C. To troubleshoot the issue with this data flow, you can initiate the `ping overlay` and `traceroute overlay` commands on VTEP1 (the source VTEP or `tunnel-src`) and specify that VTEP2 is the destination VTEP or `tunnel-dst`.

The `ping overlay` and `traceroute overlay` commands include several parameters. Table 11 on page 160 explains the purpose and provides a value for each of the parameters used in the three scenarios.

Table 11 on page 160 does not include all available `ping overlay` and `traceroute overlay` parameters. This example uses the default values of these omitted parameters.

Table 11: Ping and Traceroute Overlay Parameter Values For Scenarios 1, 2, and 3

`ping overlay` and `traceroute overlay` Parameters	Description	Scenario to Which Parameter Applies	Value
`tunnel-type`	Identifies type of tunnel that you are troubleshooting.	All	vxlan
`vni`	VXLAN network identifier (VNI) of VXLAN used in this example.	All	100
`tunnel-src`	IP address of VTEP1, on which you initiate overlay ping or traceroute.	All	192.0.2.10
`tunnel-dst`	IP address of VTEP2, which receives the overlay ping or traceroute packets.	All	192.0.2.20
`mac`	MAC address of physical server C, which is the destination endpoint.	Scenarios 2 and 3	00:00:5E:00:53:cc
`count`	Number of overlay ping requests that VTEP1 sends. **NOTE**: The count parameter does not apply to overlay traceroute.	All	5
`hash-source-mac`	MAC address of physical server A, which is the source endpoint.	Scenario 3	00:00:5E:00:53:aa

Table 11: Ping and Traceroute Overlay Parameter Values For Scenarios 1, 2, and 3 *(Continued)*

ping overlay and traceroute overlay Parameters	Description	Scenario to Which Parameter Applies	Value
hash-destination-mac	MAC address of physical server C, which is the destination endpoint. **NOTE**: When specifying this parameter for scenario 3, the MAC address must be the same MAC address as specified for the mac parameter.	Scenario 3	00:00:5E:00:53:cc
hash-source-address	IP address of physical server A.	Scenario 3	198.51.100.1
hash-destination-address	IP address of physical server C.	Scenario 3	198.51.100.3
hash-protocol	A value for the protocol used in the data flow.	Scenario 3	17
hash-source-port	A value for the outer TCP/UDP source port.	Scenario 3	4456
hash-destination-port	A value for the outer UDP destination port.	Scenario 3	4540

Table 11 on page 160 includes several hash parameters, which are used for scenario 3. For each of these parameters, you must specify a value associated with the data flow that you are troubleshooting. Based on the values that you specify, the system calculates a VXLAN UDP header source port hash, which is included in the VXLAN UDP header of the overlay ping and traceroute packets. Including the calculated hash in the VXLAN UDP header enables the overlay ping and traceroute packets to emulate data packets in the flow that you are troubleshooting.

BEST PRACTICE: When using the hash parameters, we recommend that you specify a value for each parameter. This practice ensures that the overlay ping and traceroute processes are successful and that the output for each command is accurate. If you do not specify a value for one or more of the hash parameters, the system sends an OAM request that might include incorrect hash values and generates a warning message.

Configuration

Verification

IN THIS SECTION

This section includes the following verification tasks:

Scenario-1: Verifying That VXLAN 100 Is Configured on VTEP2

Purpose

Verify that a VXLAN with the VNI of 100 is configured on VTEP2. You can use either overlay ping or traceroute to perform this verification.

Action

Overlay Ping

On VTEP1, initiate an overlay ping:

```
user@switch> ping overlay tunnel-type vxlan vni 100 tunnel-src 192.0.2.10 tunnel-dst 192.0.2.20
count 5
ping-overlay protocol vxlan

                                vni 100
                                tunnel src ip 192.0.2.10
```

```
            tunnel dst ip 192.0.2.20
            mac address 00:00:00:00:00:00
            count 5
            ttl 255

        WARNING: following hash-parameters are missing -
                hash computation may not succeed

                end-host smac
                end-host dmac
                end-host src ip
                end-host dst ip
                end-host protocol
                end-host l4-src-port
                end-host l4-dst-port
Request for seq 1, to 192.0.2.20, at 09-24 22:03:16 PDT.033 msecs

Response for seq 1, from 192.0.2.20, at 09-24 22:03:16 PDT.036 msecs, rtt 10 msecs

  Overlay-segment  not present at RVTEP 192.0.2.20



Request for seq 2, to 192.0.2.20, at 09-24 22:03:16 PDT.044 msecs

Response for seq 2, from 192.0.2.20, at 09-24 22:03:16 PDT.046 msecs, rtt 10 msecs

  Overlay-segment  not present at RVTEP 192.0.2.20



Request for seq 3, to 192.0.2.20, at 09-24 22:03:16 PDT.054 msecs

Response for seq 3, from 192.0.2.20, at 09-24 22:03:16 PDT.057 msecs, rtt 10 msecs

  Overlay-segment  not present at RVTEP 192.0.2.20



Request for seq 4, to 192.0.2.20, at 09-24 22:03:16 PDT.065 msecs

Response for seq 4, from 192.0.2.20, at 09-24 22:03:16 PDT.069 msecs, rtt 10 msecs

  Overlay-segment  not present at RVTEP 192.0.2.20

Request for seq 5, to 192.0.2.20, at 09-24 22:03:16 PDT.076 msecs
```

```
Response for seq 5, from 192.0.2.20, at 09-24 22:03:16 PDT.079 msecs, rtt 10 msecs

  Overlay-segment  not present at RVTEP 192.0.2.20
```

Overlay Traceroute

On VTEP1, initiate an overlay traceroute:

```
user@switch> traceroute overlay tunnel-type vxlan vni 100 tunnel-src 192.0.2.10 tunnel-dst
192.0.2.20
traceroute-overlay protocol vxlan

                             vni 100
                    tunnel src ip 192.0.2.10
                    tunnel dst ip 192.0.2.20
                    mac address 00:00:00:00:00:00
                    ttl 255

        WARNING: following hash-parameters are missing -
                hash computation may not succeed

                end-host smac
                end-host dmac
                end-host src ip
                end-host dst ip
                end-host protocol
                end-host l4-src-port
                end-host l4-dst-port
ttl  Address    Sender Timestamp               Receiver Timestamp            Response Time
  1   10.1.0.2   09-25 00:51:10 PDT.599 msecs            *                     10 msecs
  2   192.0.2.20   09-25 00:51:10 PDT.621 msecs   09-25 00:51:10 PDT.635 msecs   21 msecs

  Overlay-segment not present at RVTEP 192.0.2.20
```

Meaning

The sample overlay ping output indicates the following:

- VTEP1 sent five ping requests to VTEP2, and VTEP2 responded to each request.

- VTEP2 indicated that the VNI of 100 is not configured (`Overlay-segment not present at RVTEP 192.0.2.20`) and included this information in its response to VTEP1.

The sample overlay traceroute output indicates the following:

- Upon receiving an overlay traceroute packet with a time-to-live (TTL) value of 1 hop, the Layer 3 router responds to VTEP1.
- Upon receiving an overlay traceroute packet with a TTL value of 2 hops, VTEP2 responds to VTEP1.
- VTEP2 indicated that the VNI of 100 is not configured (Overlay-segment not present at RVTEP 192.0.2.20) and included this information in its response to VTEP1.

> **NOTE**: The asterisk (*) in the Receiver Timestamp column of the overlay traceroute output indicates that the Layer 3 router that received the overlay traceroute packet is not a Juniper Networks device or is a Juniper Networks device that does not support overlay traceroute.

Given that the output of both overlay ping and traceroute indicates that VXLAN 100 is not present, check for this configuration on VTEP2. If you must configure a VNI of 100 on VTEP2, use the vni configuration statement at the [edit vlans vlan-id vxlan] hierarchy level, and reissue the ping overlay or traceroute overlay command to verify that VXLAN 100 is now recognized.

Scenario 2: Verifying That the MAC Address of the Destination Endpoint Is on VTEP2

Purpose

Verify that the MAC address (00:00:5E:00:53:cc) of physical server C, which is the destination endpoint, is in the forwarding table of VTEP2. You can use either overlay ping or traceroute to perform this verification.

Action

Overlay Ping

On VTEP1, initiate an overlay ping:

```
user@switch> ping overlay tunnel-type vxlan vni 100 tunnel-src 192.0.2.10 tunnel-dst 192.0.2.20
mac 00:00:5E:00:53:cc count 5
ping-overlay protocol vxlan

                          vni 100
                 tunnel src ip 192.0.2.10
```

```
                    tunnel dst ip 192.0.2.20
                    mac address 00:00:5E:00:53:cc
                    count 5
                    ttl 255

            WARNING: following hash-parameters are missing -
                        hash computation may not succeed

                end-host smac
                end-host dmac
                end-host src ip
                end-host dst ip
                end-host protocol
                end-host l4-src-port
                end-host l4-dst-port
Request for seq 1, to 192.0.2.20, at 09-24 23:53:54 PDT.089 msecs

Response for seq 1, from 192.0.2.20, at 09-24 23:53:54 PDT.089 msecs, rtt 6 msecs

  Overlay-segment present at RVTEP 192.0.2.20

      End-System Not Present


Request for seq 2, to 192.0.2.20, at 09-24 23:53:54 PDT.096 msecs

Response for seq 2, from 192.0.2.20, at 09-24 23:53:54 PDT.100 msecs, rtt 10 msecs

  Overlay-segment present at RVTEP 192.0.2.20

      End-System Not Present


Request for seq 3, to 192.0.2.20, at 09-24 23:53:54 PDT.107 msecs

Response for seq 3, from 192.0.2.20, at 09-24 23:53:54 PDT.111 msecs, rtt 10 msecs

  Overlay-segment present at RVTEP 192.0.2.20

      End-System Not Present

Request for seq 4, to 192.0.2.20, at 09-24 23:53:54 PDT.118 msecs
```

```
Response for seq 4, from 192.0.2.20, at 09-24 23:53:54 PDT.122 msecs, rtt 11 msecs

  Overlay-segment present at RVTEP 192.0.2.20

      End-System Not Present


Request for seq 5, to 192.0.2.20, at 09-24 23:53:54 PDT.129 msecs

Response for seq 5, from 192.0.2.20, at 09-24 23:53:54 PDT.133 msecs, rtt 10 msecs

  Overlay-segment present at RVTEP 192.0.2.20

      End-System Not Present
```

Overlay Traceroute

On VTEP1, initiate an overlay traceroute:

```
user@switch> traceroute overlay tunnel-type vxlan vni 100 tunnel-src 192.0.2.10 tunnel-dst
192.0.2.20 mac 00:00:5E:00:53:cc
traceroute-overlay protocol vxlan



                            vni 100
                   tunnel src ip 192.0.2.10
                      tunnel dst ip 192.0.2.20
                   mac address 00:00:5E:00:53:cc
                   ttl 255

        WARNING: following hash-parameters are missing -
                hash computation may not succeed

                end-host smac
                end-host dmac
                end-host src ip
                end-host dst ip
                end-host protocol
                end-host l4-src-port
                end-host l4-dst-port

ttl  Address    Sender Timestamp               Receiver Timestamp             Response Time
```

```
1   10.1.0.1   09-25 00:56:17 PDT.663 msecs           *                    10 msecs
2   192.0.2.20   09-25 00:56:17 PDT.684 msecs   09-25 00:56:17 PDT.689 msecs   11 msecs

Overlay-segment present at RVTEP 192.0.2.20

    End-System not Present
```

Meaning

The sample overlay ping output indicates the following:

- VTEP1 sent five ping requests to VTEP2, and VTEP2 responded to each request.
- VTEP2 verified that the VNI of 100 is configured (`Overlay-segment present at RVTEP 192.0.2.20`) but that the MAC address of physical server C is not in the forwarding table (`End-System Not Present`). VTEP2 included this information in its response to VTEP1.

The sample overlay traceroute output indicates the following:

- Upon receiving an overlay traceroute packet with a TTL value of 1 hop, the Layer 3 router responds to VTEP1.
- Upon receiving an overlay traceroute packet with a TTL value of 2 hops, VTEP2 responds to VTEP1.
- VTEP2 verified that the VNI of 100 is configured (`Overlay-segment present at RVTEP 192.0.2.20`) and that the MAC address of physical server C is in the forwarding table (`End-System Present`). VTEP2 included this information in its response to VTEP1.

NOTE: The asterisk (*) in the Receiver Timestamp column of the overlay traceroute output indicates that the Layer 3 router that received the overlay traceroute packet is not a Juniper Networks device or is a Juniper Networks device that does not support overlay traceroute.

Given that the output of both overlay ping and traceroute indicates that the MAC address of physical server C is not known by VTEP2, you must further investigate to determine why this MAC address is not in the forwarding table of VTEP2.

Scenario 3: Verifying a Data Flow

Purpose

Verify that there are no issues that might impede the flow of data from physical server A to physical server C. The networking devices that support this flow include VTEP1, the Layer 3 router with the IP address of 192.0.2.30, and VTEP2 (see Figure 12 on page 159).

Initially, use overlay ping, and if the overlay ping results indicate an issue, use overlay traceroute to determine which device in the path has an issue.

With both overlay ping and traceroute, use the hash parameters to specify information about the devices in this data flow so that the system can calculate a VXLAN UDP header source port hash, which is included in the VXLAN UDP header of the overlay ping and traceroute packets. With the calculated hash included in the VXLAN UDP header, the overlay ping and traceroute packets can emulate data packets in this flow, which should produce more accurate ping and traceroute results.

Action

Overlay Ping

On VTEP1, initiate an overlay ping:

```
user@switch> ping overlay tunnel-type vxlan vni 100 tunnel-src 192.0.2.10 tunnel-dst 192.0.2.20
mac 00:00:5E:00:53:cc count 5 hash-source-mac 00:00:5E:00:53:aa hash-destination-mac
00:00:5E:00:53:cc hash-source-address 198.51.100.1 hash-destination-address 198.51.100.3 hash-
protocol 17 hash-source-port 4456 hash-destination-port 4540
ping-overlay protocol vxlan

        vni 100
        tunnel src ip 192.0.2.10
        tunnel dst ip 192.0.2.20
        mac address 00:00:5E:00:53:cc
        count 5
        ttl 255

        hash-parameters:
                input-ifd-idx 653
                end-host smac 00:00:5E:00:53:aa
                end-host dmac 00:00:5E:00:53:cc
                end-host src ip 198.51.100.1
                end-host dst ip 198.51.100.3
                end-host protocol 17
```

```
                end-host l4-src-port 4456
                end-host l4-dst-port 4540end-host vlan 150
Request for seq 1, to 192.0.2.20, at 09-24 19:15:33 PDT.352 msecs
Request for seq 2, to 192.0.2.20, at 09-24 19:15:33 PDT.363 msecs
Request for seq 3, to 192.0.2.20, at 09-24 19:15:33 PDT.374 msecs
Request for seq 4, to 192.0.2.20, at 09-24 19:15:33 PDT.385 msecs
Request for seq 5, to 192.0.2.20, at 09-24 19:15:33 PDT.396 msecs
```

Overlay Traceroute

If needed, on VTEP1, initiate an overlay traceroute:

```
user@switch> traceroute overlay tunnel-type vxlan vni 100 tunnel-src 192.0.2.10 tunnel-dst
192.0.2.20 mac 00:00:5E:00:53:cc hash-source-mac 00:00:5E:00:53:aa hash-destination-mac
00:00:5E:00:53:cc hash-source-address 198.51.100.1 hash-destination-address 198.51.100.3 hash-
protocol 17 hash-source-port 4456 hash-destination-port 4540
traceroute-overlay protocol vxlan

        vni 100
        tunnel src ip 192.0.2.10
        tunnel dst ip 192.0.2.20
        mac address 00:00:5E:00:53:cc
        ttl 255

        hash-parameters:
                input-ifd-idx 653
                end-host smac 00:00:5E:00:53:aa
                end-host dmac 00:00:5E:00:53:cc
                end-host src ip 198.51.100.1
                end-host dst ip 198.51.100.3
                end-host protocol 17
                end-host l4-src-port 4456
                end-host l4-dst-port 4540

ttl  Address    Sender Timestamp               Receiver Timestamp            Response Time
  1   10.1.0.1   09-25 00:56:17 PDT.663 msecs           *                     10 msecs
```

Meaning

The sample overlay ping output indicates that VTEP1 sent five ping requests to VTEP2, but VTEP2 did not respond to any of the requests. The lack of response from VTEP2 indicates that a connectivity issue exists along the path between VTEP1 and the Layer 3 router or the path between the Layer 3 router and VTEP2.

To further troubleshoot in which path the issue lies, overlay traceroute is used.The sample overlay traceroute output indicates the following:

- Upon receiving an overlay traceroute packet with a TTL value of 1 hop, the Layer 3 router responds to VTEP1, which indicates that the path between VTEP1 and the Layer 3 router is up.
- VTEP2 does not respond to the overlay traceroute packet, which indicates that the path between the Layer 3 router and VTEP2 might be down.

> **NOTE**: The asterisk (*) in the Receiver Timestamp column of the overlay traceroute output indicates that the Layer 3 router that received the overlay traceroute packet is not a Juniper Networks device or is a Juniper Networks device that does not support overlay traceroute.

Given that the overlay traceroute output indicates that there is a connectivity issue between the Layer 3 router and VTEP2, you must further investigate this path segment to determine the source of the issue.

RELATED DOCUMENTATION

Understanding Overlay ping and traceroute Packet Support | 153

ping overlay

traceroute overlay

3

PART

Configuration Statements and Operational Commands

Junos CLI Reference Overview

We've consolidated all Junos CLI commands and configuration statements in one place. Learn about the syntax and options that make up the statements and commands and understand the contexts in which you'll use these CLI elements in your network configurations and operations.

- Junos CLI Reference

Click the links to access Junos OS and Junos OS Evolved configuration statement and command summary topics.

- Configuration Statements
- Operational Commands