

## Chapter 11

# Troubleshooting Layer 3 VPNs

This chapter discusses the following strategies and tools for troubleshooting Layer 3 virtual private network (VPN) configurations:

- Diagnosing Common Problems on page 189
- Troubleshooting Layer 3 VPNs Using ping and traceroute on page 194
- Troubleshooting RSVP and LDP LSPs on page 204
- Troubleshooting Inconsistently Advertised Routes from Gigabit Ethernet Interfaces on page 205

### Diagnosing Common Problems

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When problems arise in a Layer 3 VPN configuration, the best way to troubleshoot is to start at one end of the VPN (the local customer edge [CE] router) and follow the routes to the other end of the VPN (the remote CE router). The following troubleshooting steps should help you diagnose common problems:

1. If you configured a routing protocol between the local provider edge (PE) and CE routers, check that the peering and adjacency are fully operational. When you do this, be sure to specify the name of the routing instance. For example, to check Open Shortest Path First (OSPF) adjacencies, enter the `show ospf neighbor instance routing-instance-name` command on the PE router.

If the peering and adjacency are not fully operational, check the routing protocol configuration on the CE router and check the routing protocol configuration for the associated VPN routing instance on the PE router.

2. Check that the local CE and PE routers can ping each other.

To check that the local CE router can ping the VPN interface on the local PE router, use a **ping** command in the following format, specifying the IP address or name of the PE router:

```
user@host> ping (ip-address | host-name)
```

To check that the local PE router can ping the CE router, use a **ping** command in the following format, specifying the IP address or name of the CE router, the name of the interface used for the VPN, and the source IP address (the local address) in outgoing **ECHO\_REQUEST** packets:

```
user@host> ping ip-address interface interface local echo-address
```

Often, the peering or adjacency between the local CE and local PE routers must come up before a **ping** command is successful. To check that a link is operational in a lab setting, remove the interface from the VPN routing and forwarding (VRF) by deleting the **interface** statement from the [edit **routing-instance routing-instance-name**] hierarchy level and recommitting the configuration. Doing this removes the interface from the VPN. Then try the **ping** command again. If the command is successful, configure the interface back into the VPN and check the routing protocol configuration on the local CE and PE routers again.

3. On the local PE router, check that the routes from the local CE router are in the VRF table (*routing-instance-name.inet.0*):

```
user@host> show route table routing-instance-name.inet.0 <detail>
```

The following example shows the routing table entries. Here, the loopback address of the CE router is **10.255.14.155/32** and the routing protocol between the PE and CE routers is Border Gateway Protocol (BGP). The entry looks like any ordinary BGP announcement.

```
10.255.14.155/32 (1 entry, 1 announced)
  *BGP Preference: 170/-101
    Nexthop: 192.168.197.141 via fe-1/0/0.0, selected
    State: <Active Ext>
    Peer AS: 1
    Age: 45:46
    Task: BGP_1.192.168.197.141+179
    Announcement bits (2): 0-BGP.0.0.0.0+179 1-KRT
    AS path: 1 I
    Localpref: 100
    Router ID: 10.255.14.155
```

If the routes from the local CE router are not present in the VRF routing table, check that the CE router is advertising routes to the PE router. If static routing is used between the CE and PE routers, make sure the proper static routes are configured.

4. On a remote PE router, check that the routes from the local CE router are present in the `bgp.l3vpn.0` routing table:

```
user@host> show route table bgp.l3vpn.0 extensive
10.255.14.175:3:10.255.14.155/32 (1 entry, 0 announced)
  *BGP Preference: 170/-101
    Route Distinguisher: 10.255.14.175:3
    Source: 10.255.14.175
    Nexthop: 192.168.192.1 via fe-1/1/2.0, selected
    Label-switched-path vpn07-vpn05
    Push 100004, Push 100005(top)
    State: <Active Int Ext>
    Local AS: 69 Peer AS: 69
    Age: 15:27 Metric2: 338
    Task: BGP_69.10.255.14.175+179
    AS path: 1 I
    Communities: target:69:100
    BGP next hop: 10.255.14.175
    Localpref: 100
    Router ID: 10.255.14.175
    Secondary tables: VPN-A.inet.0
```

The output of the `show route table bgp.l3vpn.0 extensive` command contains the following information specific to the VPN:

- In the prefix name (the first line of the output), the route distinguisher is added to the route prefix of the local CE router. Because the route distinguisher is unique within the Internet, the concatenation of the route distinguisher and IP prefix provides unique VPN-IP version 4 (IPv4) routing entries.
- The `Route Distinguisher` field lists the route distinguisher separately from the VPN-IPv4 address.
- The `label-switched-path` field shows the name of the label-switched path (LSP) used to carry the VPN traffic.
- The `Push` field shows both labels being carried in the VPN-IPv4 packet. The first label is the inner label, which is the VPN label that was assigned by the PE router. The second label is the outer label, which is a Resource Reservation Protocol (RSVP) label.
- The `Communities` field lists the target community.
- The `Secondary tables` field lists other routing tables on this router into which this route has been installed.

If routes from the local CE router are not present in the `bgp.l3vpn.0` routing table on the remote PE router, do the following:

- Check the VRF import filter on the remote PE router, which is configured in the `vrf-import` statement. (On the local PE router, you check the VRF export filter, which is configured with the `vrf-export` statement.)
- Check that there is an operational LSP or a Label Distribution Protocol (LDP) path between the PE routers. To do this, check that the internal Border Gateway Protocol (IBGP) next-hop addresses are in the `inet.3` table.
- Check that the IBGP session between the PE routers is established and configured properly.
- Check for “hidden” routes, which usually means that routes were not labeled properly. To do this, use the `show route table bgp.l3vpn.0 hidden` command.
- Check that the inner label matches the inner VPN label that is assigned by the local PE router. To do this, use the `show route table mpls` command.

The following example shows the output of this command on the remote PE router. Here, the inner label is `100004`.

```
...
Push 100004, Push 10005 (top)
```

The following example shows the output of this command on the local PE router, which shows that the inner label of `100004` matches the inner label on the remote PE router:

```
...
100004          *[VPN/7] 06:56:25, metric 1
                > to 192.168.197.141 via fe-1/0/0.0, Pop
```

5. On the remote PE router, check that the routes from the local CE router are present in the VRF table (`routing-instance-name.inet.0`):

```
user@host> show route table routing-instance-name.inet.0 [detail]
10.255.14.155/32 (1 entry, 1 announced)
  *BGP Preference: 170/-101
    Route Distinguisher: 10.255.14.175:3
    Source: 10.255.14.175
    Nexthop: 192.168.192.1 via fe-1/1/2.0, selected
    Label-switched-path vpn07-vpn05
    Push 100004, Push 100005(top)
    State: <Secondary Active Int Ext>
    Local AS: 69 Peer AS: 69
    Age: 1:16:22 Metric2: 338
    Task: BGP_69.10.255.14.175+179
    Announcement bits (2): 1-KRT 2-VPN-A-RIP
    AS path: 1 I
    Communities: target:69:100
    BGP next hop: 10.255.14.175
    Localpref: 100
    Router ID: 10.255.14.175
    Primary Routing Table bgp.l3vpn.0
```

In this routing table, the route distinguisher is no longer prepended to the prefix. The last line, **Primary Routing Table**, lists the table from which this route was learned.

If the routes are not present in this routing table, but were present in Step 4, the routes might have not passed the VRF import policy on the remote PE router.

If a VPN-IPv4 route matches no **vrf-import** policy, the route does not show up in the **bgp.l3vpn** table at all and hence is not present in the VRF table. If this occurs, it might indicate that on the PE router, you have configured another **vrf-import** statement on another VPN (with a common target), and the routes show up in the **bgp.l3vpn.0** table, but are imported into the wrong VPN.

6. On the remote CE router, check that the routes from the local CE router are present in the routing table (**inet.0**):

```
user@host> show route
```

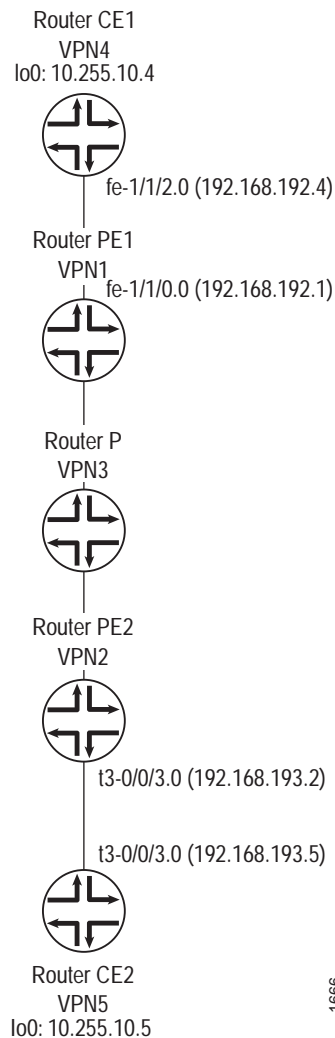
If the routes are not present, check the routing protocol configuration between the remote PE and CE routers, and make sure that peers and adjacencies (or static routes) between the PE and CE routers are correct.

7. If, in Step 1 through Step 6, you have determined that routes originated from the local CE router are correct, check the routes originated from the remote CE router by repeating Step 1 through Step 6.

## Troubleshooting Layer 3 VPNs Using ping and traceroute

This section provides examples of how to use the `ping` command to check the accessibility of various routers in a VPN topology, and how to use the `traceroute` command to check the path that packets travel between the VPN routers. The topology shown in Figure 20 illustrates these commands.

**Figure 20: Layer 3 VPN Topology for ping and traceroute Examples**



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The following sections describe how to use the `ping` and `traceroute` commands to troubleshoot Layer 3 VPN topologies:

- Pinging the CE Router from Another CE Router on page 195
- Pinging the Remote PE and CE Routers from the Local CE Router on page 197
- Pinging the Directly Connected PE Routers from the CE Routers on page 200
- Pinging the Directly Connected CE Routers from the PE Routers on page 201
- Pinging the Remote CE Router from the Local PE Router on page 203
- Pinging a Layer 3 VPN on page 204
- Disabling Normal TTL Decrementing for Layer 3 VPNs on page 204

### ***Pinging the CE Router from Another CE Router***

You can ping one CE router from the other by specifying the other CE router's loopback address as the IP address in the `ping` command. This `ping` command succeeds if the loopback addresses have been announced by the CE routers to their directly connected PE routers. The success of these `ping` commands also means that Router CE1 can ping any network devices beyond Router CE2, and vice versa. Figure 20 shows the topology referenced in the following examples:

- Pinging Router CE2 from Router CE1 on page 195
- Using Traceroute from Loopback to Loopback on page 196
- Pinging Router CE1 from Router CE2 on page 196
- Using Traceroute from Router CE2 to Router CE1 on page 196

### **Pinging Router CE2 from Router CE1**

Ping Router CE2 (VPN5) from Router CE1 (VPN4):

```
user@vpn4> ping 10.255.10.5 local 10.255.10.4 count 3
PING 10.255.10.5 (10.255.10.5): 56 data bytes
64 bytes from 10.255.10.5: icmp_seq=0 ttl=253 time=1.086 ms
64 bytes from 10.255.10.5: icmp_seq=1 ttl=253 time=0.998 ms
64 bytes from 10.255.10.5: icmp_seq=2 ttl=253 time=1.140 ms

--- 10.255.10.5 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.998/1.075/1.140/0.059 ms
```

### Using Traceroute from Loopback to Loopback

To determine the path from Router CE1's loopback interface to Router CE2's loopback interface, use the `traceroute` command:

```
user@vpn4> traceroute 10.255.10.5 source 10.255.10.4
traceroute to 10.255.10.5 (10.255.10.5) from 10.255.10.4, 30 hops max, 40 byte
packets
 1 vpn1-fe-110.isp-core.net (192.168.192.1)  0.680 ms  0.491 ms  0.456 ms
 2 vpn2-t3-001.isp-core.net (192.168.192.110)  0.857 ms  0.766 ms  0.754 ms
   MPLS Label=100005 CoS=0 TTL=1 S=1
 3 vpn5.isp-core.net (10.255.10.5)  0.825 ms  0.886 ms  0.732 ms
```

When you use the `traceroute` command to examine the path used by a Layer 3 VPN, the provider (P) routers in the service provider's network are not displayed. As shown above, the jump from Router VPN1 to Router VPN2 is displayed as a single hop. The P router (VPN3) shown in Figure 20 on page 194 is not displayed.

### Pinging Router CE1 from Router CE2

Ping Router CE1 (VPN4) from Router CE2 (VPN5):

```
user@vpn5> ping 10.255.10.4 local 10.255.10.5 count 3
PING 10.255.10.4 (10.255.10.4): 56 data bytes
64 bytes from 10.255.10.4: icmp_seq=0 ttl=253 time=1.042 ms
64 bytes from 10.255.10.4: icmp_seq=1 ttl=253 time=0.998 ms
64 bytes from 10.255.10.4: icmp_seq=2 ttl=253 time=0.954 ms

--- 10.255.10.4 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.954/0.998/1.042/0.036 ms
```

### Using Traceroute from Router CE2 to Router CE1

To determine the path from Router CE2 to Router CE1, use the `traceroute` command:

```
user@vpn5> traceroute 10.255.10.4 source 10.255.10.5
traceroute to 10.255.10.4 (10.255.10.4) from 10.255.10.5, 30 hops max, 40 byte
packets
 1 vpn-08-t3-003.isp-core.net (192.168.193.2)  0.686 ms  0.519 ms  0.548 ms
 2 vpn1-so-100.isp-core.net (192.168.192.100)  0.918 ms  0.869 ms  0.859 ms
   MPLS Label=100021 CoS=0 TTL=1 S=1
 3 vpn4.isp-core.net (10.255.10.4)  0.878 ms  0.760 ms  0.739 ms
```

## Pinging the Remote PE and CE Routers from the Local CE Router

From the local CE router, you can ping the VPN interfaces on the remote PE and CE routers, which are point-to-point interfaces. Figure 20 on page 194 shows the topology referenced in the following examples:

- Pinging Router CE2 from Router CE1 on page 197
- Using Traceroute from Router CE1 to Router CE2 on page 197
- Pinging Router PE2 from Router CE1 on page 197
- Using Traceroute from Router CE1 to Router PE2 on page 198
- Pinging a CE Router from a Multiaccess Interface on page 198

### Pinging Router CE2 from Router CE1

Ping Router CE2 (VPN5) from Router CE1 (VPN4):

```
user@vpn4> ping 192.168.193.5 local 10.255.10.4 count 3
PING 192.168.193.5 (192.168.193.5): 56 data bytes
64 bytes from 192.168.193.5: icmp_seq=0 ttl=253 time=1.040 ms
64 bytes from 192.168.193.5: icmp_seq=1 ttl=253 time=0.891 ms
64 bytes from 192.168.193.5: icmp_seq=2 ttl=253 time=0.944 ms

--- 192.168.193.5 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.891/0.958/1.040/0.062 ms
```

### Using Traceroute from Router CE1 to Router CE2

To determine the path from Router CE1's loopback interface to Router CE2's directly connected interface, use the `traceroute` command:

```
user@vpn4> traceroute 192.168.193.5 source 10.255.10.4
traceroute to 192.168.193.5 (192.168.193.5) from 10.255.10.4, 30 hops max, 40
byte packets
 1 vpn1-fe-110.isp-core.net (192.168.192.1) 0.669 ms 0.508 ms 0.457 ms
 2 vpn2-t3-001.isp-core.net (192.168.192.110) 0.851 ms 0.769 ms 0.750 ms
   MPLS Label=100000 CoS=0 TTL=1 S=1
 3 vpn5-t3-003.isp-core.net (192.168.193.5) 0.829 ms 0.838 ms 0.731 ms
```

### Pinging Router PE2 from Router CE1

Ping Router PE2 (VPN2) from Router CE1 (VPN4). In this case, packets that originate at Router CE1 go to Router PE2, then to Router CE2, and back to Router PE2 before Router PE2 can respond to Internet Control Message Protocol (ICMP) requests. You can verify this by using the `traceroute` command.

```
user@vpn4> ping 192.168.193.2 local 10.255.10.4 count 3
PING 192.168.193.2 (192.168.193.2): 56 data bytes
64 bytes from 192.168.193.2: icmp_seq=0 ttl=254 time=1.080 ms
64 bytes from 192.168.193.2: icmp_seq=1 ttl=254 time=0.967 ms
64 bytes from 192.168.193.2: icmp_seq=2 ttl=254 time=0.983 ms

--- 192.168.193.2 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.967/1.010/1.080/0.050 ms
```

### Using Traceroute from Router CE1 to Router PE2

To determine the path from Router CE1 to Router PE2, use the `traceroute` command:

```
user@vpn4> traceroute 192.168.193.2 source 10.255.10.4
traceroute to 192.168.193.2 (192.168.193.2) from 10.255.10.4, 30 hops max, 40
byte packets
 1  vpn1-fe-110.isp-core.net (192.168.192.1)  0.690 ms  0.490 ms  0.458 ms
 2  vpn2-t3-003.isp-core.net (192.168.193.2)  0.846 ms  0.768 ms  0.749 ms
    MPLS Label=100000 CoS=0 TTL=1 S=1
 3  vpn5-t3-003.isp-core.net (192.168.193.5)  0.643 ms  0.703 ms  0.600 ms
 4  vpn-08-t3-003.isp-core.net (192.168.193.2)  0.810 ms  0.739 ms  0.729 ms
```

### Pinging a CE Router from a Multiaccess Interface

You cannot ping one CE router from the other if the VPN interface is a multiaccess interface, such as the `fe-1/1/2.0` interface on Router CE1. To ping Router CE1 from Router CE2, you must either configure the `vrf-table-label` statement on Router PE1 or configure a static route on Router PE1 to the VPN interface of Router CE1. If you configure the `vrf-table-label` statement to ping a router, you cannot configure a static route.

If you configure a static route on Router PE1 to the VPN interface of Router CE1, its next hop must point to Router CE1 (at the `[edit routing-instance routing-instance-name]` hierarchy level), and this route must be announced from Router PE1 to Router PE2 as shown in the following configuration:

```
[edit]
routing-instances {
  direct-multipoint {
    instance-type vrf;
    interface fe-1/1/0.0;
    route-distinguisher 69:1;
    vrf-import direct-import;
    vrf-export direct-export;
    routing-options {
      static {
        route 192.168.192.4/32 next-hop 192.168.192.4;
      }
    }
  }
  protocols {
    bgp {
      group to-vpn4 {
        peer-as 1;
        neighbor 192.168.192.4;
      }
    }
  }
}
```

```

policy-options {
  policy-statement direct-export {
    term a {
      from protocol bgp;
      then {
        community add direct-comm;
        accept;
      }
    }
    term b {
      from {
        protocol static;
        route-filter 192.168.192.4/32 exact;
      }
      then {
        community add direct-comm;
        accept;
      }
    }
    term d {
      then reject;
    }
  }
}

```

Now you can ping Router CE1 from Router CE2:

```

user@vpn5> ping 192.168.192.4 local 10.255.10.5 count 3
PING 192.168.192.4 (192.168.192.4): 56 data bytes
64 bytes from 192.168.192.4: icmp_seq=0 ttl=253 time=1.092 ms
64 bytes from 192.168.192.4: icmp_seq=1 ttl=253 time=1.019 ms
64 bytes from 192.168.192.4: icmp_seq=2 ttl=253 time=1.031 ms

--- 192.168.192.4 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 1.019/1.047/1.092/0.032 ms

```

To determine the path between these two interfaces, use the `traceroute` command:

```

user@vpn5> traceroute 192.168.192.4 source 10.255.10.5
traceroute to 192.168.192.4 (192.168.192.4) from 10.255.10.5, 30 hops max, 40
byte packets
 1 vpn-08-t3003.isp-core.net (192.168.193.2) 0.678 ms 0.549 ms 0.494 ms
 2 vpn1-so-100.isp-core.net (192.168.192.100) 0.873 ms 0.847 ms 0.844 ms
   MPLS Label=100021 CoS=0 TTL=1 S=1
 3 vpn4-fe-112.isp-core.net (192.168.192.4) 0.825 ms 0.743 ms 0.764 ms

```

## **Pinging the Directly Connected PE Routers from the CE Routers**

From the loopback interfaces on the CE routers, you can ping the VPN interface on the directly connected PE router. Figure 20 on page 194 shows the topology referenced in the following examples:

- Pinging Router PE1 from the Loopback Interface on Router CE1 on page 200
- Using Traceroute from the Loopback Interface on Router CE1 to PE1 on page 200
- Pinging Router PE2 from the Loopback Interface on Router CE2 on page 200
- Using Traceroute from the Loopback Interface on Router CE2 to PE2 on page 201

### **Pinging Router PE1 from the Loopback Interface on Router CE1**

From the loopback interface on Router CE1 (VPN4), ping the VPN interface, fe-1/1/0.0, on Router PE1:

```
user@vpn4> ping 192.168.192.1 local 10.255.10.4 count 3
PING 192.168.192.1 (192.168.192.1): 56 data bytes
64 bytes from 192.168.192.1: icmp_seq=0 ttl=255 time=0.885 ms
64 bytes from 192.168.192.1: icmp_seq=1 ttl=255 time=0.757 ms
64 bytes from 192.168.192.1: icmp_seq=2 ttl=255 time=0.734 ms

--- 192.168.192.1 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.734/0.792/0.885/0.066 ms
```

### **Using Traceroute from the Loopback Interface on Router CE1 to PE1**

To determine the path from the loopback interface on Router CE1 to the VPN interfaces on Router PE1, use the `traceroute` command:

```
user@vpn4> traceroute 192.168.192.1 source 10.255.10.4
traceroute to 192.168.192.1 (192.168.192.1) from 10.255.10.4, 30 hops max, 40
byte packets
 1  vpn1-fe-110.isp-core.net (192.168.192.1)  0.828 ms  0.657 ms  1.972 ms
```

### **Pinging Router PE2 from the Loopback Interface on Router CE2**

From the loopback interface on Router CE2 (VPN5), ping the VPN interface, t3-0/0/3.0, on Router PE2:

```
user@vpn5> ping 192.168.193.2 local 10.255.10.5 count 3
PING 192.168.193.2 (192.168.193.2): 56 data bytes
64 bytes from 192.168.193.2: icmp_seq=0 ttl=255 time=0.998 ms
64 bytes from 192.168.193.2: icmp_seq=1 ttl=255 time=0.834 ms
64 bytes from 192.168.193.2: icmp_seq=2 ttl=255 time=0.819 ms

--- 192.168.193.2 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.819/0.884/0.998/0.081 ms
```

### Using Traceroute from the Loopback Interface on Router CE2 to PE2

To determine the path from the loopback interface on Router CE2 to the VPN interfaces on Router PE2, use the `traceroute` command:

```
user@vpn5> traceroute 192.168.193.2 source 10.255.10.5
traceroute to 192.168.193.2 (192.168.193.2) from 10.255.10.5, 30 hops max, 40
byte packets
 1  vpn-08-t3003.isp-core.net (192.168.193.2)  0.852 ms  0.670 ms  0.656 ms
```

### Pinging the Directly Connected CE Routers from the PE Routers

From the VPN and loopback interfaces on the PE routers, you can ping the VPN interface on the directly connected CE router. Figure 20 on page 194 shows the topology referenced in the following examples:

- Pinging the VPN Interface on Router CE1 from Router PE1 on page 201
- Pinging the Loopback Interface on Router CE1 from Router PE1 on page 202
- Using Traceroute from Router PE1 to Router CE1 on page 202
- Pinging the VPN Interface on Router CE2 from Router PE2 on page 202
- Pinging the Loopback Interface on Router CE2 from Router PE2 on page 202
- Using Traceroute from Router PE2 to Router CE2 on page 203

### Pinging the VPN Interface on Router CE1 from Router PE1

From the VPN interface on the PE router, you can ping the VPN or loopback interface on the directly connected CE router.

From the VPN interface on Router PE1 (VPN1), ping the VPN interface, `fe-1/1/0.0`, on Router CE1:

```
user@vpn1> ping 192.168.192.4 interface fe-1/1/0.0 local 192.168.192.1 count 3
PING 192.168.192.4 (192.168.192.4): 56 data bytes
64 bytes from 192.168.192.4: icmp_seq=0 ttl=255 time=0.866 ms
64 bytes from 192.168.192.4: icmp_seq=1 ttl=255 time=0.728 ms
64 bytes from 192.168.192.4: icmp_seq=2 ttl=255 time=0.753 ms

--- 192.168.192.4 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.728/0.782/0.866/0.060 ms
```

### Pinging the Loopback Interface on Router CE1 from Router PE1

From the VPN interface on Router PE1 (VPN1), ping the loopback interface, 10.255.10.4, on Router CE1:

```
user@vpn1> ping 10.255.10.4 interface fe-1/1/0.0 local 192.168.192.1 count 3
PING 10.255.10.4 (10.255.10.4): 56 data bytes
64 bytes from 10.255.10.4: icmp_seq=0 ttl=255 time=0.838 ms
64 bytes from 10.255.10.4: icmp_seq=1 ttl=255 time=0.760 ms
64 bytes from 10.255.10.4: icmp_seq=2 ttl=255 time=0.771 ms

--- 10.255.10.4 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.760/0.790/0.838/0.034 ms
```

### Using Traceroute from Router PE1 to Router CE1

To determine the path from the VPN interface on Router PE1 to the VPN and loopback interfaces on Router CE1, respectively, use the following traceroute commands:

```
user@vpn1> traceroute 10.255.10.4 interface fe-1/1/0.0 source 192.168.192.1
traceroute to 10.255.10.4 (10.255.10.4) from 192.168.192.1, 30 hops max, 40 byte
packets
 1  vpn4.isp-core.net (10.255.10.4)  0.842 ms  0.659 ms  0.621 ms

user@vpn1> traceroute 192.168.192.4 interface fe-1/1/0.0 source 192.168.192.1
traceroute to 192.168.192.4 (192.168.192.4) from 192.168.192.1, 30 hops max, 40
byte packets
 1  vpn4-fe-112.isp-core.net (192.168.192.4)  0.810 ms  0.662 ms  0.640 ms
```

### Pinging the VPN Interface on Router CE2 from Router PE2

From the VPN interface on Router PE2 (VPN2), ping the VPN interface, t3-0/0/3.0, on Router CE2:

```
user@vpn2> ping 192.168.193.5 interface t3-0/0/3.0 local 192.168.193.2 count 3
PING 192.168.193.5 (192.168.193.5): 56 data bytes
64 bytes from 192.168.193.5: icmp_seq=0 ttl=255 time=0.852 ms
64 bytes from 192.168.193.5: icmp_seq=1 ttl=255 time=0.909 ms
64 bytes from 192.168.193.5: icmp_seq=2 ttl=255 time=0.793 ms

--- 192.168.193.5 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.793/0.851/0.909/0.047 ms
```

### Pinging the Loopback Interface on Router CE2 from Router PE2

From the VPN interface on Router PE2 (VPN2), ping the loopback interface, 10.255.10.5, on Router CE2:

```
user@vpn2> ping 10.255.10.5 interface t3-0/0/3.0 local 192.168.193.2 count 3
PING 10.255.10.5 (10.255.10.5): 56 data bytes
64 bytes from 10.255.10.5: icmp_seq=0 ttl=255 time=0.914 ms
64 bytes from 10.255.10.5: icmp_seq=1 ttl=255 time=0.888 ms
64 bytes from 10.255.10.5: icmp_seq=2 ttl=255 time=1.066 ms

--- 10.255.10.5 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.888/0.956/1.066/0.079 ms
```

## Using Traceroute from Router PE2 to Router CE2

To determine the path from the VPN interface on Router PE2 to the VPN and loopback interfaces on Router CE2, respectively, use the following `traceroute` commands:

```
user@vpn2> traceroute 10.255.10.5 interface t3-0/0/3.0 source 192.168.193.2
traceroute to 10.255.10.5 (10.255.10.5) from 192.168.193.2, 30 hops max, 40 byte
packets
 1  vpn5.isp-core.net (10.255.10.5)  1.009 ms  0.677 ms  0.633 ms
```

```
user@vpn2> traceroute 192.168.193.5 interface t3-0/0/3.0 source 192.168.193.2
traceroute to 192.168.193.5 (192.168.193.5) from 192.168.193.2, 30 hops max, 40
byte packets
 1  vpn5-t3-003.isp-core.net (192.168.193.5)  0.974 ms  0.665 ms  0.619 ms
```

## Pinging the Remote CE Router from the Local PE Router

The following procedure is effective for Layer 3 VPNs only. To ping a remote CE router from a local PE router in a Layer 3 VPN, you need to configure the following:

1. Configure a logical unit for the loopback interface.

To configure an additional logical unit on the loopback interface of the PE router, configure the unit statement at the `[edit interfaces lo0]` hierarchy level:

```
[edit interfaces]
lo0 {
  unit number {
    family inet {
      address address;
    }
  }
}
```

2. Configure the loopback interface for the Layer 3 VPN routing instance on the local PE router. You can associate one logical loopback interface with each Layer 3 VPN routing instance, enabling you to ping a specific routing instance on a router.

Specify the loopback interface you configured in Step 1 using the `interface` statement at the `[edit routing-instances routing-instance-name]` hierarchy level:

```
[edit routing-instances routing-instance-name]
interface interface-name;
```

The *interface-name* is the logical unit on the loopback interface (for example, `lo0.1`).

3. From the VPN interface on PE router, you can now ping the logical unit on the loopback interface on the remote CE router:

```
user@host> ping interface interface host
```

Use *interface* to specify the new logical unit on the loopback interface (for example, `lo0.1`). For more information on how to use the `ping interface` command, see the *JUNOS Interfaces Command Reference*.

### Limitation on Pinging a Remote CE Router from a PE Router

If you attempt to ping a remote CE router from a PE router, ICMP echo requests are sent from the PE router, with the PE router's VPN interface as the source. Other PE routers have a route back to that address with a VPN label. When the echo replies return, they include a label. The PE router pops the VPN label and sends the packet from the VPN interface to the local CE router. The local CE router sends it back to the PE router, its actual destination.

When a Juniper Networks routing platform receives a labeled packet, the label is popped (depending on the label operation specified), and the packet is forwarded to an interface, even if the packet is destined for that particular PE router. Labeled packets are not analyzed further for the IP information under the label.

If there is a problem with the connection to the local CE router, packets are sent out but do not return to the PE router, and the ping fails. If the connection between your PE router and local CE router is down, sending a ping to the remote CE router fails even though the connection to the remote CE router might be functional.

### Pinging a Layer 3 VPN

You can ping from a PE router to a PE router in a Layer 3 VPN using the `ping mpls l3vpn l3vpn-name prefix prefix <count count>` command. For more information, see “Pinging VPNs and Layer 2 Circuits” on page 35.

For a detailed description of the `ping mpls` command, see the *JUNOS Routing Protocols and Policies Command Reference*.

### Disabling Normal TTL Decrementing for Layer 3 VPNs

For information on how to disable normal TTL decrementing for Layer 3 VPNs, see “Disabling Normal TTL Decrementing for VPNs” on page 78.

### Troubleshooting RSVP and LDP LSPs

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You can use the `show mpls lsp` command to determine whether an LSP is up and running. However, this command displays information on RSVP LSPs only. If you have configured LDP LSPs, use the `show route protocol ldp` command. For more information on how to use show commands to troubleshoot RSVP LSPs, see the *JUNOS MPLS Network Operations Guide*.

## Troubleshooting Inconsistently Advertised Routes from Gigabit Ethernet Interfaces

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For direct routes on a LAN in a VRF, the JUNOS software attempts to locate a CE that can be designated as the next hop. If this cannot be done, advertised routes from Gigabit Ethernet interfaces are dropped.

In such instances, do one of the following:

- Use the `static` statement at the `[edit routing-options]` or `[edit logical-routers logical-router-name routing-options]` hierarchy levels in the VRF routing instance to a CE router on the LAN subnet, configuring the CE as the next hop. All traffic to directly destinations on this LAN will go to the CE. You can add two static routes to two CEs on the LAN for redundancy.
- Configure the `vrf-table-label` statement at the `[edit routing-instances routing-instance-name ]` hierarchy levels to map the inner label of a packet to a specific VRF routing table. This allows the examination of the encapsulated IP header to force IP lookups on the VRF routing instance for all traffic.



**NOTE:** The `vrf-table-label` statement is not available for every core-facing interface; for example, nonchannelized interfaces and virtual LANs (VLANs) are not supported. See “Support for Ethernet, SONET/SDH, and T1/T3/E3 Interfaces” on page 166 for information about support for the `vrf-table-label` statement over Ethernet and SONET/SDH interfaces.

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