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Network Configuration Example

Collapsed Core with EVPN Multihoming

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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

Use this network configuration example to enable, configure, and manage an EVPN-VXLAN fabric in a collapsed core architecture with EVPN multihoming (also called ESI-LAG) in a campus network. This example uses EX4650 or QFX5120 switches as collapsed core switches, EX4300 switch as the access layer switch, and Mist Access Points.

CHAPTER 1

EVPN-VXLAN Fabric on a Campus Network

Overview of a Collapsed Core with EVPN Multihoming in a Campus Network

IN THIS SECTION

About This Network Configuration Example

This network configuration example (NCE) describes how to configure and manage a campus network using EVPN-VXLAN on a collapsed core architecture with EVPN multihoming (also called ESI-LAG). This example uses EX Series switches with Mist Access Points.

NOTE: Juniper Networks requires a license for EVPN-VXLAN on QFX Series and EX4650 switches. See the *Licensing Guide* for more information.

Use Case Overview

IN THIS SECTION

A campus network using EVPN-VXLAN is an efficient and scalable way to build and connect campuses with data centers and public clouds. The VXLAN overlay with an EVPN control plane enables you to create logical Layer 2 networks across an Layer 3 underlay network. A collapsed core design is ideal for a campus network where there is a need to scale your network rapidly. A collapsed core architecture is

less complex and easier to configure and manage. EVPN multihoming eliminates the need for Spanning Tree Protocol (STP) across the campus network by providing the multihoming capabilities from the access layer to the collapsed core layer and a L3 IP fabric from the collapsed core to the network core. EVPN multihoming also supports horizontal scaling with more than two devices in the distribution layer and extends the EVPN network to the core.

EVPN-VXLAN Benefits

This architecture provides optimized, seamless, and standards-compliant Layer 2 or Layer 3 connectivity. Juniper Networks EVPN-VXLAN campus networks provide the following benefits:

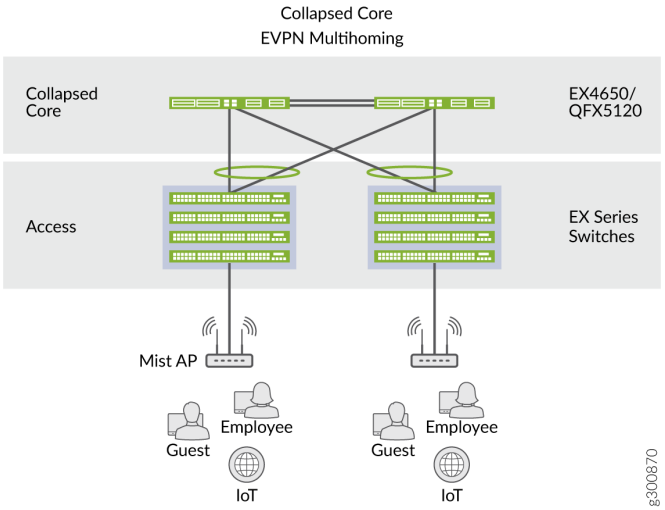
- *Consistent, scalable architecture*—Enterprises typically have multiple sites with different size requirements. A common EVPN-VXLAN-based campus architecture is consistent across all sites, irrespective of the size. EVPN-VXLAN scales out or scales in as a site evolves.
- *Multi-vendor deployment*—The EVPN-VXLAN architecture uses standards-based protocols so enterprises can deploy campus networks using multi-vendor network equipment. There is no single vendor lock-in requirement.
- *Reduced flooding and learning*—Control plane-based Layer 2/Layer 3 learning reduces the flood and learn issues associated with data plane learning. Learning MAC addresses in the forwarding plane has an adverse impact on network performance as the number of endpoints grows. The EVPN control plane handles the exchange and learning of routes, so newly learned MAC addresses are not exchanged in the forwarding plane.
- *Location-agnostic connectivity*—The EVPN-VXLAN campus architecture provides a consistent endpoint experience no matter where the endpoint is located. Some endpoints require Layer 2 reachability, such as legacy building security systems or IoT devices. The Layer 2 VXLAN overlay provides Layer 2 reachability across campuses without any changes to the underlay network. With our standards-based network access control integration, an endpoint can be connected anywhere in the network.
- *Underlay agnostic*—VXLAN as an overlay is underlay agnostic. With a VXLAN overlay, you can connect multiple campuses with a Layer 2 VPN or Layer 3 VPN service from a WAN provider or by using IPsec over Internet.
- *Consistent network segmentation*—A universal EVPN-VXLAN-based architecture across campuses and data centers means consistent end-to-end network segmentation for endpoints and applications.
- *Simplified management*—Campuses and data centers based on a common EVPN-VXLAN design can use common tools and network teams to deploy and manage campus and data center networks.

Technical Overview

IN THIS SECTION

This NCE shows how to deploy a collapsed core architecture for a campus network. You can use use the EX4650 or the QFX5120 switch as the collapsed core switch. In this example, we use the EX4650 switch as the collapsed core switches and EX series switches as access switches. Figure 1 on page 4 shows the collapsed core architecture on a campus network. The access point devices are connected to the access layer switches, which in turn are multihomed to the collapsed core switches. There are separate VLANs for employees, guests, and IoT devices.

Figure 1: Collapsed Core Architecture



Underlay and Overlay Network

This network configuration example deploys a campus fabric with a Layer 3 IP-based underlay network with EVPN-VXLAN as the overlay. You can use OSPF or BGP as the underlay protocol and iBGP as the overlay protocol, in this example we use BGP as the underlay routing protocol and MP-BGP with EVPN signaling as the overlay control plane protocol. VXLAN is the overlay data plane encapsulation protocol.

Collapsed Core Architecture

A collapsed core architecture takes the normal three-tier hierarchical network and collapses it into a two-tier network. In a two-tier network, the function of the switches in the core layer and distribution layer are “collapsed” into a combined core and distribution layer on a single switch. You can use use the EX4650 or the QFX5120 switch as the collapsed core switch. In this example, we use the EX4650 switch as the collapsed core switch.

EVPN Multihoming

New EVPN technology standards—including RFCs 8365, 7432, and 7348—introduce the concept of link aggregation in EVPNs with Ethernet segments. Ethernet segments in an EVPN collect links into a bundle and assign a number—called the Ethernet segment identifier (ESI)—to the bundled links. Links from multiple standalone nodes can be assigned the same ESI, an important link aggregation feature that brings node level redundancy to devices in an EVPN-VXLAN network. The bundled links that are numbered with an ESI are often referred to as ESI LAGs.

Layer 2 multihoming in EVPN networks is dependent on the EVPN multihoming feature. EVPN multihoming, which provides full active-active link support, is also frequently enabled with LACP to ensure multi-vendor support for the devices that access the campus network. Layer 2 multihoming with LACP is an especially attractive configuration option when deploying devices that connect to access points in a campus network because multihoming is transparent from the access point of view. With ESI, the access point functions as if it is connected to a single node even when it is connected to two or more switches.

EVPN multihoming provides redundant connectivity between access point devices and the collapsed core layer. This example configures ESI in an all-active mode to load-balance traffic across all the connected multihomed devices.

Access Layer

The access layer provides network connectivity to end-user devices, such as personal computers, VoIP phones, printers, and IoT devices as well as connectivity to wireless access point devices. In this example, we use Mist APs as the access point device. Evolving IT departments are looking for a cohesive approach for managing wired and wireless networks. Juniper Networks has a solution that can simplify

and automate operations and end-to-end troubleshooting, ultimately evolving into the Self-Driving Network™. The Integration of the Mist platform in this NCE addresses both of these challenges.

Mist is designed from the ground up to meet the stringent networking needs of the modern cloud and smart-device era, Mist delivers unique capabilities for the wired and wireless LAN.

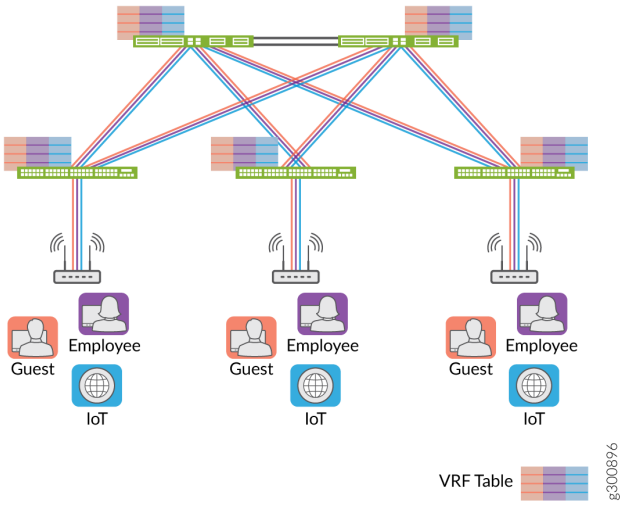
- Wired and wireless assurance—Mist is enabled with wired and wireless assurance. Once configured, Service Level Expectations (SLE) for key wired and wireless performance metrics such as throughput, capacity, roaming, and uptime are addressed in the Mist platform. This NCE uses Mist wired assurance services.
- Marvis—An integrated AI engine that provides rapid wired and wireless troubleshooting, trending analysis, anomaly detection, and proactive problem remediation.

For more details on Mist integration and EX switches, see How to Connect Mist Access Points and Juniper EX Series Switches.

VRF Segmentation

VRF segmentation is used to organize users and devices in groups on a shared network while separating and isolating the different groups. The routing devices on the network create and maintain separate virtual routing and forwarding (VRF) table for each group. The users and devices in a group are placed in one VRF segment and can communicate with each other, but they cannot communicate with users in another VRF segment. If you want to send and receive traffic from one VRF segment to another VRF segment, then you must configure the routing path. In this example, we configure routing paths to go through an SRX series router. This allows you to define policies to permit or deny access to specific resources on a VRF segment to other groups. The SRX series router enforces policy rules for transit traffic by identifying and allowing the traffic that can pass through and denying the traffic that is not permitted. For information on configuring a routing path via an SRX router, see "How to Configure the SRX Router" on page 43. Figure 2 on page 7 shows our collapsed core network topology with the 3 VRF segments (Employees, Guests, and IoT devices).

Figure 2: VRF Segmentation



RELATED DOCUMENTATION

Understanding VXLANs

How to Configure a Campus Network using EVPN Multihoming

IN THIS SECTION

Requirements

This configuration example uses the following devices:

- Two EX4650 switches or two QFX5120 switches as collapsed core devices. Software version: Junos OS Release 20.2R2 or later

  NOTE: EX4650 and QFX5120 switches are similar and can be used interchangeably.

- One EX2300, EX3400, EX4300 or EX4400 switch as the access layer. In your network this can be a Juniper Networks switch or a third-party switch.

Overview

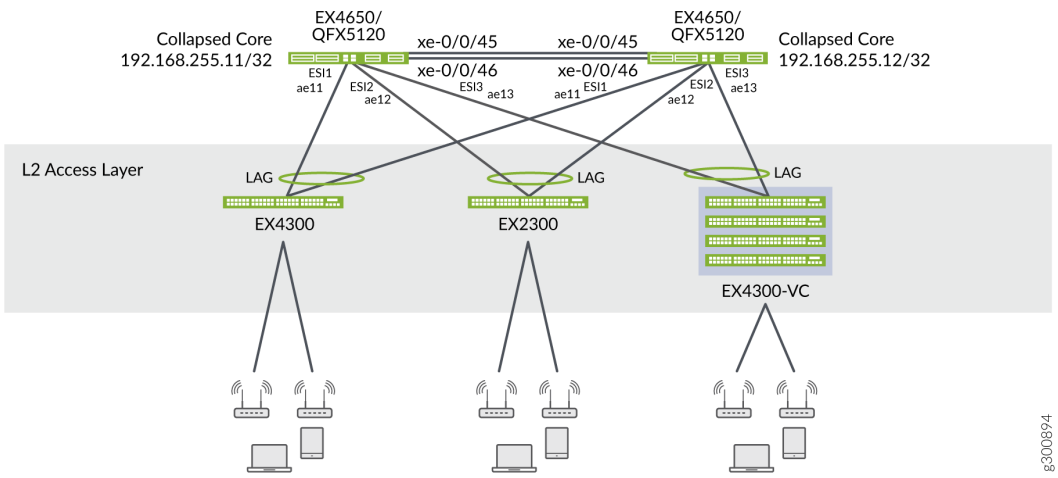
IN THIS SECTION

Use this network configuration example to deploy a single campus fabric with a Layer 3 IP-based underlay network that uses EVPN as the control plane protocol and VXLAN as the data plane protocol in the overlay network.

You can use BGP or OSPF as the underlay routing protocol to exchange loopback routes. In this example, you will first configure BGP as the underlay routing protocol. You will then configure IBGP between the core and distribution devices in the overlay to share reachability information about endpoints in the fabric.

A typical collapsed core for a campus network topology is shown in Figure 3 on page 9. You configure a subset of this topology in this example.

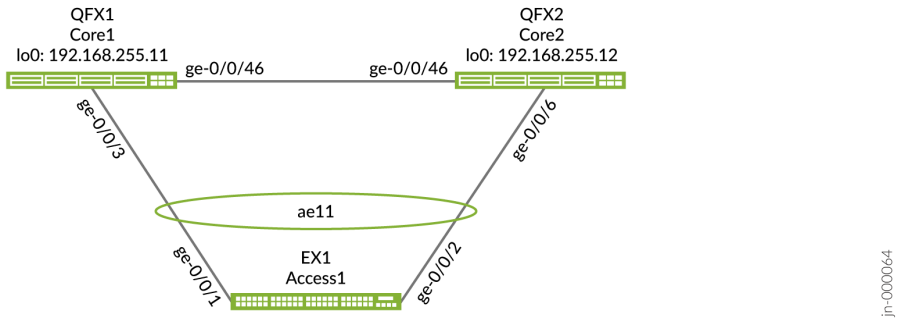
Figure 3: Collapsed Core Campus With EVPN Multihoming



Topology

The scenario demonstrated in this example involves the need to network three virtual networks: (a "separate" network for employees, guests, and IoT). The IRB interfaces for these virtual networks are on the core switches. All IRB interfaces are placed in the same routing instance. Place IRB interfaces in different routing instances for network segmentation if needed in your deployment. Figure 4 on page 9 shows the topology and the IP addressing scheme used in this example.

Figure 4: Example Campus Network EVPN Multihoming Topology



All the links in the example topology are 1 Gigabit Ethernet interfaces. In a production deployment the core link would typically operate at 10 Gbps or higher to ensure there is no possibility for blocking.

Details

In this NCE, we design the network for three different types of users and devices (Employees, Guests, and IoT devices) that will be connecting to network through wired and wireless access. Employees, Guests, and IoT devices are mapped to different virtual networks and VNIs. Table 1 on page 10 displays the configuration information for this NCE.

Table 1: NCE Configuration Information

Virtual Network	Wired Network	Wireless Network	VRF	Route Distinguisher
Employees	IRB: 101 Subnet: 192.168.101.3/24	IRB: 102 Subnet: 192.168.102.3/24	JNPR_2_VRF	102
Guests	IRB: 201 Subnet: 192.168.201.3/24	IRB: 202 Subnet: 192.168.202.3/24	JNPR_1_VRF	101
IoT Devices	IRB: 301 Subnet: 192.168.210.3/24	IRB: 302 Subnet: 192.168.212.3/24	JNPR_3_VRF	103

Configure the Underlay IP Fabric

IN THIS SECTION

Requirements

Overview

This section illustrates how to configure the IP fabric underlay on the collapsed core switches using BGP.

Interface and Underlay Configuration

IN THIS SECTION

Use this section to configure the underlay on the collapsed core switches.

This section shows the step-by-step configuration procedures for each device.

Collapsed Core 1 Configuration

Step-by-Step Procedure

1. Configure the interfaces connected to the collapsed core switches. To avoid a split-brain state in the network, we recommend configuring at least two links between the collapsed core switches and configuring multihoming from the access switches to the collapsed core switches.

```
set interfaces ge-0/0/46 unit 0 description "Connected to campus-tme-ex4650-2"
set interfaces ge-0/0/46 unit 0 family inet address 192.168.100.5/31
set interfaces ge-0/0/46 mtu 9100
```

2. Configure the loopback interface and router ID and enable per-packet load balancing.

```
set interfaces lo0 unit 0 family inet address 192.168.255.11/32
set routing-options router-id 192.168.255.11
set routing-options forwarding-table export ecmp_policy
set policy-options policy-statement ecmp_policy then load-balance per-packet
set policy-options policy-statement ecmp_policy then accept
```

3. Configure the BGP underlay network.

```
set policy-options policy-statement UNDERLAY-EXPORT term LOOPBACK from route-filter
192.168.255.0/24 orlonger
set policy-options policy-statement UNDERLAY-EXPORT term LOOPBACK then accept
set policy-options policy-statement UNDERLAY-EXPORT term DEFAULT then reject
set policy-options policy-statement UNDERLAY-IMPORT term LOOPBACK from route-filter
192.168.255.0/24 orlonger
set policy-options policy-statement UNDERLAY-IMPORT term LOOPBACK then accept
set policy-options policy-statement UNDERLAY-IMPORT term DEFAULT then reject
set protocols bgp bfd-liveness-detection minimum-interval 1000
set protocols bgp group UNDERLAY type external
set protocols bgp group UNDERLAY description "EBGP UNDERLAY"
set protocols bgp group UNDERLAY import UNDERLAY-IMPORT
set protocols bgp group UNDERLAY family inet unicast
set protocols bgp group UNDERLAY authentication-key “SecretKeyPhrase”
set protocols bgp group UNDERLAY export UNDERLAY-EXPORT
set protocols bgp group UNDERLAY local-as 65013
set protocols bgp group UNDERLAY multipath multiple-as
set protocols bgp group UNDERLAY bfd-liveness-detection minimum-interval 350
set protocols bgp group UNDERLAY bfd-liveness-detection multiplier 3
set protocols bgp group UNDERLAY neighbor 192.168.100.4 peer-as 65012
```

Collapsed Core 2 Configuration

Step-by-Step Procedure

1. Configure the interfaces connected to the collapsed core devices. To avoid a split-brain state in the network, we recommend configuring at least two links between the collapsed core switches and configuring multihoming from the access switches to the collapsed core switches.

```
set interfaces ge-0/0/46 unit 0 description "Connected to campus-tme-ex4650-01"
set interfaces ge-0/0/46 unit 0 family inet address 192.168.100.4/31
set interfaces ge-0/0/46 mtu 9100
```

2. Configure the loopback interface and router ID and enable per-packet load balancing.

```
set interfaces lo0 unit 0 family inet address 192.168.255.12/32
set routing-options router-id 192.168.255.12
```

```
set policy-options policy-statement ecmp_policy then load-balance per-packet
set policy-options policy-statement ecmp_policy then accept
set routing-options forwarding-table export ecmp_policy
```

3. Configure the BGP underlay network.

```
set policy-options policy-statement UNDERLAY-EXPORT term LOOPBACK from route-filter
192.168.255.0/24 orlonger
set policy-options policy-statement UNDERLAY-EXPORT term LOOPBACK then accept
set policy-options policy-statement UNDERLAY-EXPORT term DEFAULT then reject
set policy-options policy-statement UNDERLAY-IMPORT term LOOPBACK from route-filter
192.168.255.0/24 orlonger
set policy-options policy-statement UNDERLAY-IMPORT term LOOPBACK then accept
set policy-options policy-statement UNDERLAY-IMPORT term DEFAULT then reject
set protocols bgp group UNDERLAY type external
set protocols bgp group UNDERLAY description "Connection to EBGP UNDERLAY"
set protocols bgp group UNDERLAY import UNDERLAY-IMPORT
set protocols bgp group UNDERLAY family inet unicast
set protocols bgp group UNDERLAY authentication-key “SecretKeyPhrase”
set protocols bgp group UNDERLAY export UNDERLAY-EXPORT
set protocols bgp group UNDERLAY local-as 65012
set protocols bgp group UNDERLAY multipath multiple-as
set protocols bgp group UNDERLAY bfd-liveness-detection minimum-interval 350
set protocols bgp group UNDERLAY bfd-liveness-detection multiplier 3
set protocols bgp group UNDERLAY neighbor 192.168.100.5 peer-as 65013
```

Configure the Overlay

IN THIS SECTION

Requirements

Overview

This section shows how to configure the overlay. It includes IBGP peerings, the VLAN to VXLAN mappings, and the IRB interface configurations for the virtual networks.

Overlay and Virtual Network Configuration

IN THIS SECTION

Use this section to configure the overlay and virtual networks on the collapsed core layer switches.

This section shows the step-by-step configuration procedures for each device.

Collapsed Core 1 Configuration

Step-by-Step Procedure

1. Configure IBGP neighbors from the collapsed core switch to the core switches.

```
set routing-options autonomous-system 65100
set protocols bgp group EVPN_FABRIC type internal
set protocols bgp group EVPN_FABRIC description "OVERLAY Config"
set protocols bgp group EVPN_FABRIC local-address 192.168.255.11
set protocols bgp group EVPN_FABRIC family evpn signaling
set protocols bgp group EVPN_FABRIC authentication-key “SecretKeyPhrase”
set protocols bgp group EVPN_FABRIC local-as 65100
set protocols bgp group EVPN_FABRIC multipath
set protocols bgp group EVPN_FABRIC neighbor 192.168.255.12
set protocols evpn no-core-isolation
```

2. Configure switch options on the collapsed core switch.

```
set switch-options vtep-source-interface lo0.0
set switch-options route-distinguisher 192.168.255.11:1
set switch-options vrf-target target:999:999
set switch-options vrf-target auto
```

3. Enable VXLAN encapsulation.

```
set protocols evpn encapsulation vxlan
set protocols evpn default-gateway no-gateway-community
set protocols evpn extended-vni-list 5101
set protocols evpn extended-vni-list 5102
set protocols evpn extended-vni-list 5201
set protocols evpn extended-vni-list 5202
set protocols evpn extended-vni-list 5301
set protocols evpn extended-vni-list 5302
```

4. Configure VLANs and VXLAN mappings.

```
set vlans VLAN-101 description Employee-Wired-VLAN
set vlans VLAN-101 vlan-id 101
set vlans VLAN-101 l3-interface irb.101
set vlans VLAN-101 vxlan vni 5101
set vlans VLAN-102 description Employee-Wireless-VLAN
set vlans VLAN-102 vlan-id 102
set vlans VLAN-102 l3-interface irb.102
set vlans VLAN-102 vxlan vni 5102
set vlans VLAN-201 description Guest-Wired-VLAN
set vlans VLAN-201 vlan-id 201
set vlans VLAN-201 l3-interface irb.201
set vlans VLAN-201 vxlan vni 5201
set vlans VLAN-202 description Guest-Wireless-VLAN
set vlans VLAN-202 vlan-id 202
set vlans VLAN-202 l3-interface irb.202
set vlans VLAN-202 vxlan vni 5202
set vlans VLAN-301 description IOT-Wired-VLAN
set vlans VLAN-301 vlan-id 301
set vlans VLAN-301 l3-interface irb.301
set vlans VLAN-301 vxlan vni 5301
```

```
set vlans VLAN-302 description IOT-Wireless-VLAN
set vlans VLAN-302 vlan-id 302
set vlans VLAN-302 l3-interface irb.302
set vlans VLAN-302 vxlan vni 5302
```

5. Configure the IRB interfaces for the Employees, Guests, and the IoT devices VLANs.

```
set interfaces irb unit 101 virtual-gateway-accept-data
set interfaces irb unit 101 description Wired-Employee
set interfaces irb unit 101 family inet address 192.168.101.3/24 virtual-gateway-address
192.168.101.1
set interfaces irb unit 102 virtual-gateway-accept-data
set interfaces irb unit 102 description Wireless-Employee
set interfaces irb unit 102 family inet address 192.168.102.3/24 virtual-gateway-address
192.168.102.1
set interfaces irb unit 201 virtual-gateway-accept-data
set interfaces irb unit 201 description Guest-Wired-Subnet
set interfaces irb unit 201 family inet address 192.168.201.3/24 virtual-gateway-address
192.168.201.1
set interfaces irb unit 202 virtual-gateway-accept-data
set interfaces irb unit 202 description Guest-Wireless-Subnet
set interfaces irb unit 202 family inet address 192.168.202.3/24 virtual-gateway-address
192.168.202.1
set interfaces irb unit 301 virtual-gateway-accept-data
set interfaces irb unit 301 description Wired-IOT
set interfaces irb unit 301 family inet address 192.168.210.3/24 virtual-gateway-address
192.168.210.1
set interfaces irb unit 302 virtual-gateway-accept-data
set interfaces irb unit 302 description Wireless-IOT
set interfaces irb unit 302 family inet address 192.168.212.3/24 virtual-gateway-address
192.168.212.1
```

6. Configure the VRF instances.

```
set routing-instances JNPR_1_VRF description "VRF for Guest Access"
set routing-instances JNPR_1_VRF instance-type vrf
set routing-instances JNPR_1_VRF interface irb.201
set routing-instances JNPR_1_VRF interface irb.202
set routing-instances JNPR_1_VRF route-distinguisher 192.168.255.11:101
set routing-instances JNPR_1_VRF vrf-target target:1:65001
set routing-instances JNPR_1_VRF vrf-table-label
```

```
set routing-instances JNPR_1_VRF routing-options auto-export
set routing-instances JNPR_2_VRF description "VRF for Employee Access"
set routing-instances JNPR_2_VRF instance-type vrf
set routing-instances JNPR_2_VRF interface irb.101
set routing-instances JNPR_2_VRF interface irb.102
set routing-instances JNPR_2_VRF route-distinguisher 192.168.255.11:102
set routing-instances JNPR_2_VRF vrf-target target:2:65001
set routing-instances JNPR_2_VRF vrf-table-label
set routing-instances JNPR_3_VRF description "VRF for IOT Access"
set routing-instances JNPR_3_VRF instance-type vrf
set routing-instances JNPR_3_VRF interface irb.301
set routing-instances JNPR_3_VRF interface irb.302

set routing-instances JNPR_3_VRF route-distinguisher 192.168.255.11:103
set routing-instances JNPR_3_VRF vrf-target target:3:65001
set routing-instances JNPR_3_VRF vrf-table-label
set routing-instances JNPR_3_VRF routing-options auto-export
set routing-instances JNPR_2_VRF routing-options auto-export
```

7. (Optional) Enable IGMP snooping to constrain the flooding of IPv4 multicast traffic on the VLANs.

```
set protocols igmp-snooping vlan VLAN-201 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-202 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-101 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-102 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-301 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-301 interface ae11.0 multicast-router-interface
```

Collapsed Core 2 Configuration

Step-by-Step Procedure

1. Configure IBGP neighbors from the collapsed core switch to the core switches.

```
set routing-options autonomous-system 65100
set protocols bgp group EVPN_FABRIC type internal
set protocols bgp group EVPN_FABRIC description "OVERLAY Config"
set protocols bgp group EVPN_FABRIC local-address 192.168.255.12
set protocols bgp group EVPN_FABRIC family evpn signaling
```

```
set protocols bgp group EVPN_FABRIC authentication-key “SecretKeyPhrase”
set protocols bgp group EVPN_FABRIC local-as 65100
set protocols bgp group EVPN_FABRIC multipath
set protocols bgp group EVPN_FABRIC neighbor 192.168.255.11
set protocols evpn no-core-isolation
```

2. Configure switch options on the collapsed core switch.

```
set switch-options vtep-source-interface lo0.0
set switch-options route-distinguisher 192.168.255.12:1
set switch-options vrf-target target:999:999
set switch-options vrf-target auto
```

3. Enable VXLAN encapsulation.

```
set protocols evpn encapsulation vxlan
set protocols evpn extended-vni-list 5101
set protocols evpn extended-vni-list 5102
set protocols evpn extended-vni-list 5201
set protocols evpn extended-vni-list 5202
set protocols evpn extended-vni-list 5301
set protocols evpn extended-vni-list 5302
```

4. Configure VLANs and VXLAN mappings.

```
set vlans VLAN-101 description Employee-Wired-VLAN
set vlans VLAN-101 vlan-id 101
set vlans VLAN-101 l3-interface irb.101
set vlans VLAN-101 vxlan vni 5101
set vlans VLAN-102 description Employee-Wireless-VLAN
set vlans VLAN-102 vlan-id 102
set vlans VLAN-102 l3-interface irb.102
set vlans VLAN-102 vxlan vni 5102
set vlans VLAN-201 description "Guest Wired Subnet"
set vlans VLAN-201 vlan-id 201
set vlans VLAN-201 l3-interface irb.201
set vlans VLAN-201 vxlan vni 5201
set vlans VLAN-202 description "Guest Wireless Subnet"
set vlans VLAN-202 vlan-id 202
set vlans VLAN-202 l3-interface irb.202
```

```
set vlans VLAN-202 vxlan vni 5202
set vlans VLAN-301 description IOT-Wired-VLAN
set vlans VLAN-301 vlan-id 301
set vlans VLAN-301 l3-interface irb.301
set vlans VLAN-301 vxlan vni 5301
set vlans VLAN-302 description IOT-Wireless-VLAN
set vlans VLAN-302 vlan-id 302
set vlans VLAN-302 l3-interface irb.302
set vlans VLAN-302 vxlan vni 5302
```

5. Configure the IRB interfaces for the Employees, Guests, and the IoT devices VLANs.

```
set interfaces irb unit 101 description "** Employee-Wired-Subnet"
set interfaces irb unit 101 virtual-gateway-accept-data
set interfaces irb unit 101 family inet address 192.168.101.2/24 virtual-gateway-address
192.168.101.1
set interfaces irb unit 102 virtual-gateway-accept-data
set interfaces irb unit 102 family inet address 192.168.102.2/24 virtual-gateway-address
192.168.102.1
set interfaces irb unit 201 virtual-gateway-accept-data
set interfaces irb unit 201 description "** L3 interface for VLAN-201 in jnpr_1"
set interfaces irb unit 201 family inet address 192.168.201.2/24 virtual-gateway-address
192.168.201.1
set interfaces irb unit 202 virtual-gateway-accept-data
set interfaces irb unit 202 description "** L3 interface for VLAN-202 in jnpr_1"
set interfaces irb unit 202 family inet address 192.168.202.2/24 virtual-gateway-address
192.168.202.1
set interfaces irb unit 301 virtual-gateway-accept-data
set interfaces irb unit 301 description Wired-IOT-Subnet
set interfaces irb unit 301 family inet address 192.168.210.2/24 virtual-gateway-address
192.168.210.1
set interfaces irb unit 302 virtual-gateway-accept-data
set interfaces irb unit 302 description Wireless-IOT-subnet
set interfaces irb unit 302 family inet address 192.168.212.2/24 virtual-gateway-address
192.168.212.1
```

6. Configure the VRF instances.

```
set routing-instances JNPR_1_VRF description "VRF for Guest Access"
set routing-instances JNPR_1_VRF instance-type vrf
set routing-instances JNPR_1_VRF interface irb.201
```

```
set routing-instances JNPR_1_VRF interface irb.202
set routing-instances JNPR_1_VRF route-distinguisher 192.168.255.12:101
set routing-instances JNPR_1_VRF vrf-target target:1:65001
set routing-instances JNPR_1_VRF vrf-table-label
set routing-instances JNPR_1_VRF routing-options auto-export
set routing-instances JNPR_2_VRF description "VRF for Employee Access"
set routing-instances JNPR_2_VRF instance-type vrf
set routing-instances JNPR_2_VRF interface irb.101
set routing-instances JNPR_2_VRF interface irb.102
set routing-instances JNPR_2_VRF route-distinguisher 192.168.255.12:102
set routing-instances JNPR_2_VRF vrf-target target:2:65001
set routing-instances JNPR_2_VRF vrf-table-label
set routing-instances JNPR_2_VRF routing-options auto-export
set routing-instances JNPR_3_VRF description "VRF for IOT Access"
set routing-instances JNPR_3_VRF instance-type vrf
set routing-instances JNPR_3_VRF interface irb.301
set routing-instances JNPR_3_VRF interface irb.302
set routing-instances JNPR_3_VRF route-distinguisher 192.168.255.12:103
set routing-instances JNPR_3_VRF vrf-target target:3:65001
set routing-instances JNPR_3_VRF vrf-table-label
set routing-instances JNPR_3_VRF routing-options auto-export
```

7. (Optional) Enable IGMP snooping to constrain the flooding of IPv4 multicast traffic on the VLANs.

```
set protocols igmp-snooping vlan VLAN-201 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-202 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-101 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-102 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-301 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-301 interface ae11.0 multicast-router-interface
```

Configure Multihoming Between the Access Layer Switch and Collapsed Core Switches

IN THIS SECTION

Requirements

Overview

IN THIS SECTION

This section illustrates the configurations necessary to multihome uplink interfaces from an access layer switch to collapsed core layer switches. Use this example to configure the multihome access layer uplink interfaces in the same aggregated Ethernet interface to multiple collapsed core switches.

When you configure EVPN multihoming, use the same ESI value to configure a multihomed segment on the different collapsed core switch interfaces that connect to the same access switch. ESI values are encoded as 10-byte integers and are used to identify a multihomed segment. We recommend using an ESI value that uses the same values on the first 8 bytes and changes only the 9th and 10th bytes per EVPN LAG.

Topology

The access layer supports Layer 2 for VLANs. The uplink from the access layer is an aggregated Ethernet link bundle or LAG configured as a trunk port that carries the VLANs from the access layer switch to the collapsed core layer switches.

Refer to Figure 4 on page 9 for details on the physical topology for connectivity between one access layer switch and the Collapsed Core 1 switch.

Configuration

IN THIS SECTION

Use this example to configure the collapsed core layer for EVPN multihoming and the access layer switch.

This section shows the step-by-step configuration procedures for each device.

Collapsed Core 1 Configuration

Step-by-Step Procedure

1. Specify which members to include in the aggregated Ethernet bundle.

```
set interfaces ge-0/0/3 description "Connected to campus-tme-ex4300-01"
set interfaces ge-0/0/3 ether-options 802.3ad ae11
```

2. Configure the aggregated Ethernet interface, including the Ethernet segment identifier (ESI), which assigns the multihomed interface on this switch to an Ethernet segment. The ESI value must be the same on the different multihomed interfaces.

```
set chassis aggregated-devices ethernet device-count 1
set interfaces ae11 description To-Access-1
set interfaces ae11 mtu 9200
set interfaces ae11 esi 00:11:11:11:11:11:11:11:11:01
set interfaces ae11 esi all-active
set interfaces ae11 aggregated-ether-options lacp active
set interfaces ae11 aggregated-ether-options lacp periodic fast
set interfaces ae11 aggregated-ether-options lacp system-id 00:40:00:00:00:01
set interfaces ae11 unit 0 family ethernet-switching interface-mode trunk
set interfaces ae11 unit 0 family ethernet-switching vlan members VLAN-201
set interfaces ae11 unit 0 family ethernet-switching vlan members VLAN-202
```

```
set interfaces ae11 unit 0 family ethernet-switching vlan members VLAN-101
set interfaces ae11 unit 0 family ethernet-switching vlan members VLAN-102
set interfaces ae11 unit 0 family ethernet-switching vlan members VLAN-301
set interfaces ae11 unit 0 family ethernet-switching vlan members VLAN-302
```

Collapsed Core 2 Configuration

Step-by-Step Procedure

1. Specify which members to include in the aggregated Ethernet bundle.

```
set interfaces ge-0/0/6 description "Connected to campus-tme-ex2300-01"
set interfaces ge-0/0/6 ether-options 802.3ad ae11
```

2. Configure the aggregated Ethernet interface, including the Ethernet segment identifier (ESI), which assigns the multihomed interface on this switch to an Ethernet segment. The ESI value must be the same on the different multihomed interfaces.

```
set chassis aggregated-devices ethernet device-count 1
set interfaces ae11 description To-Access-1
set interfaces ae11 mtu 9200
set interfaces ae11 esi 00:11:11:11:11:11:11:11:11:01
set interfaces ae11 esi all-active
set interfaces ae11 aggregated-ether-options lacp active
set interfaces ae11 aggregated-ether-options lacp periodic fast
set interfaces ae11 aggregated-ether-options lacp system-id 00:40:00:00:00:01
set interfaces ae11 unit 0 family ethernet-switching interface-mode trunk
set interfaces ae11 unit 0 family ethernet-switching vlan members VLAN-201
set interfaces ae11 unit 0 family ethernet-switching vlan members VLAN-202
set interfaces ae11 unit 0 family ethernet-switching vlan members VLAN-101
set interfaces ae11 unit 0 family ethernet-switching vlan members VLAN-102
set interfaces ae11 unit 0 family ethernet-switching vlan members VLAN-301
set interfaces ae11 unit 0 family ethernet-switching vlan members VLAN-302
```

Access Switch Configuration

Step-by-Step Procedure

1. Specify which members to include in the aggregated Ethernet bundle.

```
set interfaces ge-0/0/1 description "to Campus-tme--ex4650-01"
set interfaces ge-0/0/1 ether-options 802.3ad ae11
set interfaces ge-0/0/2 description "To Campus-tme-ex4650-02"
set interfaces ge-0/0/2 ether-options 802.3ad ae11
```

2. Configure the aggregated Ethernet interface.

```
set chassis aggregated-devices ethernet device-count 1
set interfaces ae11 aggregated-ether-options lacp active
set interfaces ae11 aggregated-ether-options lacp periodic fast
set interfaces ae11 unit 0 family ethernet-switching interface-mode trunk
set interfaces ae11 unit 0 family ethernet-switching vlan members 101-102
set interfaces ae11 unit 0 family ethernet-switching vlan members 201-202
set interfaces ae11 unit 0 family ethernet-switching vlan members 301-302
```

3. Configure the VLANs.

```
set vlans VLAN-201 vlan-id 201
set vlans VLAN-101 vlan-id 101
set vlans VLAN-102 vlan-id 102
set vlans VLAN-201 vlan-id 201
set vlans VLAN-202 vlan-id 202
set vlans VLAN-301 vlan-id 301
set vlans VLAN-302 vlan-id 302
```

You now have multihomed the uplink interfaces from the access layer switch to the collapsed core devices.

If you have multiple access layer switches in your network, repeat this configuration procedure for each switch.

NOTE: For more information on configuring ports for PoE, trunk ports for Access Point, and configuring 802.1X, see "How to Configure the SRX Router" on page 43.

Verification

IN THIS SECTION

Requirements

Overview

In this section you verify proper operation of the EVPN MC LAG example. Log in to each device and verify that the EVPN-VXLAN fabric has been configured.

Verification

IN THIS SECTION

Collapsed Core 1: Verifying BGP Sessions

Purpose

Verify the state of the BGP sessions with the core devices.

Action

Verify that the Collapsed Core 1 IBGP sessions are established with the loopbacks of the core devices, which have IP addresses 192.168.0.4 and 192.168.0.5.

```
user@campus-tme-ex4650-01> show bgp summary
Threading mode: BGP I/O
Default eBGP mode: advertise - accept, receive - accept
Groups: 2 Peers: 2 Down peers: 0
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0
                       1          1          0          0          0          0
bgp.evpn.0
                      39         39          0          0          0          0
Peer                     AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn State|#Active/
Received/Accepted/Damped...
192.168.100.4         65012         54         53       0       0       22:51 Establ
  inet.0: 1/1/1/0
192.168.255.12        65100        177        167       0       0       22:49 Establ
  bgp.evpn.0: 39/39/39/0
  default-switch.evpn.0: 38/38/38/0
  __default_evpn__.evpn.0: 1/1/1/0
```

Meaning

The IBGP sessions are established with the loopbacks of the core devices using MP-IBGP with EVPN signaling in the overlay layer to enable the exchange of EVPN routes.

Collapsed Core 2: Verifying BGP Sessions

Purpose

Verify the state of the BGP sessions with the Collapsed Core 2.

Action

Verify that BGP sessions are established with the core devices. The IP addresses of the core devices are 192.168.0.4 and 192.168.0.5.

```
user@campus-tme-ex4650-02> show bgp summary
Threading mode: BGP I/O
Default eBGP mode: advertise - accept, receive - accept
Groups: 2 Peers: 2 Down peers: 0
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0
                       1          1          0          0          0          0
bgp.evpn.0
                      39         39          0          0          0          0
Peer                     AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn State|#Active/
Received/Accepted/Damped...
192.168.100.5         65013         62         61       0       0       26:45 Establ
  inet.0: 1/1/1/0
192.168.255.11        65100        176        185       0       0       26:43 Establ
  bgp.evpn.0: 39/39/39/0
  default-switch.evpn.0: 38/38/38/0
  __default_evpn__.evpn.0: 1/1/1/0
```

Meaning

The IBGP sessions are established with the loopbacks of the core devices using MP-IBGP with EVPN signaling in the overlay layer to enable the exchange of EVPN routes.

Collapsed Core 1: Verifying EVPN Database Information

Purpose

Verify that the EVPN database has been populated correctly.

Action

Verify that the EVPN database is installing MAC address information for locally attached hosts and receiving advertisements from other leaf devices with information about remote hosts.

```
user@campus-tme-ex4650-01> show evpn database
Instance: default-switch
VLAN  DomainId  MAC address        Active source                  Timestamp        IP address
     5101       00:00:5e:00:01:01  05:00:00:fe:4c:00:00:13:ed:00  Aug 19 10:21:46  192.168.101.1
     5101       02:05:86:71:5d:00  irb.101                        Aug 19 10:21:46  192.168.101.3
     5101       02:05:86:71:8d:00  192.168.255.12                 Aug 19 10:21:46  192.168.101.2
     5102       00:00:5e:00:01:01  05:00:00:fe:4c:00:00:13:ee:00  Aug 19 10:21:46  192.168.102.1
     5102       02:05:86:71:5d:00  irb.102                        Aug 19 10:21:46  192.168.102.3
     5102       02:05:86:71:8d:00  192.168.255.12                 Aug 19 10:21:46  192.168.102.2
     5201       00:00:5e:00:01:01  05:00:00:fe:4c:00:00:14:51:00  Aug 19 10:21:46  192.168.201.1
     5201       02:05:86:71:5d:00  irb.201                        Aug 19 10:21:46  192.168.201.3
     5201       02:05:86:71:8d:00  192.168.255.12                 Aug 19 10:21:46  192.168.201.2
     5202       00:00:5e:00:01:01  05:00:00:fe:4c:00:00:14:52:00  Aug 19 10:21:46  192.168.202.1
     5202       02:05:86:71:5d:00  irb.202                        Aug 19 10:21:46  192.168.202.3
     5202       02:05:86:71:8d:00  192.168.255.12                 Aug 19 10:21:46  192.168.202.2
     5301       00:00:5e:00:01:01  05:00:00:fe:4c:00:00:14:b5:00  Aug 19 10:22:35  192.168.210.1
     5301       02:05:86:71:5d:00  irb.301                        Aug 19 10:21:46  192.168.210.3
     5301       02:05:86:71:8d:00  192.168.255.12                 Aug 19 10:22:35  192.168.210.2
     5302       00:00:5e:00:01:01  05:00:00:fe:4c:00:00:14:b6:00  Aug 19 10:21:46  192.168.212.1
     5302       02:05:86:71:5d:00  irb.302                        Aug 19 10:21:46  192.168.212.3
     5302       02:05:86:71:8d:00  192.168.255.12                 Aug 19 10:22:35  192.168.212.2
```

Meaning

The output above confirms that the EVPN database is properly learning and installing MAC routes for all endpoints. It also shows the relationship between MAC addresses and their associated VNIs: 5101, 5102, 5201, 5202 , 5301 and 5302.

Collapsed Core 2: Verifying EVPN Database Information

Purpose

Verify that the EVPN database has been populated correctly.

Action

Verify that the EVPN database is installing MAC address information for locally attached hosts and receiving advertisements from the other leaf devices with information about remote hosts.

```
user@campus-tme-ex4650-02> show evpn database
Instance: default-switch
VLAN  DomainId  MAC address        Active source                  Timestamp        IP address
     5101       00:00:5e:00:01:01  05:00:00:fe:4c:00:00:13:ed:00  Aug 19 10:21:46  192.168.101.1
     5101       02:05:86:71:5d:00  irb.101                        Aug 19 10:21:46  192.168.101.3
     5101       02:05:86:71:8d:00  192.168.255.12                 Aug 19 10:21:46  192.168.101.2
     5102       00:00:5e:00:01:01  05:00:00:fe:4c:00:00:13:ee:00  Aug 19 10:21:46  192.168.102.1
     5102       02:05:86:71:5d:00  irb.102                        Aug 19 10:21:46  192.168.102.3
     5102       02:05:86:71:8d:00  192.168.255.12                 Aug 19 10:21:46  192.168.102.2
     5201       00:00:5e:00:01:01  05:00:00:fe:4c:00:00:14:51:00  Aug 19 10:21:46  192.168.201.1
     5201       02:05:86:71:5d:00  irb.201                        Aug 19 10:21:46  192.168.201.3
     5201       02:05:86:71:8d:00  192.168.255.12                 Aug 19 10:21:46  192.168.201.2
     5202       00:00:5e:00:01:01  05:00:00:fe:4c:00:00:14:52:00  Aug 19 10:21:46  192.168.202.1
     5202       02:05:86:71:5d:00  irb.202                        Aug 19 10:21:46  192.168.202.3
     5202       02:05:86:71:8d:00  192.168.255.12                 Aug 19 10:21:46  192.168.202.2
     5301       00:00:5e:00:01:01  05:00:00:fe:4c:00:00:14:b5:00  Aug 19 10:22:35  192.168.210.1
     5301       02:05:86:71:5d:00  irb.301                        Aug 19 10:21:46  192.168.210.3
     5301       02:05:86:71:8d:00  192.168.255.12                 Aug 19 10:22:35  192.168.210.2
     5302       00:00:5e:00:01:01  05:00:00:fe:4c:00:00:14:b6:00  Aug 19 10:21:46  192.168.212.1
     5302       02:05:86:71:5d:00  irb.302                        Aug 19 10:21:46  192.168.212.3
     5302       02:05:86:71:8d:00  192.168.255.12                 Aug 19 10:22:35  192.168.212.2
```

Meaning

The output above confirms that the EVPN database is properly learning and installing MAC routes for all endpoints. It also shows the relationship between MAC addresses and their associated VNIs: 5101, 5102, 5201, 5202 , 5301 and 5302.

Collapsed Core 1: Verifying Local Switching Table Information

Purpose

Verify that the local switching table has been populated correctly.

Action

Verify that the local switching table is installing MAC address information for locally attached hosts and receiving advertisements from the other leaf devices with information about remote hosts.

```
user@campus-tme-ex4650-01> 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, O - ovsdb MAC)


Ethernet switching table : 12 entries, 12 learned
Routing instance : default-switch
   Vlan                MAC                 MAC      Logical                SVLBNH/      Active
   name                address             flags    interface              VENH Index   source
   VLAN-101            00:00:5e:00:01:01   DR       esi.1734
05:00:00:fe:4c:00:00:13:ed:00
   VLAN-101            02:05:86:71:8d:00   D        vtep.32769
192.168.255.12
   VLAN-102            00:00:5e:00:01:01   DR       esi.1739
05:00:00:fe:4c:00:00:13:ee:00
   VLAN-102            02:05:86:71:8d:00   D        vtep.32769
192.168.255.12
   VLAN-201            00:00:5e:00:01:01   DR       esi.1735
05:00:00:fe:4c:00:00:14:51:00
   VLAN-201            02:05:86:71:8d:00   D        vtep.32769
192.168.255.12
   VLAN-202            00:00:5e:00:01:01   DR       esi.1736
05:00:00:fe:4c:00:00:14:52:00
   VLAN-202            02:05:86:71:8d:00   D        vtep.32769
192.168.255.12
   VLAN-301            00:00:5e:00:01:01   DR       esi.1737
05:00:00:fe:4c:00:00:14:b5:00
   VLAN-301            02:05:86:71:8d:00   D        vtep.32769
192.168.255.12
   VLAN-302            00:00:5e:00:01:01   DR       esi.1738
05:00:00:fe:4c:00:00:14:b6:00
   VLAN-302            02:05:86:71:8d:00   D        vtep.32769
192.168.255.12
```

Meaning

The output above confirms that the local switching table is correctly learning and installing MAC addresses for all endpoints. It also shows the relationship between MAC addresses, VLANs they are associated to (in this case, VLANs 101,102, 201,202, 301 and 302), and their next-hop interface.

Collapsed Core 2: Verifying Local Switching Table Information

Purpose

Verify that the local switching table has been populated correctly.

Action

Verify that the local switching table is installing MAC address information for locally attached hosts and receiving advertisements from the other leaf devices with information about remote hosts.

```
user@campus-tme-ex4650-02> 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, O - ovsdb MAC)


Ethernet switching table : 12 entries, 12 learned
Routing instance : default-switch
   Vlan                MAC                 MAC      Logical                SVLBNH/      Active
   name                address             flags    interface              VENH Index   source
   VLAN-101            00:00:5e:00:01:01   DR       esi.1878
05:00:00:fe:4c:00:00:13:ed:00
   VLAN-101            02:05:86:71:5d:00   D        vtep.32769
192.168.255.11
   VLAN-102            00:00:5e:00:01:01   DR       esi.1958
05:00:00:fe:4c:00:00:13:ee:00
   VLAN-102            02:05:86:71:5d:00   D        vtep.32769
192.168.255.11
   VLAN-201            00:00:5e:00:01:01   DR       esi.1960
05:00:00:fe:4c:00:00:14:51:00
   VLAN-201            02:05:86:71:5d:00   D        vtep.32769
192.168.255.11
   VLAN-202            00:00:5e:00:01:01   DR       esi.1959
05:00:00:fe:4c:00:00:14:52:00
   VLAN-202            02:05:86:71:5d:00   D        vtep.32769
192.168.255.11
```

```
   VLAN-301            00:00:5e:00:01:01   DR       esi.1860
05:00:00:fe:4c:00:00:14:b5:00
   VLAN-301            02:05:86:71:5d:00   D        vtep.32769
192.168.255.11
   VLAN-302            00:00:5e:00:01:01   DR       esi.1957
05:00:00:fe:4c:00:00:14:b6:00
   VLAN-302            02:05:86:71:5d:00   D        vtep.32769
192.168.255.11
```

Meaning

The output above confirms that the local switching table is correctly learning and installing MAC addresses for all endpoints. It also shows the relationship between MAC addresses, VLANs they are associated to (in this case, VLANs 101,102, 201,202, 301 and 302), and their next-hop interface.

Collapsed Core1: Verifying Multihomed Ethernet Segment

Purpose

Check the multihomed connection from Access Switch 1 to the collapsed core devices.

Action

Verify the local interfaces that are part of the Ethernet segment, other collapsed core devices that are part of the same Ethernet segment, the bridge domains that are part of the Ethernet segment, and the designated forwarder for the Ethernet segment.

```
user@campus-tme-ex4650-01> show evpn instance esi 00:11:11:11:11:11:11:11:11:01 extensive
Instance: default-switch
  Route Distinguisher: 192.168.255.11:1
  Encapsulation type: VXLAN
  Duplicate MAC detection threshold: 5
  Duplicate MAC detection window: 180
  MAC database status                    Local  Remote
    MAC advertisements:                      6      12
    MAC+IP advertisements:                  12      12
    Default gateway MAC advertisements:     12       6
  Number of local interfaces: 2 (2 up)
    Interface name  ESI                            Mode             Status     AC-Role
    .local..3       00:00:00:00:00:00:00:00:00:00  single-homed     Up         Root
    ae11.0          00:11:11:11:11:11:11:11:11:01  all-active       Up         Root
```

```
  Number of IRB interfaces: 6 (6 up)
    Interface name  VLAN   VNI    Status  L3 context
    irb.101                5101    Up     JNPR_2_VRF
    irb.102                5102    Up     JNPR_2_VRF
    irb.201                5201    Up     JNPR_1_VRF
    irb.202                5202    Up     JNPR_1_VRF
    irb.301                5301    Up     JNPR_3_VRF
    irb.302                5302    Up     JNPR_3_VRF
  Number of protect interfaces: 0
  Number of bridge domains: 6
    VLAN  Domain-ID Intfs/up   IRB-intf  Mode            MAC-sync IM-label  v4-SG-sync IM-core-
NH v6-SG-sync IM-core-NH Trans-ID
    101   5101         1  1    irb.101   Extended        Enabled  5101      Enabled
131134     Disabled             5101
    102   5102         1  1    irb.102   Extended        Enabled  5102      Enabled
131130     Disabled             5102
    201   5201         1  1    irb.201   Extended        Enabled  5201      Enabled
131142     Disabled             5201
    202   5202         1  1    irb.202   Extended        Enabled  5202      Enabled
131138     Disabled             5202
    301   5301         1  1    irb.301   Extended        Enabled  5301      Enabled
131126     Disabled             5301
    302   5302         1  1    irb.302   Extended        Enabled  5302      Enabled
131122     Disabled             5302
  Number of neighbors: 1
    Address               MAC    MAC+IP        AD        IM        ES Leaf-label Remote-DCI-Peer
    192.168.255.12         12        12         8         6         0
  Number of ethernet segments: 7
    ESI: 00:11:11:11:11:11:11:11:11:01
      Status: Resolved by IFL ae11.0
      Local interface: ae11.0, Status: Up/Forwarding
      Number of remote PEs connected: 1
        Remote-PE        MAC-label  Aliasing-label  Mode
        192.168.255.12   0          0               all-active
      DF Election Algorithm: MOD based
      Designated forwarder: 192.168.255.12
      Backup forwarder: 192.168.255.11
      Last designated forwarder update: Aug 19 10:21:50
  Router-ID: 192.168.255.11
  SMET Forwarding: Enabled: Nexthop Limit: 10000 Nexthop Usage: 1
```

Meaning

Interface ae11.0 is part of this Ethernet segment. The virtual networks (Employees, Guests, and IoT) are part of this Ethernet segment. The remote PE or collapsed core device participating in this Ethernet segment is 192.168.255.12.

Collapsed Core 2: Verifying Multihomed Ethernet Segment

Purpose

Check the multihomed connection from Access Switch 1 to the collapsed core.

Action

Verify that the local interfaces that are part of the Ethernet segment, other collapsed core devices that are part of the same Ethernet segment, the bridge domains that are part of the Ethernet segment, and the designated forwarder for the Ethernet segment.

```
user@campus-tme-ex4650-02> show evpn instance esi 00:11:11:11:11:11:11:11:11:01 extensive
Instance: default-switch
  Route Distinguisher: 192.168.255.12:1
  Encapsulation type: VXLAN
  Duplicate MAC detection threshold: 5
  Duplicate MAC detection window: 180
  MAC database status                    Local  Remote
    MAC advertisements:                      6      12
    MAC+IP advertisements:                  12      12
    Default gateway MAC advertisements:     12       0
  Number of local interfaces: 2 (2 up)
    Interface name  ESI                            Mode             Status     AC-Role
    .local..3       00:00:00:00:00:00:00:00:00:00  single-homed     Up         Root
    ae11.0          00:11:11:11:11:11:11:11:11:01  all-active       Up         Root
  Number of IRB interfaces: 6 (6 up)
    Interface name  VLAN   VNI    Status  L3 context
    irb.101                5101    Up     JNPR_2_VRF
    irb.102                5102    Up     JNPR_2_VRF
    irb.201                5201    Up     JNPR_1_VRF
    irb.202                5202    Up     JNPR_1_VRF
    irb.301                5301    Up     JNPR_3_VRF
    irb.302                5302    Up     JNPR_3_VRF
  Number of protect interfaces: 0
  Number of bridge domains: 6
```

```
    VLAN  Domain-ID Intfs/up   IRB-intf  Mode           MAC-sync IM-label  v4-SG-sync IM-core-
NH v6-SG-sync IM-core-NH Trans-ID
    101   5101         1  1    irb.101   Extended       Enabled  5101      Enabled
131088     Disabled             5101
    102   5102         1  1    irb.102   Extended       Enabled  5102      Enabled
131084     Disabled             5102
    201   5201         1  1    irb.201   Extended       Enabled  5201      Enabled
131076     Disabled             5201
    202   5202         1  1    irb.202   Extended       Enabled  5202      Enabled
131072     Disabled             5202
    301   5301         1  1    irb.301   Extended       Enabled  5301      Enabled
131080     Disabled             5301
    302   5302         1  1    irb.302   Extended       Enabled  5302      Enabled
131093     Disabled             5302
  Number of neighbors: 1
    Address               MAC    MAC+IP        AD        IM        ES Leaf-label Remote-DCI-Peer
    192.168.255.11         12        12         8         6         0
  Number of ethernet segments: 7
    ESI: 00:11:11:11:11:11:11:11:11:01
      Status: Resolved by IFL ae11.0
      Local interface: ae11.0, Status: Up/Forwarding
      Number of remote PEs connected: 1
        Remote-PE        MAC-label  Aliasing-label  Mode
        192.168.255.11   0          0               all-active
      DF Election Algorithm: MOD based
      Designated forwarder: 192.168.255.12
      Backup forwarder: 192.168.255.11
      Last designated forwarder update: Aug 19 10:21:50
  Router-ID: 192.168.255.12
  SMET Forwarding: Enabled: Nexthop Limit: 10000 Nexthop Usage: 1
```

Meaning

Interface ae11.0 is part of this Ethernet segment. The virtual networks 1, 2, and 3 are part of this Ethernet segment. The remote PE, or collapsed core device, participating in this Ethernet segment is 192.168.255.11.

Managing the EVPN-VXLAN Fabric

IN THIS SECTION

Up to this point in the configuration of the EVPN-VXLAN fabric, we have used a topology with three virtual networks and one access layer switch that simulates an access closet. Use this section to add a second access switch and a new virtual network.

These configuration examples use the same devices you configured in the "How to Configure a Campus Network using EVPN Multihoming" on page 7 configuration example.

Add an Access Layer Switch

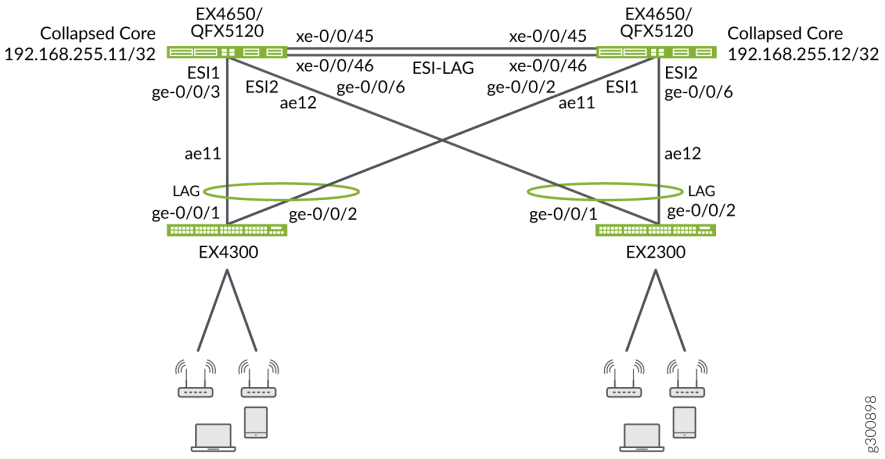
IN THIS SECTION

Requirements

Overview

Use this section to add a new access layer switch (Access Switch 2) to the network that is multihomed to the same collapsed core switches. Figure 5 on page 37 shows the physical topology with Access Switch 2.

Figure 5: EVPN-VXLAN Topology with Access Switch 2



Configuration

IN THIS SECTION

This section shows the step-by-step configuration procedures to add a new access Switch (Access Switch 2) to your network.

Collapsed Core 1 Configuration

Step-by-Step Procedure

1. Specify the interface to include in the aggregated Ethernet bundle.

```
set interfaces ge-0/0/6 description "Access Switch 2"
set interfaces ge-0/0/6 ether-options 802.3ad ae12
```

2. Configure the aggregated Ethernet interface to the new access layer switch and increase the ethernet device-count to two to support the additional aggregated Ethernet interface.

```
set chassis aggregated-devices ethernet device-count 2
set interfaces ae12 description To-Access-2
set interfaces ae12 mtu 9200
set interfaces ae12 esi 00:11:11:11:11:11:11:11:11:02
set interfaces ae12 esi all-active
set interfaces ae12 aggregated-ether-options lacp active
set interfaces ae12 aggregated-ether-options lacp periodic fast
set interfaces ae12 aggregated-ether-options lacp system-id 00:40:00:00:00:02
set interfaces ae12 unit 0 family ethernet-switching interface-mode trunk
set interfaces ae12 unit 0 family ethernet-switching vlan members VLAN-201
set interfaces ae12 unit 0 family ethernet-switching vlan members VLAN-202
set interfaces ae12 unit 0 family ethernet-switching vlan members VLAN-101
set interfaces ae12 unit 0 family ethernet-switching vlan members VLAN-102
set interfaces ae12 unit 0 family ethernet-switching vlan members VLAN-301
set interfaces ae12 unit 0 family ethernet-switching vlan members VLAN-302
```

Collapsed Core 2 Configuration

Step-by-Step Procedure

1. Specify the interface to include in the aggregated Ethernet bundle.

```
set interfaces ge-0/0/6 description "Access Switch 2"
set interfaces ge-0/0/6 ether-options 802.3ad ae12
```

2. Configure the aggregated Ethernet interface to the new access layer switch and increase the ethernet device-count to two to support the additional aggregated Ethernet interface.

```
set chassis aggregated-devices ethernet device-count 2
set interfaces ae12 description To-Access-2
set interfaces ae12 mtu 9200
set interfaces ae12 esi 00:11:11:11:11:11:11:11:11:02
set interfaces ae12 esi all-active
set interfaces ae12 aggregated-ether-options lacp active
set interfaces ae12 aggregated-ether-options lacp periodic fast
```

```
set interfaces ae12 aggregated-ether-options lacp system-id 00:40:00:00:00:02
set interfaces ae12 unit 0 family ethernet-switching interface-mode trunk
set interfaces ae12 unit 0 family ethernet-switching vlan members VLAN-201
set interfaces ae12 unit 0 family ethernet-switching vlan members VLAN-202
set interfaces ae12 unit 0 family ethernet-switching vlan members VLAN-101
set interfaces ae12 unit 0 family ethernet-switching vlan members VLAN-102
set interfaces ae12 unit 0 family ethernet-switching vlan members VLAN-301
set interfaces ae12 unit 0 family ethernet-switching vlan members VLAN-302
```

3. (Optional) Enable IGMP snooping to constrain the flooding of IPv4 multicast traffic on the VLANs.

```
set protocols igmp-snooping vlan VLAN-201 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-202 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-101 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-102 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-301 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-301 interface ae11.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-201 interface ae12.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-202 interface ae12.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-101 interface ae12.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-102 interface ae12.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-301 interface ae12.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-301 interface ae12.0 multicast-router-interface
```

Access Switch 2 Configuration

Step-by-Step Procedure

1. Configure the physical LAG interface.

```
set interfaces ge-0/0/1 description "to campus-tme-ex4650-01"
set interfaces ge-0/0/1 ether-options 802.3ad ae12
set interfaces ge-0/0/2 description "to campus-tme-ex4650-02"
set interfaces ge-0/0/2 ether-options 802.3ad ae12
```

2. Configure the LAG interface to the new access layer switch.

```
set chassis aggregated-devices ethernet device-count 1
```

```
set interfaces ae12 aggregated-ether-options lacp active
set interfaces ae12 aggregated-ether-options lacp periodic fast
set interfaces ae12 unit 0 family ethernet-switching interface-mode trunk
set interfaces ae12 unit 0 family ethernet-switching vlan members 101-102
set interfaces ae12 unit 0 family ethernet-switching vlan members 201-202
set interfaces ae12 unit 0 family ethernet-switching vlan members 301-302
```

3. (Optional) Enable IGMP snooping to constrain the flooding of IPv4 multicast traffic on the VLANs.

```
set protocols igmp-snooping vlan VLAN-201 interface ae12.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-202 interface ae12.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-101 interface ae12.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-102 interface ae12.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-301 interface ae12.0 multicast-router-interface
set protocols igmp-snooping vlan VLAN-301 interface ae12.0 multicast-router-interface
```

Configuring Optional Add-Ins

IN THIS SECTION

This section shows how to configure the following features, which are optional add-ins to the Collapsed Core with EVPN Multihomed Campus Network.

How to Configure DHCP

IN THIS SECTION

Requirements

Configure DHCP on the following devices that you configured in the "How to Configure a Campus Network using EVPN Multihoming" on page 7 configuration example:

- Two EX4650 or QFX5120 switches as collapsed core devices. Software version: Junos OS Release 20.2R2 or later.
- An external DHCP server.

Overview

Use this section to configure DHCP on the network. To avoid flooding the network with DHCP discover packets, configure DHCP on an interface in a VRF routing instance. The collapsed core devices act as a DHCP relay to a Layer 3 reachable external DHCP server.

Configuration

IN THIS SECTION

Procedure

Step-by-Step Procedure

1. Configure the collapsed core device to act as a DHCP relay only. It will not maintain a binding table.

```
set routing-instances JNPR_1_VRF forwarding-options dhcp-relay forward-only
```

2. Create a server group and specify the IP address of the DHCP server.

```
set routing-instances JNPR_1_VRF forwarding-options dhcp-relay server-group server_group_1
192.168.192.1
```

3. Specify the new server group as the active server group.

```
set routing-instances JNPR_1_VRF forwarding-options dhcp-relay group dhcp_relay_1 active-
server-group server_group_1
```

4. Suppress the installation of access, access-internal, or destination routes during client binding during the JDHCPD process.

```
set routing-instances JNPR_1_VRF forwarding-options dhcp-relay group dhcp_relay_1 route-
suppression destination
```

5. Always set the broadcast bit to one for all types of DHCP messages. If you do not configure this option, some clients will set the bit to zero before sending the message, which is not preferable.

```
set routing-instances JNPR_1_VRF forwarding-options dhcp-relay group dhcp_relay_1 overrides
no-unicast-replies
```

6. Configure the IRBs to connect to the related VLANs and subnets and provide DHCP services to those clients.

```
set routing-instances JNPR_1_VRF forwarding-options dhcp-relay group Relay_Group1 interface
irb.201
```

```
set routing-instances JNPR_1_VRF forwarding-options dhcp-relay group Relay_Group1 interface
irb.202
```

NOTE: In this step, you can include any IRB that is part of the routing instance.

NOTE: You will need to repeat this configuration on all the collapsed core devices in your network.

How to Configure the SRX Router

IN THIS SECTION

Configuration

IN THIS SECTION

CLI Quick Configuration

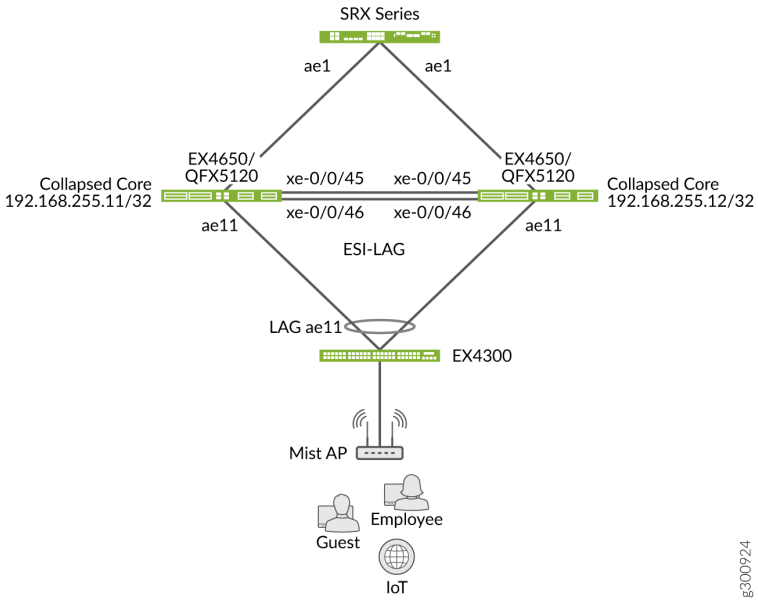
In this sample configuration, SRX is used to route user traffic from the Mist Access Points to the internet. Figure 6 on page 44 shows the collapsed core network along with the SRX router. This example uses the following configuration settings:

- VLAN 126 is used to forward traffic from the collapsed cores to the SRX and to internet.
- VLAN 125 is used send management traffic for cloud registration and operation of the Mist AP's.

- VLAN 125 is also marked as a native VLAN in the trunk port where the access point is connected
- Designate server_group_1 192.168.192.1 as the DHCP server.

For more information on configuring inter-vrf routing on the SRX router, see *SRX Configuration*

Figure 6: Collapse Core Network with SRX



SRX Configuration

Configure the following settings on the SRX router.

```
set security zones security-zone trust interfaces irb.126
set interfaces irb unit 126 family inet address 192.168.3.1/24
set vlans mgmt1 l3-interface irb.126
set interfaces ae1 unit 0 family ethernet-switching interface-mode trunk
set interfaces ae1 unit 0 family ethernet-switching vlan members mgmt1
set interfaces ge-0/0/4 unit 0 family inet address 10.204.37.175/20
set security nat source rule-set trust-to-untrust from zone trust
set security nat source rule-set trust-to-untrust to zone untrust
set security nat source rule-set trust-to-untrust rule source-nat-rule match source-address
0.0.0.0/0
set security nat source rule-set trust-to-untrust rule source-nat-rule then source-nat interface
set security policies from-zone trust to-zone trust policy trust-to-trust match source-address
```

```
any
set security policies from-zone trust to-zone trust policy trust-to-trust match destination-
address any
set security policies from-zone trust to-zone trust policy trust-to-trust match application any
set security policies from-zone trust to-zone trust policy trust-to-trust then permit
set security policies from-zone trust to-zone untrust policy trust-to-untrust match source-
address any
set security policies from-zone trust to-zone untrust policy trust-to-untrust match destination-
address any
set security policies from-zone trust to-zone untrust policy trust-to-untrust match application
any
set security policies from-zone trust to-zone untrust policy trust-to-untrust then permit
set security zones security-zone trust host-inbound-traffic system-services ping
set security zones security-zone trust host-inbound-traffic system-services all
set security zones security-zone trust host-inbound-traffic protocols all
set security zones security-zone trust interfaces irb.126
```

Collapsed Core 1 Configuration

Configure the following settings on the collapsed core switch.

```
set interfaces irb unit 126 family inet address 192.168.3.2/24
set vlans mgmt1 vxlan vni 1000126
set vlans mgmt1 vlan-id 126
set vlans mgmt1 l3-interface irb.126
set interfaces irb unit 125 family inet address 192.168.2.2/24
set vlans mgmt vlan-id 125
set vlans mgmt l3-interface irb.125
set vlans mgmt vxlan vni 1000125
set interfaces ae31 unit 0 family ethernet-switching vlan members mgmt1
set interfaces ae22 unit 0 family ethernet-switching vlan members mgmt
set groups dhcp-mist-relay forwarding-options dhcp-relay forward-only routing-instance default
set groups dhcp-mist-relay forwarding-options dhcp-relay forward-only-replies
set groups dhcp-mist-relay forwarding-options dhcp-relay server-group server_group_1
192.168.192.1
set groups dhcp-mist-relay forwarding-options dhcp-relay group dhcp_mist active-server-group
server_group_1
set groups dhcp-mist-relay forwarding-options dhcp-relay group dhcp_mist route-suppression
destination
set groups dhcp-mist-relay forwarding-options dhcp-relay group dhcp_mist interface irb.125
set apply-groups dhcp-mist-relay
```

Collapsed Core 2 Configuration

Configure the following settings on the collapsed core switch.

```
set interfaces irb unit 126 family inet address 192.168.3.3/24
set vlans mgmt1 vxlan vni 1000126
set vlans mgmt1 vlan-id 126
set vlans mgmt1 l3-interface irb.126
set interfaces irb unit 125 family inet address 192.168.2.3/24
set vlans mgmt vlan-id 125
set vlans mgmt l3-interface irb.125
set vlans mgmt vxlan vni 1000125
set interfaces ae31 unit 0 family ethernet-switching vlan members mgmt1
set interfaces ae22 unit 0 family ethernet-switching vlan members mgmt
set groups dhcp-mist-relay forwarding-options dhcp-relay forward-only routing-instance default
set groups dhcp-mist-relay forwarding-options dhcp-relay forward-only-replies
set groups dhcp-mist-relay forwarding-options dhcp-relay server-group server_group_1
192.168.192.1
set groups dhcp-mist-relay forwarding-options dhcp-relay group dhcp_mist active-server-group
server_group_1
set groups dhcp-mist-relay forwarding-options dhcp-relay group dhcp_mist route-suppression
destination
set groups dhcp-mist-relay forwarding-options dhcp-relay group dhcp_mist interface irb.125
set apply-groups dhcp-mist-relay
```

Access Switch Configuration for Mist AP

Configure the following settings on the access switch.

```
set poe interface ge-0/0/4
set poe interface ge-0/0/5
set interfaces ae22 unit 0 family ethernet-switching vlan members mgmt
set interfaces ge-0/0/4 native-vlan-id 125
set interfaces ge-0/0/4 unit 0 family ethernet-switching vlan members 125
set interfaces ge-0/0/5 native-vlan-id 125
set interfaces ge-0/0/5 unit 0 family ethernet-switching vlan members 125
```

Access Switch Configuration for 802.1X

We recommend that you enable 802.1x port-based network access control (PNAC) authentication for wired clients on the switches to authenticate the clients that connect to the switch ports.

There are three ways you can do this:

- Authenticate the first end device (supplicant) on an authenticator port, and allow all other connecting end devices to also have access to the LAN
- Authenticate a single end device on an authenticator port at one time
- Authenticate multiple end devices on an authenticator port (this is typically used in VoIP configurations

For this example, we will configure the switch to accept multiple supplicants.

```
set groups dot1x access radius-server 192.168.10.1 secret "$9$8.s7b2ZGi.mTZUqf5QCA"
set groups dot1x access radius-server 192.168.10.1 source-address 192.168.10.200
set groups dot1x protocols dot1x authenticator authentication-profile-name pdt_profile_1
set groups dot1x protocols dot1x authenticator no-mac-table-binding
set groups dot1x protocols dot1x authenticator interface ge-1/0/12.0 supplicant multiple
set groups dot1x protocols dot1x authenticator interface ge-1/0/12.0 mac-radius
set groups dot1x access profile pdt_profile_1 authentication-order radius
set groups dot1x access profile pdt_profile_1 radius authentication-server 192.168.10.1
```

What's Next

Juniper's Campus solution, based on a VXLAN overlay with EVPN control plane, is an efficient and scalable way to build and interconnect multiple campuses across a core network. With a robust BGP/EVPN implementation Juniper is well-positioned to harness the full potential of EVPN technology.

For more information on available EVPN features and how to configure them, see *EVPN User Guide*.

Collapsed Core EVPN-VXLAN with EVPN Multihoming Campus Network Scaling Data

Table 2 on page 48 lists the scaling values for the EX4650 switch and Table 3 on page 49 lists the scaling values for the QFX5120 switch operating as distribution nodes in the EVPN-VXLAN collapsed core with EVPN multihoming example. You can find the topology and configuration in "How to Configure a Campus Network using EVPN Multihoming" on page 7. These numbers do not represent the maximum supported scale. They represent only the solution testing performed for this example. The results of the tests are provided for reference purposes only.

Table 2: Scaling Values for the EX4650 Switch as a Distribution Node

Attribute	Fabric	Per Distribution Node (EX4650)
Virtual switches	1	1
VLANS/bridge domains/VNIs	4000	4000
ESIs	Not Applicable	62
IRB interfaces	4000	4000
VRF instances	2000	2000
ARP entries	44,000	44,000
ND scale (incudes link local)	44,000	44,000
Multicast *,G	Not Applicable	Not Applicable
Multicast S,G	Not Applicable	Not Applicable
IGMPv2 snooping	15,000	15,000
MAC addresses	44,000	44,000
Unique MAC addresses configured per IRB	100	100
Unique Virtual GW MAC addresses configured per IRB	100	100
DHCP-Relay Session	30,000	30,000

Table 3: Scaling Values for the QFX5120 Switch as a Distribution Node

Attribute	Fabric	Per Leaf Node (QFX5120)
Virtual switches	1	1
VLANS/bridge domains/VNIs	4000	4000
ESIs	62	62
IRB interfaces	4000	4000
VRF instances	2000	2000
ARP entries	44,000	44,000
ND scale (incudes link local)	44, 000	44,000
Multicast *,G	Not Applicable	Not Applicable
Multicast S,G	Not Applicable	Not Applicable
IGMPv2 snooping	15,000	15,000
MAC addresses	44,000	44,000
Unique MAC addresses configured per IRB	100	100
Unique Virtual GW MAC addresses configured per IRB	100	100
DHCP-Relay Session	30,000	30,000