# Campus Fabric Interconnect - MPLS L3VPN

This feature explains a sample Software-Defined Access (SD-Access) network topology comprising two Locator/ID Separation Protocol (LISP) control plane-Virtual eXtensible Local Area Network (VXLAN) data plane based campus fabrics connected through Multiprotocol Label Switching (MPLS) L3VPN. The focus of the feature is the role of the Cisco Nexus 7000/7700 Series border leaf switch which sends end host traffic from the fabric to an end host in a remote fabric over MPLS (through the MPLS core).

**Note** IPv6 unicast traffic is not supported for the LISP VRF leak feature on Software-Defined Access fabrics since Cisco Catalyst 3000 Series switches do not support IPv6 traffic for extranets.

This chapter contains the following sections:



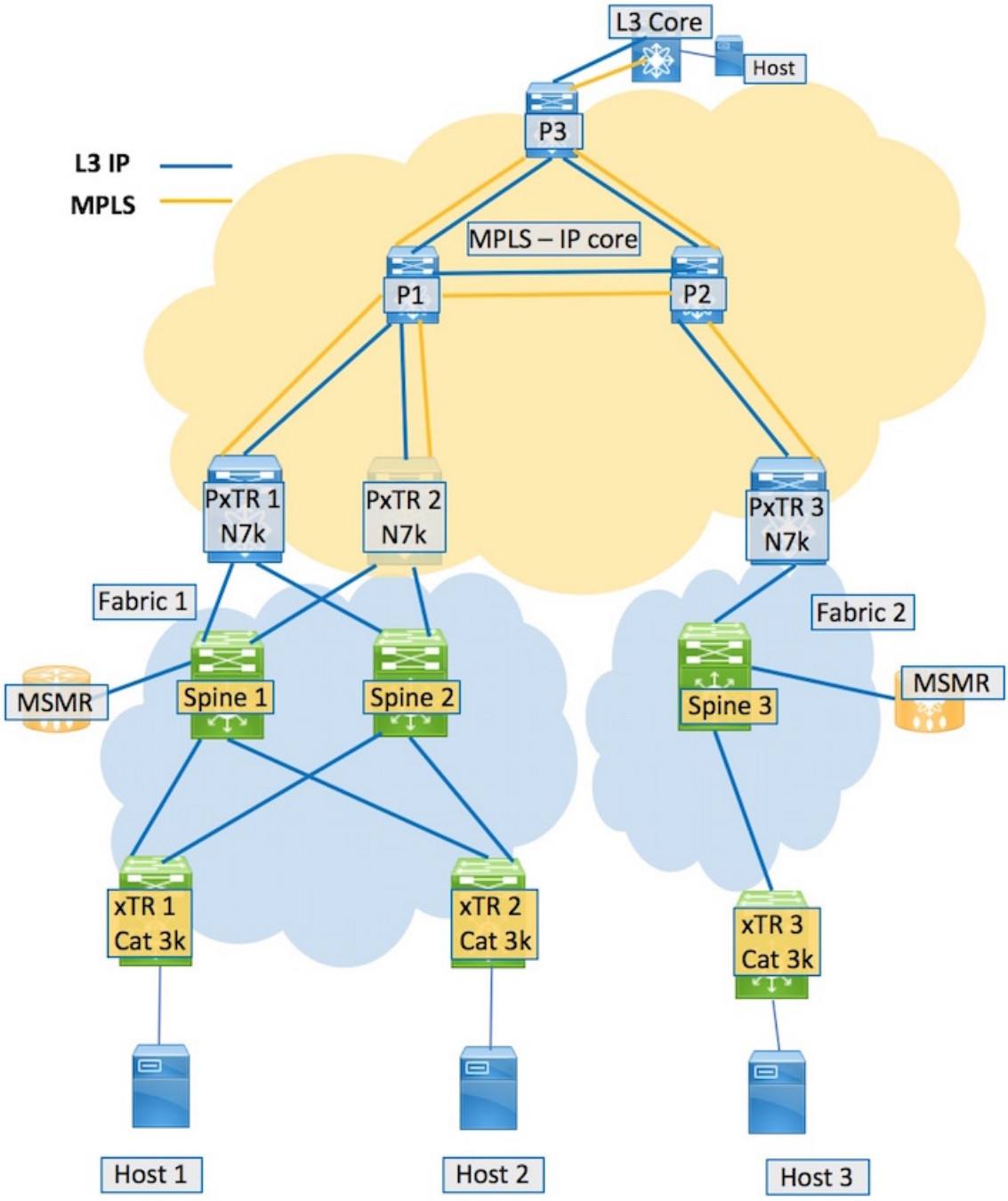
# Prerequisites of Campus Fabric Interconnect—MPLS L3VPN

- A Nexus 7000 or 7700 Series switch with an M3 line card.
- Conceptual and configuration knowledge about VXLAN-with-LISP campus fabrics, since the focus of this feature is the fabric interconnect function.
- Functioning campus fabrics wherein the LISP, VXLAN and other required configurations are enabled. See the "Campus Fabric" chapter for more information.

# Information About Campus Fabric Interconnect—MPLS L3VPN

Sample topology and traffic flow between two campus fabrics connected through MPLS L3VPN:

*Figure 1: Sample topology - Campus Fabric Interconnect—MPLS L3VPN*




Fabric 1 and Fabric 2 are two campus fabrics. PxTR 1 and PxTR 2 are Cisco Nexus 7000/7700 Series switches that perform the role of border switches in Fabric 1. PxTR 2 is the fabric border switch in Fabric 2. MPLS configurations are enabled on the PxTR switches such that Fabric 1 and Fabric 2 are connected through MPLS L3VPN between PxTR 1/PxTR 2 and PxTR 3.

# Campus Fabric Architecture—Fabric 1

End hosts are attached to Cisco Catalyst switches xTR 1 and xTR 2 which perform the role of LISP xTRs. The LISP control plane extends from the xTRs to PxTR 1 and PxTR 2. Spine1 and Spine 2 are Layer-3 switches used for routing in the underlay, through an interior gateway protocol (IGP) such as Open Shortest Path First (OSPF). Spine 1 is connected to the Map-Server/Map-Resolver (MSMR).

For the overlay, VXLAN is implemented on the xTRs and the PxTRs, and they also perform the role of VXLAN Virtual Tunnel End Points (VTEPs).

The LISP (control plane) and the VXLAN (data plane) overlays begin and terminate between the xTRs and PxTRs.

# Traffic Flow Between Fabrics—Campus Fabric Interconnect

PxTR1 and PxTR2 perform the provider edge (PE) function, and are connected to the provider switch P1 in the MPLS/IP core. MPLS L3VPN is implemented on the PxTRs for traffic flow across the fabrics. If Host 1 in Fabric 1 sends traffic to Host 3 in Fabric 2, then this is a sample flow:

- Traffic from Host1 reaches a PxTR, the fabric border switch, since the destination end host is located in a remote site. The PxTR VXLAN decapsulates the packets and sends it towards P1 through MPLS.

**Note** The **redistribute lisp route-map** command ensures that the LISP map-cache routes are redistributed into Multiprotocol Border Gateway Protocol (MP-BGP).

- P1 sends the traffic through the MPLS/IP core to the Provider switch P2 which is connected to the fabric border switch of Fabric 2, PxTR 3. P2 forwards the MPLS traffic to PxTR3.

**Note** The assumption is that MPLS L3VPN is implemented on the receiving switch and the LISP control plane and VXLAN data planes are converged/updated.

- PxTR3 receives the traffic, removes the MPLS label, and does appropriate lookups as regards to the destination end host. Then, PxTR3 VXLAN encapsulates the packets towards xTR3, since Host 3 is attached to it.
- xTR 3 receives the traffic, VXLAN decapsulates the packets and sends the original packets (sent by Host 1) to Host 3.

# How to Configure Campus Fabric Interconnect—MPLS L3VPN

**Note**

- Type the **switch# configure terminal** command to enter global configuration mode **(config)#**
- Since the focus of this feature is the fabric interconnect function, ensure that the campus fabric is functional, and LISP, VXLAN and other configurations are enabled.
- The example is for PxTR 1 configurations. However, configurations have to be implemented on PxTR 1, PxTR 2, and PxTR 3 for traffic flow across fabrics.

## Feature Set Configuration

**Configure MPLS L3VPN, BGP, LDP, LISP and VXLAN features:**

```
PxTR 1(config)# feature-set mpls
                feature-set fabric
                feature bgp
                feature lisp
                feature mpls l3vpn
                feature mpls ldp
                feature nv overlay
                feature vni
```

- Some configurations, such as LISP and VXLAN features, are already enabled for campus fabric configuration. They are noted here for completeness.

## Campus Fabric Configuration

**Step 1 Configure VXLAN related commands**

**Create a bridge domain and associate the corresponding Layer 3 VNI:**

```
PxTR 1(config)#  vni 6000
                 system bridge-domain 300
                 bridge-domain 300
                    member vni 6000
```

**Add the Layer 3 virtual routing and forwarding (VRF) VNI to the VXLAN overlay network and enable LISP reachability:**

```
PxTR 1(config)# interface nve1
                  no shutdown
                  host-reachability protocol lisp
                  source-interface loopback0
                  member vni 6000 associate-vrf
```

**Step 2 Configure LISP related commands**

**Configure LISP parameters and route distinguisher and route target functions for the *vrf6000* VRF:**

```
PxTR 1(config)# vrf context vrf6000
                 vni 6000
                 ip lisp proxy-itr 192.0.2.1
                 ip lisp proxy-etr
                 lisp instance-id 6000
                 ip lisp locator-vrf fab0
                 ip lisp map-cache 198.51.0.0/16 map-request
                 lisp encapsulation vxlan
                 rd 6000:6000
                 address-family ipv4 unicast
                    route-target import 6000:6000
                    route-target export 6000:6000
```

The **ip lisp map-cache** command creates a static map-cache entry for reachability to remote Endpoint Identifiers (EIDs).

**Step 3 Configure fabric facing BDI**

**Associate a BDI to the *vrf6000* VRF:**

```
PxTR 1(config)# interface Bdi300
                 no shutdown
                 vrf member vrf6000
                 no ip redirects
                 ip forward
```

# Campus Fabric Interconnect Configuration

**Step 1 Configure MPLS commands on the WAN facing interface:**

```
PxTR 1(config)# interface Ethernet1/35.1
                 mpls ip
                 description connect_P1_mpls
                 encapsulation dot1q 162
                 ip address 203.0.113.1/30
                 ip router ospf 299 area 0.0.0.0
                 no shutdown
```

- After enabling the corresponding interface on P1, an MPLS link is established between PxTR 1 (the PE switch) and P1 (the Provider switch) .

```
PxTR 1(config)# mpls ldp configuration
                 router-id Lo299 force
```

- The configurations enable the specified loopback interface's IP address as the Label Distribution Protocol (LDP) router ID.

**Step 2 Configure BGP for traffic flow between the fabric border (PE) switch PxTR 1 and the Provider switch P1:**

```
PxTR 1(config)# router bgp 100
                 router-id 209.165.201.1
```

```
        address-family ipv4 unicast
```

- The IPv4 address family and router ID configurations are enabled.

```
neighbor 209.165.200.225 remote-as 5000
         update-source loopback299
         ebgp-multihop 10
         address-family vpnv4 unicast
            send-community extended
            exit
         address-family ipv4 unicast
```

- BGP neighbor/peer VPNv4 and IPv4 address family configurations are enabled.

```
vrf vrf6000
          address-family ipv4 unicast
             redistribute lisp route-map LISP-RMAP
             aggregate-address 198.51.0.0/16 summary-only
             label-allocation-mode per-vrf
```

- The **redistribute lisp route-map** command redistributes the LISP map-cache routes into MP-BGP.
- Aggregate routes within the vrf6000 VRF are enabled to be distributed to the BGP neighbor.

**Note** The configurations are relevant to PxTR 1. Similarly, enable the campus fabric interconnect function on PxTR 2 and PxTR 3.

# Verifying Campus Fabric Interconnect—MPLS L3VPN

You can verify MPLS configurations on a fabric border switch with these verification commands:

## Verifying MPLS LDP Configuration

In the following example, you can verify MPLS LDP configuration:

```
PxTR1# show mpls ldp discovery

Local LDP Identifier:
    209.165.201.1:0
    Discovery Sources:
    Interfaces:
        Ethernet2/20.1 (ldp): xmit/recv
        LDP Id: 203.0.113.1:0
```

## Verifying MPLS LDP Neighbor Configuration

In the following example, you can verify MPLS LDP neighbor configuration:

```
PxTR1# show mpls ldp neighbor
```

```
Peer LDP Ident: 203.0.113.1:0; Local LDP Ident 209.165.201.1:0
    TCP connection: 203.0.113.1.646 - 209.165.201.1.63118
    State: Oper; Msgs sent/rcvd: 69/71; Downstream
    Up time: 00:53:49
    LDP discovery sources:
      Ethernet2/20.1, Src IP addr: 192.0.2.250
    Addresses bound to peer LDP Ident:
      203.0.113.1   172.16.0.1   192.0.2.250  203.0.113.10
```

# Verifying MPLS Label Switching VRF Information

In the following example, you can verify MPLS label switching VRF information:

```
PxTR1# show mpls switching vrf vrf6000

Legend:
(P)=Protected, (F)=FRR active, (*)=more labels in stack.

In-Label   VRF
IPv4 Aggregate Labels
31         vrf6000
```

# Feature History for Campus Fabric Interconnect—MPLS L3VPN

This table lists the release history for this feature.

***Table 1: Feature History for Campus Fabric Interconnect—MPLS L3VPN***

| Feature Name | Release | Feature Information | |
|---|---|---|---|
| Feature History for Campus Fabric Interconnect—MPLS L3VPN | 8.2(1) | This feature was introduced. This feature explains how to enable traffic flow across two campus fabrics through MPLS L3VPN.<br><br>No new commands were introduced for this feature. | |