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Junos<sup>®</sup> OS

# Multiple Instances for Label Distribution Protocol Feature Guide

Release  
11.2



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Release 11.2

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#### Revision History

April 2011—R1 Junos OS 11.2

The information in this document is current as of the date listed in the revision history.

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## PART 1

# Multiple Instances for Label Distribution Protocol

- Multiple Instances for Label Distribution Protocol Concepts and Reference Materials on page 3
- Multiple Instances for Label Distribution Protocol Configuration Example on page 7



## CHAPTER 1

# Multiple Instances for Label Distribution Protocol Concepts and Reference Materials

This section contains the following topics:

- Multiple Instances for Label Distribution Protocol Overview on page 3
- Multiple Instances for Label Distribution Protocol System Requirements on page 4
- Multiple Instances for Label Distribution Protocol Terms and Acronyms on page 5

### Multiple Instances for Label Distribution Protocol Overview

Versions of Junos OS earlier than Release 5.3 support multiple VPN routing and forwarding (VRF) instances of Border Gateway Protocol (BGP), Intermediate System-to-Intermediate System (IS-IS), Open Shortest Path First (OSPF), Protocol Independent Multicast (PIM), and Routing Information Protocol (RIP). Junos OS Release 5.4 and later adds support for multiple instances of the Label Distribution Protocol (LDP).

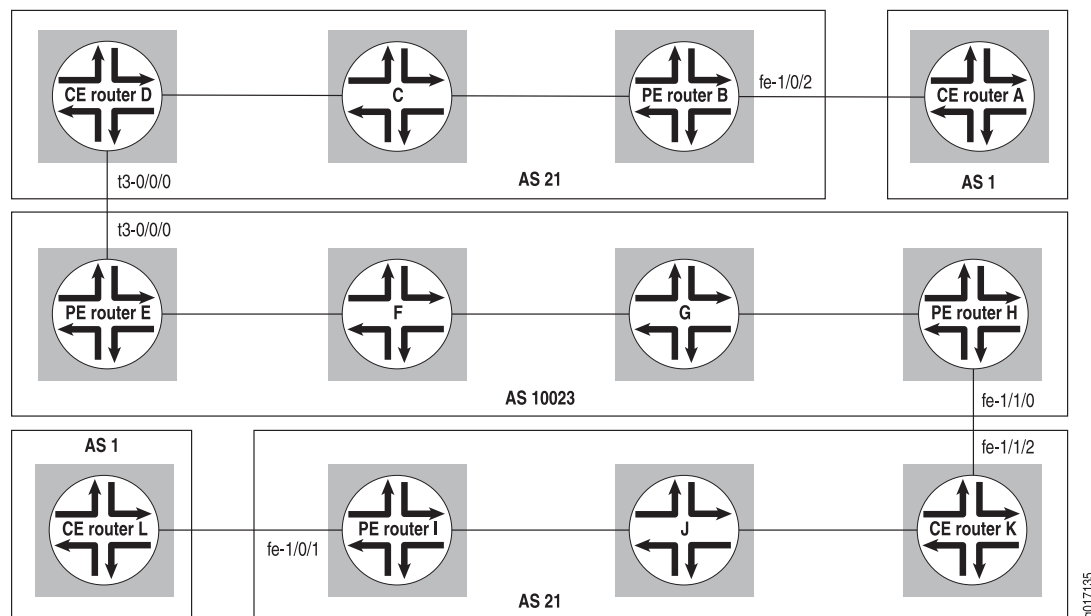
This support allows LDP to be used to advertise labels in a carrier-of-carriers scenario from a core provider edge (PE) router to a customer carrier edge (CE) router. This is especially useful when the carrier customer is a basic Internet service provider (ISP) and wants to restrict full Internet routes to its PE routers. By using LDP instead of BGP, the carrier customer shields its other internal routers from the Internet at large.

Multiple-instance LDP is also useful when a carrier customer wants to provide Layer 2 VPN or Layer 3 VPN services to its customers.

Using multiple-instance LDP lets you circumvent one of the requirements of RFC 3107: the need to run full-mesh internal BGP (IBGP) within the carrier customer's autonomous system (AS). When you use multiple-instance LDP, full-mesh IBGP is unnecessary.

In Figure 1 on page 4, the customer carrier in AS 21 can configure one instance of LDP for all routers in AS 21 instead of using full-mesh IBGP.

Figure 1: Carrier-of-Carriers Example



In general, if there are a limited number of customer carrier sites and few internal routes in the customer carrier AS, it is simpler and quicker to use LDP than to configure a full IBGP mesh.

An instance of LDP operates essentially in the same way as a master instance. Each instance of LDP must be enabled on all the desired interfaces and a separate set of LDP data structures is maintained for each instance. Instance information includes a set of LDP interfaces, neighbors, sessions, and databases.

For more information about carrier-of-carriers VPNs, see the *Junos VPNs Configuration Guide*.

For more information about LDP, see the *Junos MPLS Applications Configuration Guide*.

## Multiple Instances for Label Distribution Protocol System Requirements

To implement the multiple-instance LDP feature, your system must meet these minimum requirements:

- Junos OS Release 8.2 for support on MX Series routers.
- Junos OS Release 5.4 or later for support on M Series and T Series routers.
- Two Juniper Networks M Series, MX Series, or T Series routers for basic multiple-instance LDP; and a minimum of four Juniper Networks routers to act as PE routers in a carrier-of-carriers network.



## Multiple Instances for Label Distribution Protocol Terms and Acronyms

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### C

**carrier-of-carriers VPN** A VPN that transports data traffic between two or more telecommunications carrier sites across a core provider network. The core provider becomes a carrier for the customer carrier, which, in turn, provides Internet or VPN services to end customers. For more information about carrier-of-carriers VPNs, see the *Junos VPNs Configuration Guide*.

### L

**Label Distribution Protocol (LDP)** A protocol used to distribute labels in an MPLS-enabled network. For more information about LDP, see the *Junos MPLS Applications Configuration Guide*.

### V

**VPN routing and forwarding (VRF) instance** A unique routing table created to maintain VPN routing and forwarding information. One routing table is created per instance, which keeps prefix information and data private from other instances. For more information about VRF instances, see the *Junos VPNs Configuration Guide*.



## CHAPTER 2

# Multiple Instances for Label Distribution Protocol Configuration Example

This section contains the following topic:

- Example: Configuring Multiple-Instance LDP on page 7

### Example: Configuring Multiple-Instance LDP

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The master LDP instance is configured at the **[edit protocols]** hierarchy level.

You can configure a specific instance of LDP by using the **ldp** statement at the **[edit routing-instances *routing-instance-name* protocols]** hierarchy level. This creates an instance of LDP for the particular VRF routing instance. You must specify all the required VRF statements and apply export and import policies to your LDP instance for the configuration to commit properly.

Most of the LDP hierarchy levels available in a master instance are also available for specific instances of LDP. However, the **no-forwarding** option does not work in a VRF-based instance of LDP.

Figure 2: Multiple-Instance LDP Topology Diagram

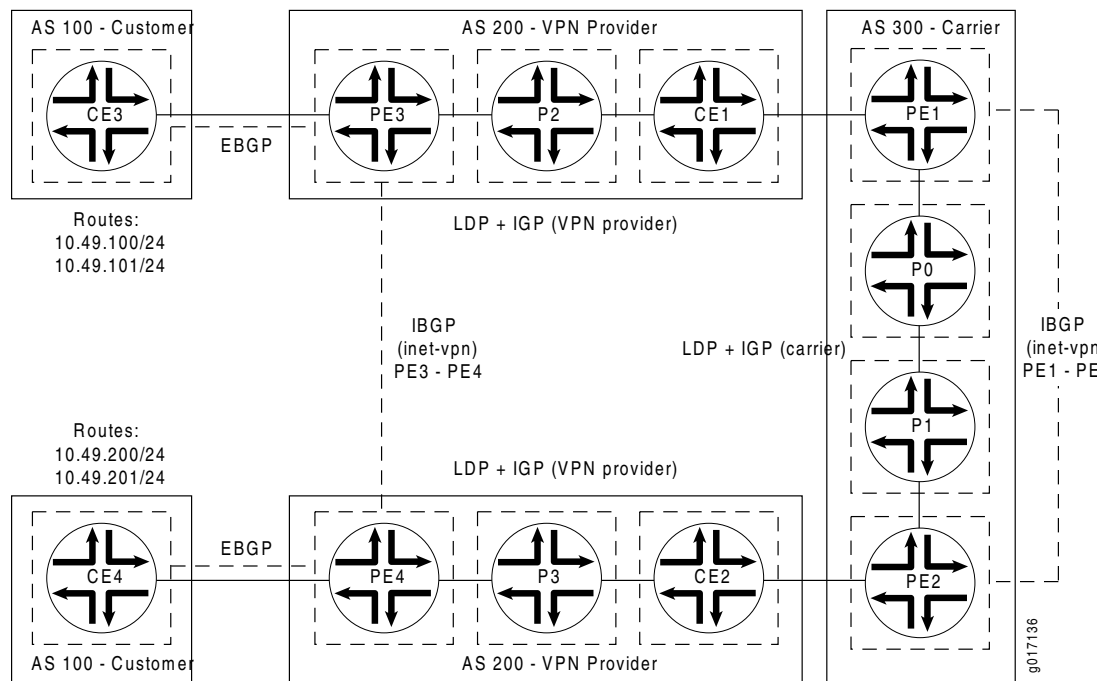


Figure 2 on page 8 shows an example of a carrier-of-carriers network. CE3 and CE4 are end customer CE routers residing in AS 100. The VPN provider in AS 200 has three types of routers: PE3 and PE4 are PE routers that connect to the end customer, CE1 and CE2 act as the intermediate carrier CE routers, and P2 and P3 are internal transit routers. PE1 and PE2 in AS 300 are PE routers servicing the intermediate VPN provider, and P0 and P1 are transit routers for the top-tier carrier.

To make this configuration work, you must complete three major tasks:

1. Configure external BGP between the VPN customer CE and the VPN provider PE.
2. Configure internal BGP using the VPN family between both pairs of PE routers (one IBGP connection between PE1 and PE2 and a second IBGP connection between Router PE3 and Router PE4).
3. Establish LDP and Interior Gateway Protocol (IGP) connections on all remaining links. This example uses OSPF as the IGP, but you can use the IGP of your choice.

Information supporting this carrier-of-carriers multiple-instance LDP example is summarized in Table 1 on page 8 and Table 2 on page 9.

Table 1: Multiple-Instance LDP Example—Routing Protocol Summary

Connection	Protocols
CE3 - PE3	EBGP family inet
PE3 - P2 - CE1	OSPF and LDP

**Table 1: Multiple-Instance LDP Example—Routing Protocol Summary** (*continued*)

Connection	Protocols
CE1 - PE1	OSPF and LDP
PE1 - P0 - P1 - PE2	OSPF and LDP
PE1 - PE2	IBGP family inet-vpn
PE2 - CE2	OSPF and LDP
CE2 - P3 - PE4	OSPF and LDP
PE4 - CE4	EBGP family inet
PE3 - PE4	IBGP family inet-vpn

**Table 2: Multiple-Instance LDP Example—Loopback Addresses**

Router	Loopback Address
PE1	10.255.255.171
PE2	10.255.255.172
P0	10.255.255.173
P1	10.255.255.174
P2	10.255.255.175
P3	10.255.255.176
PE3	10.255.255.177
PE4	10.255.255.178
CE1	10.255.255.179
CE2	10.255.255.180
CE3	10.255.255.181 10.49.100.1
CE4	10.255.255.182 10.49.200.1

Your configuration tasks start at Router CE3 and move router by router through the first part of the VPN provider network, into the carrier AS, through the second VPN provider cluster of AS 200, and end at the second VPN customer Router CE4.

Since Router CE3 is the first customer router, configure EBGP between Router CE3 and the connected VPN provider Router PE3. You must also advertise your loopback address into BGP with a routing policy to allow IP reachability with Router CE4.

```
Router CE3 [edit]
interfaces {
  so-1/2/0 {
    description "to pe3 so-1/2/0";
    unit 0 {
      family inet {
        address 192.255.198.14/30;
      }
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.255.255.181/32;
        address 10.49.100.1/32;
      }
    }
  }
}
routing-options {
  static {
    route 10.49.100.0/24 reject;
    route 10.49.101.0/24 reject;
  }
  autonomous-system 100;
}
protocols {
  bgp {
    group provider {
      type external;
      export static-to-bgp;
      peer-as 200;
      neighbor 192.255.198.13;
    }
  }
}
policy-options {
  policy-statement static-to-bgp {
    term 1 {
      from {
        protocol static;
        route-filter 10.49.100.0/24 exact;
        route-filter 10.49.101.0/24 exact;
      }
      then accept;
    }
    term 2 {
```

```

        from protocol direct;
        then accept;
    }
    term 3 {
        then reject;
    }
}
}

```

On Router PE3, the configuration tasks are more involved. You need to complete the EBGP connection to Router CE3 in a VRF instance, enable MPLS and LDP on the interface pointing toward the VPN provider Router CE1, and configure a master instance of IBGP to reach Router PE4 at the far edge of AS 200.

Finally, set up an outbound VRF policy that places all BGP traffic and directly connected interfaces into a BGP community and an inbound VRF policy that accepts similar BGP community traffic from Router PE4.

```

Router PE3 [edit]
interfaces {
  so-1/2/0 {
    unit 0 {
      family inet {
        address 192.255.198.13/30;
      }
      family mpls;
    }
  }
  so-1/2/1 {
    description "to p2 so-1/2/1";
    unit 0 {
      family inet {
        address 192.255.198.9/30;
      }
      family mpls;
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.255.255.177/32;
      }
    }
  }
}
routing-options {
  autonomous-system 200;
}
protocols {
  mpls {
    interface so-1/2/0.0;
  }
  bgp {
    group internal {
      type internal;
      local-address 10.255.255.177;
    }
  }
}

```

```
    peer-as 200;
    neighbor 10.255.255.178 {
        family inet-vpn {
            unicast;
        }
    }
}
ospf {
    area 0.0.0.0 {
        interface so-1/2/1.0;
        interface lo0.0 {
            passive;
        }
    }
}
ldp {
    interface so-1/2/1.0;
}
}
policy-options {
    policy-statement vpn-customer-import {
        term 1 {
            from {
                protocol bgp;
                community vpn-customer-comm;
            }
            then accept;
        }
        term 2 {
            then reject;
        }
    }
    policy-statement vpn-customer-export {
        term 1 {
            from protocol [bgp direct];
            then {
                community add vpn-customer-comm;
                accept;
            }
        }
        term 2 {
            then reject;
        }
    }
    community vpn-customer-comm members target:200:100;
}
routing-instances {
    vpn-customer {
        instance-type vrf;
        interface so-1/2/0.0;
        route-distinguisher 10.255.255.177:1;
        vrf-import vpn-customer-import;
        vrf-export vpn-customer-export;
        protocols {
            bgp {
```



```

        group customer {
            type external;
            peer-as 100;
            as-override;
            neighbor 192.255.198.14;
        }
    }
}

```

On Router P2, enable LDP and the IGP used for transporting labels (in this case, OSPF). You will repeat these tasks on all transit core routers, both in the VPN provider network and the core carrier network.

```

Router P2 [edit]
interfaces {
    so-1/2/0 {
        description "to ce1 so-1/2/0";
        unit 0 {
            family inet {
                address 192.255.198.2/30;
            }
            family mpls;
        }
    }
    so-1/2/1 {
        description "to pe3 so-1/2/1";
        unit 0 {
            family inet {
                address 192.255.198.10/30;
            }
            family mpls;
        }
    }
    lo0 {
        unit 0 {
            family inet {
                address 10.255.255.175/32;
            }
        }
    }
}
routing-options {
    autonomous-system 200;
}
protocols {
    ospf {
        area 0.0.0.0 {
            interface lo0.0 {
                passive;
            }
            interface so-1/2/0.0;
            interface so-1/2/1.0;
        }
    }
}

```

```
ldp {  
  interface so-1/2/0.0;  
  interface so-1/2/1.0;  
}  
}
```

For Router CE1, configure LDP and OSPF in the same manner that you configured Router P2.

```
Router CE1 [edit]  
interfaces {  
  t3-0/1/0 {  
    description "to pe1 t3-0/2/1";  
    unit 0 {  
      family inet {  
        address 192.255.197.18/30;  
      }  
      family mpls;  
    }  
  }  
  so-1/2/0 {  
    description "to p2 so-1/2/0";  
    unit 0 {  
      family inet {  
        address 192.255.198.1/30;  
      }  
      family mpls;  
    }  
  }  
  lo0 {  
    unit 0 {  
      family inet {  
        address 10.255.255.179/32;  
      }  
    }  
  }  
}  
routing-options {  
  autonomous-system 200;  
}  
protocols {  
  ospf {  
    area 0.0.0.0 {  
      interface so-1/2/0.0;  
      interface lo0.0 {  
        passive;  
      }  
      interface t3-0/1/0.0;  
    }  
  }  
  ldp {  
    interface t3-0/1/0.0;  
    interface so-1/2/0.0;  
  }  
}
```

On core carrier Router PE1, configure a master instance for OSPF, LDP, MPLS, and IBGP (with the **family inet-vpn** option) to connect the router to neighbor Router PE2. Next, implement multiple-instance LDP by establishing a secondary instance. Enable LDP and OSPF in this instance for Router PE1 to communicate with Router CE1. MPLS is not required in the secondary instance.

Finally, set up an outbound VRF policy that places all LDP traffic coming from Router CE1 into a BGP community, an export policy that sends this community traffic to Router PE2, and an inbound VRF policy that accepts similar BGP community traffic from Router PE2. This step tunnels the VPN provider's LDP traffic into the carrier's BGP session.

```
Router PE1 [edit]
interfaces {
  so-0/0/0 {
    description "to p0 so-0/1/0";
    unit 0 {
      family inet {
        address 192.255.197.21/30;
      }
      family mpls;
    }
  }
  t3-0/2/1 {
    description "to ce1 t3-0/1/0";
    unit 0 {
      family inet {
        address 192.255.197.17/30;
      }
      family mpls;
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.255.255.171/32;
      }
    }
  }
}
routing-options {
  autonomous-system 300;
}
protocols {
  mpls {
    interface t3-0/2/1.0;
  }
  bgp {
    group pe {
      type internal;
      local-address 10.255.255.171;
      family inet-vpn {
        unicast;
      }
      peer-as 300;
      neighbor 10.255.255.172;
    }
  }
}
```

```
    }
  }
  ospf {
    area 0.0.0.0 {
      interface lo0.0 {
        passive;
      }
      interface so-0/0/0.0;
    }
  }
  ldp {
    interface so-0/0/0.0;
  }
}
policy-options {
  policy-statement vpn-provider-import {
    term 1 {
      from {
        protocol bgp;
        community vpn-provider-comm;
      }
      then accept;
    }
    term 2 {
      then reject;
    }
  }
  policy-statement vpn-provider-export {
    term 1 {
      from protocol ldp;
      then {
        community add vpn-provider-comm;
        accept;
      }
    }
    term 2 {
      then reject;
    }
  }
  policy-statement bgp-routes-to-export {
    term 1 {
      from {
        protocol bgp;
        community vpn-provider-comm;
      }
      then accept;
    }
    term 2 {
      then reject;
    }
  }
  community vpn-provider-comm members target:300:200;
}
routing-instances {
  vpn-provider {
    instance-type vrf;
```

```

interface t3-0/2/1.0;
route-distinguisher 10.255.255.171:1;
vrf-import vpn-provider-import;
vrf-export vpn-provider-export;
protocols {
  ospf {
    export bgp-routes-to-export;
    area 0.0.0.0 {
      interface t3-0/2/1.0;
    }
  }
  ldp {
    egress-policy bgp-routes-to-export;
    interface t3-0/2/1.0;
  }
}
}

```

On Router P0, enable LDP and OSPF in the same manner that you configured these protocols on Router P2. You will repeat these tasks on Router P1 and Router P3.

```

Router P0 [edit]
interfaces {
  so-0/1/0 {
    description "to pe1 so-0/0/0";
    unit 0 {
      family inet {
        address 192.255.197.22/30;
      }
      family mpls;
    }
  }
  so-1/0/0 {
    description "to p1 so-1/0/0";
    unit 0 {
      family inet {
        address 192.255.197.85/30;
      }
      family mpls;
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.255.255.173/32;
      }
    }
  }
}
routing-options {
  autonomous-system 300;
}
protocols {
  ospf {
    area 0.0.0.0 {

```

```
        interface so-0/1/0.0;
        interface so-1/0/0.0;
        interface lo0.0 {
            passive;
        }
    }
}
ldp {
    interface so-0/1/0.0;
    interface so-1/0/0.0;
}
}
```

On Router P1, enable LDP and the IGP used for transporting labels (OSPF in this case).

```
Router P1 [edit]
interfaces {
    so-0/0/0 {
        description "to pe2 so-0/2/0";
        unit 0 {
            family inet {
                address 192.255.197.74/30;
            }
            family mpls;
        }
    }
    so-1/0/0 {
        description "to p0 so-1/0/0";
        unit 0 {
            family inet {
                address 192.255.197.86/30;
            }
            family mpls;
        }
    }
    lo0 {
        unit 0 {
            family inet {
                address 10.255.255.174/32;
            }
        }
    }
}
routing-options {
    autonomous-system 300;
}
protocols {
    ospf {
        area 0.0.0.0 {
            interface so-0/0/0.0;
            interface so-1/0/0.0;
            interface lo0.0 {
                passive;
            }
        }
    }
}
```

```

ldp {
  interface so-0/0/0.0;
  interface so-1/0/0.0;
}

```

Core carrier Router PE2 is a mirror image of Router PE1. First, configure a master instance for OSPF, LDP, MPLS, and IBGP (with the **family inet-vpn** option) to connect Router PE2 to neighbor Router PE1. Next, implement multiple-instance LDP by establishing a secondary instance. Enable LDP and OSPF in this instance for Router PE2 to communicate with Router CE2. MPLS is not required in the secondary instance.

Finally, set up an outbound VRF policy that places all LDP traffic coming from Router CE2 into a BGP community, an export policy that sends this community traffic to Router PE1, and an inbound VRF policy that accepts similar BGP community traffic from Router PE1. This step tunnels the VPN provider's LDP traffic into the carrier's BGP session.

```

Router PE2 [edit]
interfaces {
  so-0/2/0 {
    description "to p1 so-0/0/0";
    unit 0 {
      family inet {
        address 192.255.197.73/30;
      }
      family mpls;
    }
  }
  t1-3/0/0 {
    description "to ce2 t1-0/0/0";
    unit 0 {
      family inet {
        address 192.255.197.37/30;
      }
      family mpls;
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.255.255.172/32;
      }
    }
  }
}
routing-options {
  autonomous-system 300;
}
protocols {
  mpls {
    interface t1-3/0/0.0;
  }
  bgp {
    group pe {
      type internal;
    }
  }
}

```

```
        local-address 10.255.255.172;
        family inet-vpn {
            unicast;
        }
        peer-as 300;
        neighbor 10.255.255.171;
    }
}
ospf {
    area 0.0.0.0 {
        interface so-0/2/0.0;
        interface lo0.0 {
            passive;
        }
    }
}
ldp {
    interface so-0/2/0.0;
}
}
policy-options {
    policy-statement vpn-provider-import {
        term 1 {
            from {
                protocol bgp;
                community vpn-provider-comm;
            }
            then accept;
        }
        term 2 {
            then reject;
        }
    }
    policy-statement vpn-provider-export {
        term 1 {
            from protocol ldp;
            then {
                community add vpn-provider-comm;
                accept;
            }
        }
        term 2 {
            then reject;
        }
    }
    policy-statement bgp-routes-to-export {
        term 1 {
            from {
                protocol bgp;
                community vpn-provider-comm;
            }
            then accept;
        }
        term 2 {
            then reject;
        }
    }
}
```



```

    }
    community vpn-provider-comm members target:300:200;
  }
  routing-instances {
    vpn-provider {
      instance-type vrf;
      interface t1-3/0/0.0;
      route-distinguisher 10.255.255.172:1;
      vrf-import vpn-provider-import;
      vrf-export vpn-provider-export;
      protocols {
        ospf {
          export bgp-routes-to-export;
          area 0.0.0.0 {
            interface t1-3/0/0.0;
          }
        }
        ldp {
          egress-policy bgp-routes-to-export;
          interface t1-3/0/0.0;
        }
      }
    }
  }
}

```

For Router CE2, configure LDP and OSPF as you did on Router CE1 and the transit P routers.

```

Router CE2 [edit]
interfaces {
  t1-0/0/0 {
    description "to pe2 t1-3/0/0";
    unit 0 {
      family inet {
        address 192.255.197.38/30;
      }
      family mpls;
    }
  }
  t3-0/3/3 {
    description "to p3 t3-0/0/3";
    unit 0 {
      family inet {
        address 192.255.198.26/30;
      }
      family mpls;
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.255.255.180/32;
      }
    }
  }
}
routing-options {

```

```
    autonomous-system 200;
  }
  protocols {
    ospf {
      area 0.0.0.0 {
        interface t1-0/0/0.0;
        interface t3-0/3/3.0;
        interface lo0.0 {
          passive;
        }
      }
    }
    ldp {
      interface t1-0/0/0.0;
      interface t3-0/3/3.0;
    }
  }
}
```

Since Router P3 is another core provider router, enable LDP and OSPF on all transit interfaces.

```
Router P3 [edit]
interfaces {
  t3-0/0/3 {
    description "to ce2 t3-0/3/3";
    unit 0 {
      family inet {
        address 192.255.198.25/30;
      }
      family mpls;
    }
  }
  t1-0/1/1 {
    description "to pe4 t1-0/1/1";
    unit 0 {
      family inet {
        address 192.255.198.37/30;
      }
      family mpls;
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.255.255.176/32;
      }
    }
  }
}
routing-options {
  autonomous-system 200;
}
protocols {
  ospf {
    area 0.0.0.0 {
```

```

        interface t3-0/0/3.0;
        interface t1-0/1/1.0;
        interface lo0.0 {
            passive;
        }
    }
    ldp {
        interface t3-0/0/3.0;
        interface t1-0/1/1.0;
    }
}

```

On Router PE4, complete the IBGP connection initiated on Router PE3 to connect the edge routers in AS 200. Also, enable LDP and MPLS on the **t1-0/0/1** interface pointing toward the VPN provider Router CE2 and establish an EBGP connection to Router CE4 through use of a VRF instance.

Finally, set up an outbound VRF policy that places all BGP traffic and directly connected interfaces into a BGP community and an inbound VRF policy that accepts similar BGP community traffic from Router PE3.

```

Router PE4 [edit]
interfaces {
    t3-0/0/3 {
        description to ce4 t3-0/0/3";
        unit 0 {
            family inet {
                address 192.255.198.21/30;
            }
            family mpls;
        }
    }
    t1-0/1/1 {
        unit 0 {
            family inet {
                address 192.255.198.38/30;
            }
            family mpls;
        }
    }
    lo0 {
        unit 0 {
            family inet {
                address 10.255.255.178/32;
            }
        }
    }
}
routing-options {
    autonomous-system 200;
}
protocols {
    mpls {
        interface t3-0/0/3.0;
    }
}

```

```
bgp {
  group internal {
    type internal;
    local-address 10.255.255.178;
    peer-as 200;
    neighbor 10.255.255.177 {
      family inet-vpn {
        unicast;
      }
    }
  }
}
ospf {
  area 0.0.0.0 {
    interface t1-0/1/1.0;
    interface lo0.0 {
      passive;
    }
  }
}
ldp {
  interface t1-0/1/1.0;
}
}
policy-options {
  policy-statement vpn-customer-import {
    term 1 {
      from {
        protocol bgp;
        community vpn-customer-comm;
      }
      then accept;
    }
    term 2 {
      then reject;
    }
  }
  policy-statement vpn-customer-export {
    term 1 {
      from protocol [bgp direct];
      then {
        community add vpn-customer-comm;
        accept;
      }
    }
    term 2 {
      then reject;
    }
  }
  community vpn-customer-comm members target:200:100;
}
routing-instances {
  vpn-customer {
    instance-type vrf;
    interface t3-0/0/3.0;
    route-distinguisher 10.255.255.178:1;
  }
}
```

```

vrf-import vpn-customer-import;
vrf-export vpn-customer-export;
protocols {
  bgp {
    group customer {
      type external;
      peer-as 100;
      as-override;
      neighbor 192.255.198.22;
    }
  }
}

```

Router CE4 is the destination VPN customer router. Configure EBGp between Router CE4 and the connected VPN provider Router PE4 to complete the configuration. Remember to advertise the loopback address into BGP by using a routing policy to allow IP reachability with Router CE3.

```

Router CE4 [edit]
interfaces {
  t3-0/0/3 {
    description "to pe4 t3-0/0/3";
    unit 0 {
      family inet {
        address 192.255.198.22/30;
      }
    }
  }
  lo0 {
    unit 0 {
      family inet {
        address 10.255.255.182/32;
        address 10.49.200.1/32;
      }
    }
  }
}
routing-options {
  static {
    route 10.49.200.0/24 reject;
    route 10.49.201.0/24 reject;
  }
  autonomous-system 100;
}
protocols {
  bgp {
    group provider {
      type external;
      export static-to-bgp;
      peer-as 200;
      neighbor 192.255.198.21;
    }
  }
}

```

```
policy-options {
  policy-statement static-to-bgp {
    term 1 {
      from {
        protocol static;
        route-filter 10.49.200.0/24 exact;
        route-filter 10.49.201.0/24 exact;
      }
      then accept;
    }
    term 2 {
      from protocol direct;
      then accept;
    }
    term 3 {
      then reject;
    }
  }
}
```

## Verifying Your Work

To verify the proper operation of your multiple-instance LDP configuration, use the following commands:

- **show ldp database**
- **show ldp interface**
- **show ldp neighbor**
- **show ldp path**
- **show ldp route**
- **show ldp session**
- **show ldp statistics**

The display output for these commands is the same as in previous Junos OS Releases, except for one difference. An instance name can now be used as an argument.

If you include an instance name with these commands, you display information for the specified LDP instance. For example, the command **show ldp neighbor instance crockett** shows all the LDP neighbors for a VRF instance named **crockett**. Conversely, **show ldp neighbor** without an instance name displays the LDP neighbors associated with the master instance.

The following sections show the output of these commands used with the configuration example:

- Router CE3 Status on page 27
- Router PE3 Status on page 27
- Router CE1 Status on page 29
- Router PE1 Status on page 30

- Router PE2 Status on page 32
- Router CE2 Status on page 37
- Router PE4 Status on page 38
- Router CE4 Status on page 40

### Router CE3 Status

user@CE3> show bgp summary

```
Groups: 1 Peers: 1 Down peers: 0
Table      Tot Paths  Act Paths Suppressed  History Damp State   Pending
inet.0      10          5          0          0        0      0        0
Peer      AS      InPkt    OutPkt    OutQ    Flaps  Last Up/DwnState|#Active/Received/Damped...
192.255.198.13  200      440      433        0        0    3:34:34 5/10/0 0/0/0
```

user@CE3> show route protocol bgp

inet.0: 23 destinations, 28 routes (22 active, 0 holddown, 6 hidden)

+ = Active Route, - = Last Active, \* = Both

```
10.49.200.0/24 * [BGP/170] 00:19:20, localpref 100
                  AS path: 200 200 I
                  > to 192.255.198.13 via so-1/2/0.0
10.49.200.1/32 * [BGP/170] 00:19:20, localpref 100
                  AS path: 200 200 I
                  > to 192.255.198.13 via so-1/2/0.0
10.49.201.0/24 * [BGP/170] 00:19:20, localpref 100
                  AS path: 200 200 I
                  > to 192.255.198.13 via so-1/2/0.0
10.255.255.182/32 * [BGP/170] 00:19:20, localpref 100
                  AS path: 200 200 I
                  > to 192.255.198.13 via so-1/2/0.0
192.255.198.20/30 * [BGP/170] 00:19:20, localpref 100
                  AS path: 200 I
                  > to 192.255.198.13 via so-1/2/0.0
```

### Router PE3 Status

user@PE3> show bgp summary

```
Groups: 2 Peers: 2 Down peers: 0
Table      Tot Paths  Act Paths Suppressed  History Damp State   Pending
bgp.l3vpn.0  6          6          0          0        0      0        0
Peer      AS      InPkt    OutPkt    OutQ    Flaps  Last Up/DwnState|#Active/Received/Damped...
192.255.198.14  100      432      441        0        0    3:34:55 Estab1
  vpn-customer.inet.0: 5/6/0
10.255.255.178  200      62       63        0        2    27:23 Estab1
  bgp.l3vpn.0: 6/6/0
  vpn-customer.inet.0: 5/6/0
```

user@PE3> show route protocol ldp

inet.0: 19 destinations, 20 routes (18 active, 0 holddown, 1 hidden)

inet.3: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)

+ = Active Route, - = Last Active, \* = Both

```
10.255.255.175/32 * [LDP/9] 03:35:45, metric 1
                  > via so-1/2/1.0
10.255.255.176/32 * [LDP/9] 00:29:32, metric 1
                  > via so-1/2/1.0, Push 100007
10.255.255.178/32 * [LDP/9] 00:29:32, metric 1
                  > via so-1/2/1.0, Push 100008
10.255.255.179/32 * [LDP/9] 03:34:39, metric 1
                  > via so-1/2/1.0, Push 100001
```

```

10.255.255.180/32 *[LDP/9] 03:31:15, metric 1
> via so-1/2/1.0, Push 100002
vpn-customer.inet.0: 12 destinations, 14 routes (12 active, 0 holddown, 0 hidden)
mpls.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
100000 *[LDP/9] 03:35:45, metric 1
> via so-1/2/1.0, Pop
100000(S=0) *[LDP/9] 03:35:45, metric 1
> via so-1/2/1.0, Pop
100001 *[LDP/9] 03:34:39, metric 1
> via so-1/2/1.0, Swap 100001
100002 *[LDP/9] 03:31:15, metric 1
> via so-1/2/1.0, Swap 100002
100011 *[LDP/9] 00:29:32, metric 1
> via so-1/2/1.0, Swap 100007
100012 *[LDP/9] 00:29:32, metric 1
> via so-1/2/1.0, Swap 100008
bgp.l3vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)

user@PE3> show route protocol bgp
inet.0: 19 destinations, 20 routes (18 active, 0 holddown, 1 hidden)
inet.3: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
vpn-customer.inet.0: 12 destinations, 14 routes (12 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.49.100.0/24 *[BGP/170] 03:34:59, MED 0, localpref 100
AS path: 100 I
> to 192.255.198.14 via so-1/2/0.0
10.49.100.1/32 *[BGP/170] 03:34:59, localpref 100
AS path: 100 I
> to 192.255.198.14 via so-1/2/0.0
10.49.101.0/24 *[BGP/170] 03:34:59, MED 0, localpref 100
AS path: 100 I
> to 192.255.198.14 via so-1/2/0.0
10.49.200.0/24 *[BGP/170] 00:26:39, MED 0, localpref 100, from 10.255.255.178
AS path: 100 I
> via so-1/2/1.0, Push 100019, Push 100008(top)
10.49.200.1/32 *[BGP/170] 00:26:39, localpref 100, from 10.255.255.178
AS path: 100 I
> via so-1/2/1.0, Push 100019, Push 100008(top)
10.49.201.0/24 *[BGP/170] 00:26:39, MED 0, localpref 100, from 10.255.255.178
AS path: 100 I
> via so-1/2/1.0, Push 100019, Push 100008(top)
10.255.255.181/32 *[BGP/170] 03:34:59, localpref 100
AS path: 100 I
> to 192.255.198.14 via so-1/2/0.0
10.255.255.182/32 *[BGP/170] 00:26:39, localpref 100, from 10.255.255.178
AS path: 100 I
> via so-1/2/1.0, Push 100019, Push 100008(top)
192.255.14.0/24 *[BGP/170] 03:34:59, localpref 100
AS path: 100 I
> to 192.255.198.14 via so-1/2/0.0
[BGP/170] 00:26:39, localpref 100, from 10.255.255.178
AS path: 100 I
> via so-1/2/1.0, Push 100019, Push 100008(top)
192.255.198.12/30 [BGP/170] 03:34:59, localpref 100
AS path: 100 I
> to 192.255.198.14 via so-1/2/0.0
192.255.198.20/30 *[BGP/170] 00:26:39, localpref 100, from 10.255.255.178
AS path: I
> via so-1/2/1.0, Push 100020, Push 100008(top)
mpls.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)

```



```

bgp.l3vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.255.255.178:1:10.49.200.0/24
    *[BGP/170] 00:27:27, MED 0, localpref 100, from 10.255.255.178
        AS path: 100 I
        > via so-1/2/1.0, Push 100019, Push 100008(top)
10.255.255.178:1:10.49.200.1/32
    *[BGP/170] 00:27:27, localpref 100, from 10.255.255.178
        AS path: 100 I
        > via so-1/2/1.0, Push 100019, Push 100008(top)
10.255.255.178:1:10.49.201.0/24
    *[BGP/170] 00:27:27, MED 0, localpref 100, from 10.255.255.178
        AS path: 100 I
        > via so-1/2/1.0, Push 100019, Push 100008(top)
10.255.255.178:1:10.255.255.182/32
    *[BGP/170] 00:27:27, localpref 100, from 10.255.255.178
        AS path: 100 I
        > via so-1/2/1.0, Push 100019, Push 100008(top)
10.255.255.178:1:192.255.14.0/24
    *[BGP/170] 00:27:27, localpref 100, from 10.255.255.178
        AS path: 100 I
        > via so-1/2/1.0, Push 100019, Push 100008(top)
10.255.255.178:1:192.255.198.20/30
    *[BGP/170] 00:27:27, localpref 100, from 10.255.255.178
        AS path: I
        > via so-1/2/1.0, Push 100020, Push 100008(top)

```

### Router CE1 Status

```

user@CE1> show ldp neighbor

```

Address	Interface	Label space ID	Hold time
192.255.197.17	t3-0/1/0.0	192.255.197.17:0	11
192.255.198.2	so-1/2/0.0	10.255.255.175:0	14

```

user@CE1> show route

```

```

inet.0: 21 destinations, 23 routes (20 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both
0.0.0.0/0      *[Static/5] 07:53:10, metric 0
                Discard
10.255.255.175/32 *[OSPF/10] 00:31:44, metric 1
                > via so-1/2/0.0
10.255.255.176/32 *[OSPF/150] 00:31:44, metric 1, tag 3489661228
                > via t3-0/1/0.0
10.255.255.177/32 *[OSPF/10] 00:31:44, metric 2
                > via so-1/2/0.0
10.255.255.178/32 *[OSPF/150] 00:31:44, metric 1, tag 3489661228
                > via t3-0/1/0.0
10.255.255.179/32 *[Direct/0] 07:53:10
                > via lo0.0
10.255.255.180/32 *[OSPF/150] 00:31:44, metric 1, tag 3489661228
                > via t3-0/1/0.0
172.16.0.0/12   *[Static/5] 07:53:10
                > to 192.255.14.254 via fxp0.0
192.255.0.0/18  *[Static/5] 07:53:10
                > to 192.255.14.254 via fxp0.0
192.255.14.0/24 *[Direct/0] 07:53:10
                > via fxp0.0
192.255.14.179/32 *[Local/0] 07:53:10
                Local via fxp0.0
192.255.40.0/22 *[Static/5] 03:38:37

```

```

> to 192.255.14.254 via fxp0.0
192.255.64.0/18 * [Static/5] 03:38:37
> to 192.255.14.254 via fxp0.0
192.255.197.16/30 * [Direct/0] 03:37:42
> via t3-0/1/0.0
[OSPF/10] 00:31:44, metric 2
> via t3-0/1/0.0
192.255.197.18/32 * [Local/0] 07:52:01
Local via t3-0/1/0.0
192.255.198.0/30 * [Direct/0] 07:51:18
> via so-1/2/0.0
[OSPF/10] 00:31:44, metric 1
> via so-1/2/0.0
192.255.198.1/32 * [Local/0] 07:51:59
Local via so-1/2/0.0
192.255.198.8/30 * [OSPF/10] 00:31:44, metric 2
> via so-1/2/0.0
207.17.136.192/32 * [Static/5] 07:53:10
> to 192.255.14.254 via fxp0.0
224.0.0.5/32 * [OSPF/10] 07:53:14, metric 1
MultiRecv
inet.3: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.255.255.175/32 * [LDP/9] 01:00:52, metric 1
> via so-1/2/0.0
10.255.255.176/32 * [LDP/9] 00:33:24, metric 1
> via t3-0/1/0.0, Push 100020
10.255.255.177/32 * [LDP/9] 01:00:52, metric 1
> via so-1/2/0.0, Push 100000
10.255.255.178/32 * [LDP/9] 00:33:24, metric 1
> via t3-0/1/0.0, Push 100021
10.255.255.180/32 * [LDP/9] 01:00:52, metric 1
> via t3-0/1/0.0, Push 100015
mpls.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
100000 * [LDP/9] 03:38:31, metric 1
> via so-1/2/0.0, Pop
100000(S=0) * [LDP/9] 03:38:31, metric 1
> via so-1/2/0.0, Pop
100001 * [LDP/9] 03:38:31, metric 1
> via so-1/2/0.0, Swap 100000
100002 * [LDP/9] 03:35:06, metric 1
> via t3-0/1/0.0, Swap 100015
100007 * [LDP/9] 00:33:24, metric 1
> via t3-0/1/0.0, Swap 100020
100008 * [LDP/9] 00:33:24, metric 1
> via t3-0/1/0.0, Swap 100021

```

### Router PE1 Status

```
user@PE1> show ldp neighbor instance vpn-provider
```

Address	Interface	Label space ID	Hold time
192.255.197.18	t3-0/2/1.0	10.255.255.179:0	11

```
user@PE1> show ldp database instance vpn-provider
```

Input label	Label	Prefix
	3	10.255.255.179/32
	100002	10.255.255.180/32
	100007	10.255.255.176/32
	100001	10.255.255.177/32

```

100008      10.255.255.178/32
100000      10.255.255.175/32
Output label database, 192.255.197.17:0--10.255.255.179:0
Label      Prefix
100007      10.255.255.175/32
100020      10.255.255.176/32
100008      10.255.255.177/32
100021      10.255.255.178/32
100006      10.255.255.179/32
100015      10.255.255.180/32

```

```
user@PE1> show ldp interface instance vpn-provider
```

```

Interface      Label space ID      Nbr count      Next hello
t3-0/2/1.0      192.255.197.17:0      1              0

```

```
user@PE1> show ldp path instance vpn-provider
```

```

Output Session (label)      Input Session (label)
10.255.255.179:0(100006)(      ) 10.255.255.179:0(3)( )
10.255.255.179:0(100007)      10.255.255.179:0(100000)
10.255.255.179:0(100008)      10.255.255.179:0(100001)
10.255.255.179:0(100015)      ( )
10.255.255.179:0(100020)      ( )
10.255.255.179:0(100021)      ( )

```

```
user@PE1> show ldp route instance vpn-provider
```

```

Destination      Next-hop intf/lsp      Next-hop address
10.255.255.175/32 t3-0/2/1.0
10.255.255.176/32 so-0/0/0.0
10.255.255.177/32 t3-0/2/1.0
10.255.255.178/32 so-0/0/0.0
10.255.255.179/32 t3-0/2/1.0
10.255.255.180/32 so-0/0/0.0
192.255.197.16/30 t3-0/2/1.0
192.255.197.17/32
192.255.198.0/30  t3-0/2/1.0
192.255.198.8/30  t3-0/2/1.0
224.0.0.5/32

```

```
user@PE1> show ldp session instance vpn-provider
```

```

Address      State      Connection      Hold time
10.255.255.179      Operational      Open      24

```

```
user@PE1> show ldp statistics instance vpn-provider
```

```

Message type      Total      Last 5 seconds
Sent      Received      Sent      Received
Hello      2838      2839      1      2
Initialization      1      1      0      0
Keepalive      1240      1239      0      0
Notification      0      0      0      0
Address      1      1      0      0
Address withdraw      0      0      0      0
Label mapping      10      10      0      0
Label request      0      0      0      0
Label withdraw      4      4      0      0
Label release      4      4      0      0
Label abort      0      0      0      0
All UDP      2837      2839      1      2
All TCP      1258      1251      0      0
Event type      Total      Last 5 seconds
Sessions opened      1      0
Sessions closed      0      0
Topology changes      21      0

```

No router id	0	0
No address	0	0
No interface	0	0
No session	0	0
No adjacency	0	0
Unknown version	0	0
Malformed PDU	0	0
Malformed message	0	0
Unknown message type	0	0
Inappropriate message	0	0
Malformed TLV	0	0
Bad TLV value	0	0
Missing TLV	0	0
PDU too large	0	0
PDU too small	0	0

user@PE1> show ldp traffic-statistics instance vpn-provider

FEC	Type	Packets	Bytes	Shared
10.255.255.175/32	Transit	0	0	No
10.255.255.175/32	Ingress	0	0	No
10.255.255.176/32	Transit	0	0	No
10.255.255.177/32	Transit	2798	241984	No
10.255.255.177/32	Ingress	0	0	No
10.255.255.178/32	Transit	1365	125580	No
10.255.255.179/32	Transit	0	0	No
10.255.255.179/32	Ingress	2427	149076	No
10.255.255.180/32	Transit	0	0	No

user@PE1> show bgp summary

Groups: 1 Peers: 1 Down peers: 0

Table	Tot Paths	Act Paths	Suppressed	History	Damp	State	Pending
bgp.13vpn.0	3	3	0	0		0	0

Peer	AS	InPkt	OutPkt	OutQ	Flaps	Last
10.255.255.172	300	428	422	0	0	3:28:37 Establ

Up/DwnState|#Active/Received/Damped...

bgp.13vpn.0: 3/3/0

vpn-provider.inet.0: 3/3/0

## Router PE2 Status

user@PE2> show ldp neighbor instance vpn-provider

Address	Interface	Label space ID	Hold time
192.255.197.38	tl-3/0/0.0	10.255.255.180:0	11

user@PE2> show ldp database instance vpn-provider

Input label database, 192.255.197.37:0--10.255.255.180:0

Label	Prefix
3	10.255.255.180/32
100003	10.255.255.177/32
100010	10.255.255.178/32
100009	10.255.255.176/32
100002	10.255.255.175/32
100004	10.255.255.179/32

Output label database, 192.255.197.37:0--10.255.255.180:0

Label	Prefix
100026	10.255.255.175/32
100028	10.255.255.179/32
100027	10.255.255.177/32
100021	10.255.255.180/32
100039	10.255.255.178/32
100037	10.255.255.176/32

```
user@PE2> show ldp interface instance vpn-provider
```

Interface	Label space ID	Nbr count	Next hello
t1-3/0/0.0	192.255.197.37:0		
1	1		

```
user@PE2> show ldp path instance vpn-provider
```

Output Session (label)	Input Session (label)
10.255.255.180:0(100021)(	) 10.255.255.180:0(3)( )
10.255.255.180:0(100026)	( )
10.255.255.180:0(100027)	( )
10.255.255.180:0(100028)	( )
10.255.255.180:0(100037)	10.255.255.180:0(100009)
10.255.255.180:0(100039)	10.255.255.180:0(100010)

```
user@PE2> show ldp route instance vpn-provider
```

Destination	Next-hop intf/lsp	Next-hop address
10.255.255.175/32	so-0/2/0.0	
10.255.255.176/32	t1-3/0/0.0	
10.255.255.177/32	so-0/2/0.0	
10.255.255.178/32	t1-3/0/0.0	
10.255.255.179/32	so-0/2/0.0	
10.255.255.180/32	t1-3/0/0.0	
192.255.197.36/30	t1-3/0/0.0	
192.255.197.37/32		
192.255.198.24/30	t1-3/0/0.0	
192.255.198.36/30	t1-3/0/0.0	
224.0.0.5/32		

```
user@PE2> show ldp session instance vpn-provider
```

Address	State	Connection	Hold time
10.255.255.180	Operational	Open	29

```
user@PE2> show ldp statistics instance vpn-provider
```

Message type	Total		Last 5 seconds	
	Sent	Received	Sent	Received
Hello	2948	2939	1	1
Initialization	1	1	0	0
Keepalive	1285	1285	0	0
Notification	0	0	0	0
Address	1	1	0	0
Address withdraw	0	0	0	0
Label mapping	10	10	0	0
Label request	0	0	0	0
Label withdraw	4	4	0	0
Label release	4	4	0	0
Label abort	0	0	0	0
All UDP	2947	2939	1	1
All TCP	1297	1299	0	0
Event type	Total		Last 5 seconds	
Sessions opened	1		0	
Sessions closed	0		0	
Topology changes	33		0	
No router id	0		0	
No address	0		0	
No interface	0		0	
No session	0		0	
No adjacency	0		0	
Unknown version	0		0	
Malformed PDU	0		0	
Malformed message	0		0	

```

Unknown message type          0          0
Inappropriate message         0          0
Malformed TLV                 0          0
Bad TLV value                 0          0
Missing TLV                   0          0
PDU too large                 0          0
PDU too small

```

```

                                0          0
user@PE2> show ldp traffic-statistics instance vpn-provider

```

FEC	Type	Packets	Bytes	Shared
10.255.255.175/32	Transit	0	0	No
10.255.255.176/32	Transit	0	0	No
10.255.255.176/32	Ingress	0	0	No
10.255.255.177/32	Transit	3131	274830	No
10.255.255.178/32	Transit	1966	178256	No
10.255.255.178/32	Ingress	0	0	No
10.255.255.179/32	Transit	1	44	No
10.255.255.180/32	Transit	0	0	No
10.255.255.180/32	Ingress	2330	144838	No

```
user@PE2> show bgp summary
```

```

Groups: 1 Peers: 1 Down peers: 0
Table      Tot Paths  Act Paths Suppressed  History  Damp State  Pending
inet.0      0          0          0          0          0          0          0
bgp.l3vpn.0  3          3          0          0          0          0          0
Peer      AS      InPkt  OutPkt  OutQ  Flaps Last
Up/DwnState|#Active/Received/Damped...
10.255.255.171 300      429      438      0      0      3:33:32 Establ
  bgp.l3vpn.0: 3/3/0
  vpn-provider.inet.0: 3/3/0

```

```
user@PE2> show route protocol bgp
```

```

inet.0: 18 destinations, 19 routes (17 active, 0 holddown, 1 hidden)
inet.3: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
vpn-provider.inet.0: 11 destinations, 15 routes (11 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.255.255.175/32 *[BGP/170] 00:27:59, MED 1, localpref 100, from 10.255.255.171

```

```
AS path: I
```

```
> via so-0/2/0.0, Push 100012, Push 100028(top)
```

```
10.255.255.177/32 *[BGP/170] 00:27:59, MED 1, localpref 100, from 10.255.255.171
```

```
AS path: I
```

```
> via so-0/2/0.0, Push 100013, Push 100028(top)
```

```
10.255.255.179/32 *[BGP/170] 00:27:59, MED 1, localpref 100, from 10.255.255.171
```

```
AS path: I
```

```
> via so-0/2/0.0, Push 100014, Push 100028(top)
```

```
vpn-provider.inet.3: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
```

```
mpls.0: 11 destinations, 11 routes (11 active, 0 holddown, 0 hidden)
```

```
vpn-provider.mpls.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)
```

```
bgp.l3vpn.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
```

```
+ = Active Route, - = Last Active, * = Both
```

```
10.255.255.171:1:10.255.255.175/32
```

```
*[BGP/170] 03:33:34, MED 1, localpref 100, from 10.255.255.171
```

```
AS path: I
```

```
> via so-0/2/0.0, Push 100012, Push 100028(top)
```

```
10.255.255.171:1:10.255.255.177/32
```

```
*[BGP/170] 03:33:34, MED 1, localpref 100, from 10.255.255.171
```

```

AS path: I
> via so-0/2/0.0, Push 100013, Push 100028(top)
10.255.255.171:1:10.255.255.179/32
*[BGP/170] 03:33:34, MED 1, localpref 100, from 10.255.255.171

```

```

AS path: I
> via so-0/2/0.0, Push 100014, Push 100028(top)
Address          Interface      Label space ID      Hold time
192.255.197.38   t1-3/0/0.0    10.255.255.180:0    11

```

```

user@PE2> show ldp database instance vpn-provider
Input label database, 192.255.197.37:0--10.255.255.180:0
  Label      Prefix
    3        10.255.255.180/32
 100003      10.255.255.177/32
 100010      10.255.255.178/32
 100009      10.255.255.176/32
 100002      10.255.255.175/32
 100004      10.255.255.179/32
Output label database, 192.255.197.37:0--10.255.255.180:0
  Label      Prefix
 100026      10.255.255.175/32
 100028      10.255.255.179/32
 100027      10.255.255.177/32
 100021      10.255.255.180/32
 100039      10.255.255.178/32
 100037      10.255.255.176/32

```

```

user@PE2> show ldp interface instance vpn-provider
Interface      Label space ID      Nbr count      Next hello
t1-3/0/0.0     192.255.197.37:0    1               1

```

```

user@PE2> show ldp path instance vpn-provider
Output Session (label)      Input Session (label)
10.255.255.180:0(100021)(   ) 10.255.255.180:0(3)( )
10.255.255.180:0(100026)      ( )
10.255.255.180:0(100027)      ( )
10.255.255.180:0(100028)      ( )
10.255.255.180:0(100037)      10.255.255.180:0(100009)
10.255.255.180:0(100039)      10.255.255.180:0(100010)

```

```

user@PE2> show ldp route instance vpn-provider
Destination      Next-hop intf/lsp      Next-hop address
10.255.255.175/32 so-0/2/0.0
10.255.255.176/32 t1-3/0/0.0
10.255.255.177/32 so-0/2/0.0
10.255.255.178/32 t1-3/0/0.0
10.255.255.179/32 so-0/2/0.0
10.255.255.180/32 t1-3/0/0.0
192.255.197.36/30 t1-3/0/0.0
192.255.197.37/32
192.255.198.24/30 t1-3/0/0.0
192.255.198.36/30 t1-3/0/0.0
224.0.0.5/32

```

```

user@PE2> show ldp session instance vpn-provider
Address      State      Connection      Hold time
10.255.255.180 Operational Open              29

```

```
user@PE2> show ldp statistics instance vpn-provider
```

Message type	Total		Last 5 seconds	
	Sent	Received	Sent	Received
Hello	2948	2939	1	1
Initialization	1	1	0	0
Keepalive	1285	1285	0	0
Notification	0	0	0	0
Address	1	1	0	0
Address withdraw	0	0	0	0
Label mapping	10	10	0	0
Label request	0	0	0	0
Label withdraw	4	4	0	0
Label release	4	4	0	0
Label abort	0	0	0	0
All UDP	2947	2939	1	1
All TCP	1297	1299	0	0
Event type	Total		Last 5 seconds	
Sessions opened	1		0	
Sessions closed	0		0	
Topology changes	33		0	
No router id	0		0	
No address	0		0	
No interface	0		0	
No session	0		0	
No adjacency	0		0	
Unknown version	0		0	
Malformed PDU	0		0	
Malformed message	0		0	
Unknown message type	0		0	
Inappropriate message	0		0	
Malformed TLV	0		0	
Bad TLV value	0		0	
Missing TLV	0		0	
PDU too large	0		0	
PDU too small	0		0	

```
user@PE2> show ldp traffic-statistics instance vpn-provider
```

FEC	Type	Packets	Bytes	Shared
10.255.255.175/32	Transit	0	0	No
10.255.255.176/32	Transit	0	0	No
10.255.255.176/32	Ingress	0	0	No
10.255.255.177/32	Transit	3131	274830	No
10.255.255.178/32	Transit	1966	178256	No
10.255.255.178/32	Ingress	0	0	No
10.255.255.179/32	Transit	1	44	No
10.255.255.180/32	Transit	0	0	No
10.255.255.180/32	Ingress	2330	144838	No

```
user@PE2> show bgp summary
```

```
Groups: 1 Peers: 1 Down peers: 0
```

Table	Tot Paths	Act Paths	Suppressed	History	Damp	State	Pending
inet.0	0	0	0	0	0	0	0
bgp.13vpn.0	3	3	0	0	0	0	0
Peer	AS	InPkt	OutPkt	OutQ	Flaps	Last	
Up/DwnState #Active/Received/Damped...							
10.255.255.171	300	429	438	0	0	3:33:32	Establ
bgp.13vpn.0: 3/3/0							
vpn-provider.inet.0: 3/3/0							

```
user@PE2> show route protocol bgp
```

```
inet.0: 18 destinations, 19 routes (17 active, 0 holddown, 1 hidden)
```



```

inet.3: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
vpn-provider.inet.0: 11 destinations, 15 routes (11 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.255.255.175/32 * [BGP/170] 00:27:59, MED 1, localpref 100, from 10.255.255.171

    AS path: I
    > via so-0/2/0.0, Push 100012, Push 100028(top)
10.255.255.177/32 * [BGP/170] 00:27:59, MED 1, localpref 100, from 10.255.255.171

    AS path: I
    > via so-0/2/0.0, Push 100013, Push 100028(top)
10.255.255.179/32 * [BGP/170] 00:27:59, MED 1, localpref 100, from 10.255.255.171

    AS path: I
    > via so-0/2/0.0, Push 100014, Push 100028(top)
vpn-provider.inet.3: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
mpls.0: 11 destinations, 11 routes (11 active, 0 holddown, 0 hidden)
vpn-provider.mpls.0: 7 destinations, 7 routes (7 active, 0 holddown, 0 hidden)
bgp.l3vpn.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.255.255.171:1:10.255.255.175/32
    * [BGP/170] 03:33:34, MED 1, localpref 100, from 10.255.255.171

    AS path: I
    > via so-0/2/0.0, Push 100012, Push 100028(top)
10.255.255.171:1:10.255.255.177/32
    * [BGP/170] 03:33:34, MED 1, localpref 100, from 10.255.255.171

    AS path: I
    > via so-0/2/0.0, Push 100013, Push 100028(top)
10.255.255.171:1:10.255.255.179/32
    * [BGP/170] 03:33:34, MED 1, localpref 100, from 10.255.255.171

    AS path: I
    > via so-0/2/0.0, Push 100014, Push 100028(top)

```

### Router CE2 Status

```

user@CE2> show ldp neighbor
Address          Interface          Label space ID      Hold time
192.255.197.37   t1-0/0/0.0        192.255.197.37:0    12
192.255.198.25   t3-0/3/3.0        10.255.255.176:0    13

user@CE2> show route
inet.0: 21 destinations, 23 routes (20 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both
0.0.0.0/0        * [Static/5] 07:53:49, metric 0
                  Discard
10.255.255.175/32 * [OSPF/150] 00:29:56, metric 1, tag 3489661228
                  > via t1-0/0/0.0
10.255.255.176/32 * [OSPF/10] 00:29:56, metric 2
                  > via t3-0/3/3.0
10.255.255.177/32 * [OSPF/150] 00:29:56, metric 1, tag 3489661228
                  > via t1-0/0/0.0
10.255.255.178/32 * [OSPF/10] 00:29:56, metric 67
                  > via t3-0/3/3.0
10.255.255.179/32 * [OSPF/150] 00:29:56, metric 1, tag 3489661228
                  > via t1-0/0/0.0
10.255.255.180/32 * [Direct/0] 07:53:49
                  > via lo0.0
172.16.0.0/12    * [Static/5] 07:53:49

```

```

> to 192.255.14.254 via fxp0.0
192.255.0.0/18 * [Static/5] 07:53:49
> to 192.255.14.254 via fxp0.0
192.255.14.0/24 * [Direct/0] 07:53:49
> via fxp0.0
192.255.14.180/32 * [Local/0] 07:53:49
Local via fxp0.0
192.255.40.0/22 * [Static/5] 06:07:28
> to 192.255.14.254 via fxp0.0
192.255.64.0/18 * [Static/5] 07:49:39
> to 192.255.14.254 via fxp0.0
192.255.197.36/30 * [Direct/0] 03:38:03
> via t1-0/0/0.0
[OSPF/10] 00:29:56, metric 65
> via t1-0/0/0.0
192.255.197.38/32 * [Local/0] 07:52:52
Local via t1-0/0/0.0
192.255.198.24/30 * [Direct/0] 03:33:17
> via t3-0/3/3.0
[OSPF/10] 00:29:56, metric 2
> via t3-0/3/3.0
192.255.198.26/32 * [Local/0] 07:52:49
Local via t3-0/3/3.0
192.255.198.36/30 * [OSPF/10] 00:29:56, metric 67
> via t3-0/3/3.0
207.17.136.192/32 * [Static/5] 07:53:49
> to 192.255.14.254 via fxp0.0
224.0.0.5/32 * [OSPF/10] 03:38:55, metric 1
MultiRecv
inet.3: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.255.255.175/32 * [LDP/9] 03:35:53, metric 1
> via t1-0/0/0.0, Push 100026
10.255.255.176/32 * [LDP/9] 00:34:13, metric 1
> via t3-0/3/3.0
10.255.255.177/32 * [LDP/9] 03:35:53, metric 1
> via t1-0/0/0.0, Push 100027
10.255.255.178/32 * [LDP/9] 00:34:13, metric 1
> via t3-0/3/3.0, Push 100014
10.255.255.179/32 * [LDP/9] 03:35:53, metric 1
> via t1-0/0/0.0, Push 100028
mpls.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
100002 * [LDP/9] 03:35:53, metric 1
> via t1-0/0/0.0, Swap 100026
100003 * [LDP/9] 03:35:53, metric 1
> via t1-0/0/0.0, Swap 100027
100004 * [LDP/9] 03:35:53, metric 1
> via t1-0/0/0.0, Swap 100028
100009 * [LDP/9] 00:34:13, metric 1
> via t3-0/3/3.0, Pop
100009(S=0) * [LDP/9] 00:34:13, metric 1
> via t3-0/3/3.0, Pop
100010 * [LDP/9] 00:34:13, metric 1
> via t3-0/3/3.0, Swap 100014

```

#### Router PE4 Status

```
user@PE4> show bgp summary
```

```

Groups: 2 Peers: 2 Down peers: 0
Table      Tot Paths  Act Paths Suppressed  History Damp State   Pending
bgp.l3vpn.0      6          6          0          0          0          0
inet.0          12         10          0          0          0          0
Peer          AS      InPkt    OutPkt    OutQ    Flaps  Last Up/DwnState|#Active/Received/Damped...
192.255.198.22  100      420      429        0        0      3:28:57 Establ
  vpn-customer.inet.0: 5/6/0
10.255.255.177  200      394      406        0        2      28:35 Establ
  bgp.l3vpn.0: 6/6/0
  vpn-customer.inet.0: 5/6/0

```

```
user@PE4> show route protocol bgp
```

```

inet.0: 20 destinations, 21 routes (19 active, 0 holddown, 1 hidden)
inet.3: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
vpn-customer.inet.0: 12 destinations, 14 routes (12 active, 0 holddown,
0 hidden)
+ = Active Route, - = Last Active, * = Both
10.49.100.0/24    *[BGP/170] 00:23:27, MED 0, localpref 100, from 10.255.255.177
                  AS path: 100 I
                  > via t1-0/1/1.0, Push 100013, Push 100012(top)
10.49.100.1/32   *[BGP/170] 00:23:27, localpref 100, from 10.255.255.177
                  AS path: 100 I
                  > via t1-0/1/1.0, Push 100013, Push 100012(top)
10.49.101.0/24   *[BGP/170] 00:23:27, MED 0, localpref 100, from 10.255.255.177
                  AS path: 100 I
                  > via t1-0/1/1.0, Push 100013, Push 100012(top)
10.49.200.0/24   *[BGP/170] 03:29:00, MED 0, localpref 100
                  AS path: 100 I
                  > to 192.255.198.22 via t3-0/0/3.0
10.49.200.1/32   *[BGP/170] 03:29:00, localpref 100
                  AS path: 100 I
                  > to 192.255.198.22 via t3-0/0/3.0
10.49.201.0/24   *[BGP/170] 03:29:00, MED 0, localpref 100
                  AS path: 100 I
                  > to 192.255.198.22 via t3-0/0/3.0
10.255.255.181/32 *[BGP/170] 00:23:27, localpref 100, from 10.255.255.177
                  AS path: 100 I
                  > via t1-0/1/1.0, Push 100013, Push 100012(top)
10.255.255.182/32 *[BGP/170] 03:29:00, localpref 100
                  AS path: 100 I
                  > to 192.255.198.22 via t3-0/0/3.0
192.255.14.0/24  *[BGP/170] 03:29:00, localpref 100
                  AS path: 100 I
                  > to 192.255.198.22 via t3-0/0/3.0
                  [BGP/170] 00:23:27, localpref 100, from 10.255.255.177
                  AS path: 100 I
                  > via t1-0/1/1.0, Push 100013, Push 100012(top)
192.255.198.12/30 *[BGP/170] 00:23:27, localpref 100, from 10.255.255.177
                  AS path: I
                  > via t1-0/1/1.0, Push 100014, Push 100012(top)
192.255.198.20/30 [BGP/170] 03:29:00, localpref 100
                  AS path: 100 I
                  > to 192.255.198.22 via t3-0/0/3.0
mpls.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)
bgp.l3vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.255.255.177:1:10.49.100.0/24
                  *[BGP/170] 00:28:38, MED 0, localpref 100, from 10.255.255.177
                  AS path: 100 I
                  > via t1-0/1/1.0, Push 100013, Push 100012(top)
10.255.255.177:1:10.49.100.1/32

```

```

* [BGP/170] 00:28:38, localpref 100, from 10.255.255.177
  AS path: 100 I
  > via t1-0/1/1.0, Push 100013, Push 100012(top)
10.255.255.177:1:10.49.101.0/24
* [BGP/170] 00:28:38, MED 0, localpref 100, from 10.255.255.177
  AS path: 100 I
  > via t1-0/1/1.0, Push 100013, Push 100012(top)
10.255.255.177:1:10.255.255.181/32
* [BGP/170] 00:28:38, localpref 100, from 10.255.255.177
  AS path: 100 I
  > via t1-0/1/1.0, Push 100013, Push 100012(top)
10.255.255.177:1:192.255.14.0/24
* [BGP/170] 00:28:38, localpref 100, from 10.255.255.177
  AS path: 100 I
  > via t1-0/1/1.0, Push 100013, Push 100012(top)
10.255.255.177:1:192.255.198.12/30
* [BGP/170] 00:28:38, localpref 100, from 10.255.255.177
  AS path: I
  > via t1-0/1/1.0, Push 100014, Push 100012(top)

```

user@PE4> show route protocol ldp

```

inet.0: 20 destinations, 21 routes (19 active, 0 holddown, 1 hidden)
inet.3: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
10.255.255.175/32 * [LDP/9] 00:29:08, metric 1
  > via t1-0/1/1.0, Push 100011
10.255.255.176/32 * [LDP/9] 00:29:08, metric 1
  > via t1-0/1/1.0
10.255.255.177/32 * [LDP/9] 00:29:08, metric 1
  > via t1-0/1/1.0, Push 100012
10.255.255.179/32 * [LDP/9] 00:29:08, metric 1
  > via t1-0/1/1.0, Push 100013
10.255.255.180/32 * [LDP/9] 00:29:08, metric 1
  > via t1-0/1/1.0, Push 100010
vpn-customer.inet.0: 12 destinations, 14 routes (12 active, 0 holddown, 0 hidden)
mpls.0: 13 destinations, 13 routes (13 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
100014 * [LDP/9] 00:29:08, metric 1
  > via t1-0/1/1.0, Pop
100014(S=0) * [LDP/9] 00:29:08, metric 1
  > via t1-0/1/1.0, Pop
100015 * [LDP/9] 00:29:08, metric 1
  > via t1-0/1/1.0, Swap 100010
100016 * [LDP/9] 00:29:08, metric 1
  > via t1-0/1/1.0, Swap 100011
100017 * [LDP/9] 00:29:08, metric 1
  > via t1-0/1/1.0, Swap 100012
100018 * [LDP/9] 00:29:08, metric 1
  > via t1-0/1/1.0, Swap 100013
bgp.l3vpn.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)

```

### Router CE4 Status

user@CE4> show route protocol bgp

```

inet.0: 20 destinations, 25 routes (19 active, 0 holddown, 6 hidden)
+ = Active Route, - = Last Active, * = Both
10.49.100.0/24 * [BGP/170] 00:28:00, localpref 100
  AS path: 200 200 I
  > to 192.255.198.21 via t3-0/0/3.0
10.49.100.1/32 * [BGP/170] 00:28:00, localpref 100
  AS path: 200 200 I

```

```

> to 192.255.198.21 via t3-0/0/3.0
10.49.101.0/24 * [BGP/170] 00:28:00, localpref 100
                AS path: 200 200 I
> to 192.255.198.21 via t3-0/0/3.0
10.255.255.181/32 * [BGP/170] 00:28:00, localpref 100
                AS path: 200 200 I
> to 192.255.198.21 via t3-0/0/3.0
192.255.198.12/30 * [BGP/170] 00:28:00, localpref 100
                AS path: 200 I
> to 192.255.198.21 via t3-0/0/3.0

```

```
user@CE4> show bgp summary
```

```
Groups: 1 Peers: 1 Down peers: 0
```

Table	Tot Paths	Act Paths	Suppressed	History	Damp	State	Pending
inet.0	0	0	0	0	0	0	0

Peer	AS	InPkt	OutPkt	OutQ	Flaps	Last
Up/DwnState #Active/Received/Damped...						
192.255.198.21	200	426	421	0	0	3:28:20 5/10/0
	0/0/0					

#### Related Documentation

- *Junos VPNs Configuration Guide*
- *Junos MPLS Applications Configuration Guide*
- *Junos Policy Framework Configuration Guide*
- RFC 3017, *Carrying Label Information in BGP-4*
- RFC 5036, *LDP Specification*



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