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Multiple Instances for Label Distribution Protocol Feature Guide

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Junos® OS Multiple Instances for Label Distribution Protocol Feature Guide
Release 11.4

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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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PART 1

Multiple Instances for Label Distribution Protocol

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

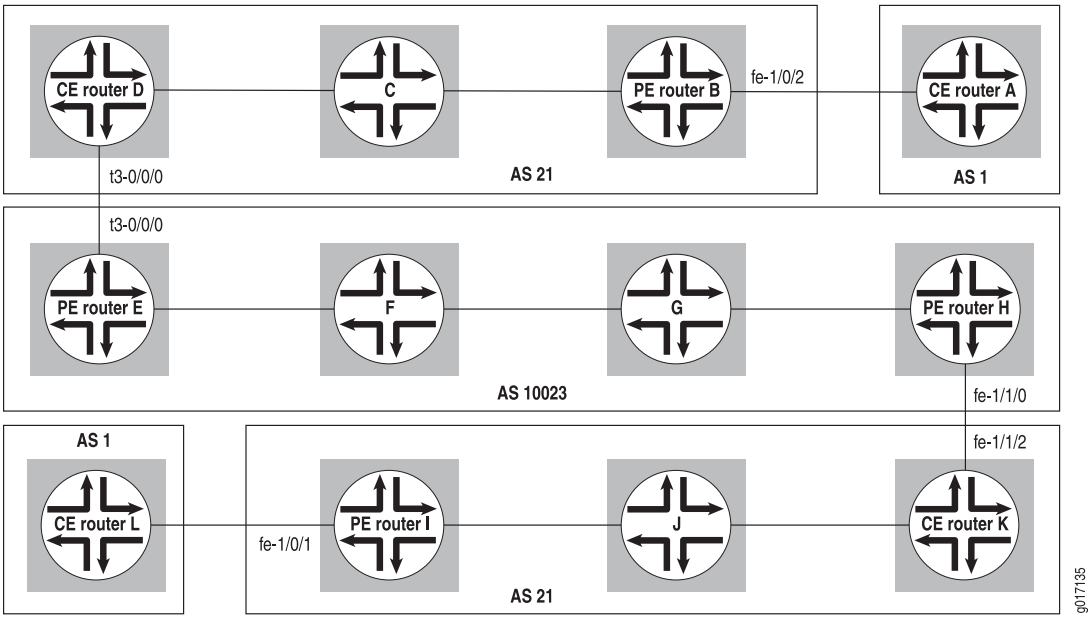
Versions of Junos OS earlier than Release 5.3 support multiple VPN routing and forwarding (VRF) instances of Border Gateway Protocol (BGP), Intermediate System-to-Intermediate System (IS-IS), Open Shortest Path First (OSPF), Protocol Independent Multicast (PIM), and Routing Information Protocol (RIP).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

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

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

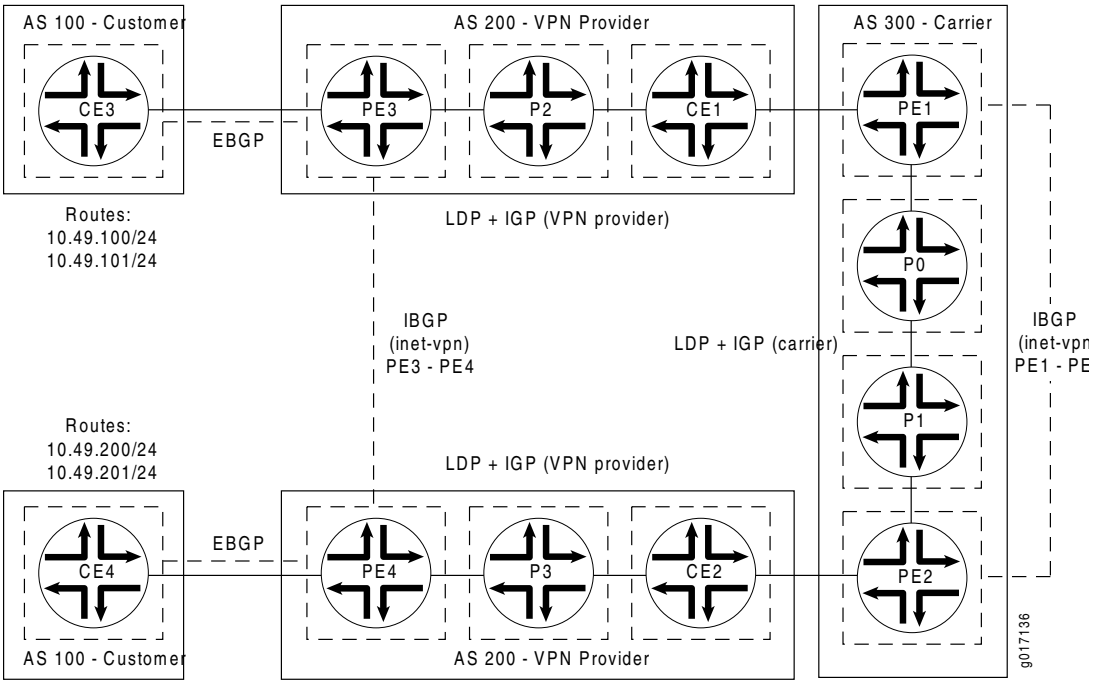


Figure 2 on page 8 shows an example of a carrier-of-carriers network. CE3 and CE4 are end customer CE routers residing in AS 100. The VPN provider in AS 200 has three types of routers: PE3 and PE4 are PE routers that connect to the end customer, CE1 and CE2 act as the intermediate carrier CE routers, 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 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
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
Peer               AS      InPkt     OutPkt    OutQ   Flaps Last Up/DwnState|#Active/Received/Damped...
192.255.198.14    100        432        441       0       0     3:34:55 Establ
  vpn-customer.inet.0: 5/6/0
10.255.255.178    200         62         63       0       2       27:23 Establ
  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 database, 192.255.197.17:0--10.255.255.179:0
  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.l3vpn.0            3          3          0          0          0          0
Peer               AS      InPkt     OutPkt    OutQ   Flaps Last
Up/DwnState|#Active/Received/Damped...
10.255.255.172    300        428        422       0       0     3:28:37 Establ
  bgp.l3vpn.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     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
bgp.l3vpn.0            3          3          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
bgp.l3vpn.0            3          3          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)
```

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
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*

PART 2

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