JUNIPER NETWORKS

Network Configuration Example

Configuring External BGP Peering

Release
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Introduction

This document provides an overview of BGP peering and a sample topology of two autonomous systems (ASs) with a BGP peering session. It also includes two examples. The first example shows how to create an external BGP point-to-point peer session between two ASs. The second example shows how to configure external BGP point-to-point peer sessions on logical systems with IPv6 interfaces.

Advantages of Using External BGP Peer Groups

BGP is the only routing protocol in use today that is suited to carry all of the routes in the Internet. This is largely because BGP runs on top of TCP and can make use of TCP flow control. In contrast, the internal gateway protocols (IGPs) do not have flow control. When IGPs have too much route information, they begin to churn. When BGP has a neighboring speaker that is sending information too quickly, BGP can throttle down the neighbor by delaying TCP acknowledgements.

Another benefit of BGP is that (like IS-IS) it uses type, length, value (TLV) tuples and network layer reachability information (NLRI) that provide seemingly endless extensibility without the need for the underlying protocol to be altered.

In the Junos® operating system (Junos OS), BGP is completely policy driven. The operator must explicity configure neighbors to peer with and explicity accept routes into BGP. Further, routing policy is used to filter and modify routing information. Thus, routing policies provide complete administrative control over the routing tables.

The preferred way to configure a large number of BGP peer neighbors is to configure peer groups consisting of multiple neighbors per group.

As the number of external BGP (EBGP) groups increases, the ability to support a large number of BGP sessions might become a CPU and memory resource scaling issue. Supporting fewer EBGP groups generally scales better than supporting a large number of EBGP groups. This becomes more evident in the case of hundreds of EBGP groups when compared with a few EBGP groups with multiple peers in each group. The reason for this scaling behavior is that Junos OS has data structures that occur on a per route-per group basis. When you add a group, you multiply those numbers and decrease the amount of memory available.

BGP peering creates mutually beneficial traffic exchange relationships between two independent autonomous systems (ASs). It is especially useful at service provider exchange points. This relationship has the primary benefit of reducing transit costs and equipment resources for both networks. Other potential benefits of creating BGP peer groups include reducing the complexity of the BGP configuration and increasing route redundancy by reducing the dependence on transit providers.

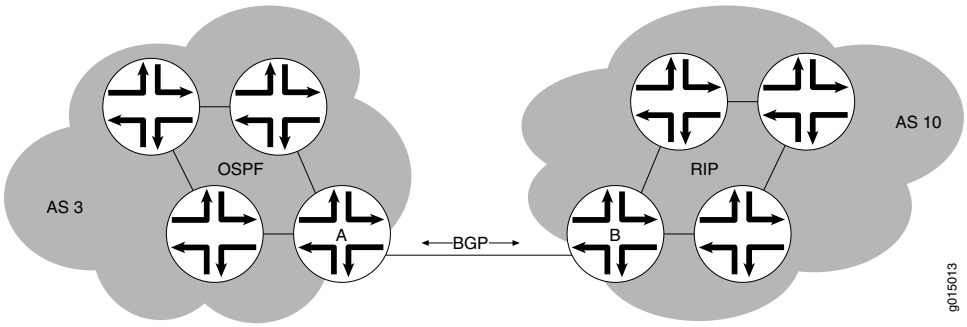
BGP peering can be used to create point-to-point traffic exchanges between two remote networks, such as a remote office and the company headquarters. It can also be used to quickly connect two disparate networks, such as between two merged offices.

Related Documentation

Understanding External BGP Peering Sessions

To establish point-to-point connections between peer autonomous systems (ASs), you configure a BGP session on each interface of a point-to-point link. Generally, such sessions are made at network exit points with neighboring hosts outside the AS. Figure 1 on page 2 shows an example of a BGP peering session.

Figure 1: BGP Peering Session



In Figure 1 on page 2, Router A is a gateway router for AS 3, and Router B is a gateway router for AS 10. For traffic internal to either AS, an interior gateway protocol (IGP) is used (OSPF, for instance). To route traffic between peer ASs, a BGP session is used.

You arrange BGP routing devices into groups of peers. Different peer groups can have different group types, AS numbers, and route reflector cluster identifiers.

To define a BGP group that recognizes only the specified BGP systems as peers, statically configure all the system's peers by including one or more **neighbor** statements. The peer neighbor's address can be either an IPv6 or IPv4 address.

As the number of external BGP (EBGP) groups increases, the ability to support a large number of BGP sessions might become a scaling issue. The preferred way to configure a large number of BGP neighbors is to configure a few groups consisting of multiple neighbors per group. Supporting fewer EBGP groups generally scales better than supporting a large number of EBGP groups. This becomes more evident in the case of hundreds of EBGP groups when compared with a few EBGP groups with multiple peers in each group.

After the BGP peers are established, BGP routes are not automatically advertised by the BGP peers. At each BGP-enabled device, policy configuration is required to export the local, static, or IGP-learned routes into the BGP RIB and then advertise them as BGP routes to the other peers. BGP's advertisement policy, by default, does not advertise any non-BGP routes (such as local routes) to peers.

Related Documentation

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding BGP
- Example: Configuring External BGP Point-to-Point Peer Sessions on page 3
- Example: Configuring Internal BGP Peer Sessions

Example: Configuring External BGP Point-to-Point Peer Sessions

This example shows how to configure BGP point-to-point peer sessions.

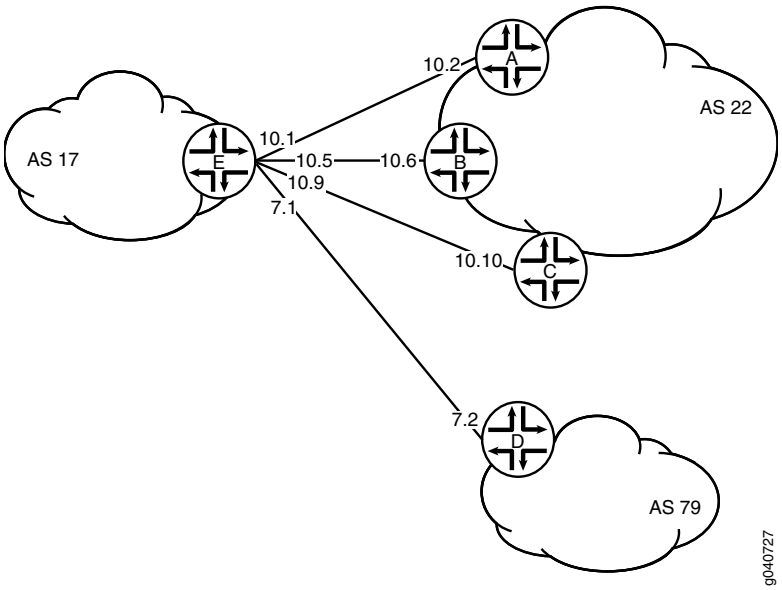
Requirements

Before you begin, if the default BGP policy is not adequate for your network, configure routing policies to filter incoming BGP routes and to advertise BGP routes.

Overview

Figure 2 on page 3 shows a network with BGP peer sessions. In the sample network, Device E in AS 17 has BGP peer sessions to a group of peers called **external-peers**. Peers A, B, and C reside in AS 22 and have IP addresses 10.10.10.2, 10.10.10.6, and 10.10.10.10. Peer D resides in AS 79, at IP address 10.21.7.2. This example shows the configuration on Device E.

Figure 2: Typical Network with BGP Peer Sessions



Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set interfaces ge-1/2/0 unit 0 description to-A
set interfaces ge-1/2/0 unit 0 family inet address 10.10.10.1/30
set interfaces ge-0/0/1 unit 5 description to-B
set interfaces ge-0/0/1 unit 5 family inet address 10.10.10.5/30
set interfaces ge-0/1/0 unit 9 description to-C
set interfaces ge-0/1/0 unit 9 family inet address 10.10.10.9/30
set interfaces ge-1/2/1 unit 21 description to-D
set interfaces ge-1/2/1 unit 21 family inet address 10.21.7.1/30
set protocols bgp group external-peers type external
set protocols bgp group external-peers peer-as 22
set protocols bgp group external-peers neighbor 10.10.10.2
set protocols bgp group external-peers neighbor 10.10.10.6
set protocols bgp group external-peers neighbor 10.10.10.10
set protocols bgp group external-peers neighbor 10.21.7.2 peer-as 79
set routing-options autonomous-system 17
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see Using the CLI Editor in Configuration Mode in the CLI User Guide.

To configure the BGP peer sessions:

1. Configure the interfaces to Peers A, B, C, and D.

```
[edit interfaces]
user@E# set ge-1/2/0 unit 0 description to-A
user@E# set ge-1/2/0 unit 0 family inet address 10.10.10.1/30
user@E# set ge-0/0/1 unit 5 description to-B
user@E# set ge-0/0/1 unit 5 family inet address 10.10.10.5/30
user@E# set ge-0/1/0 unit 9 description to-C
user@E# set ge-0/1/0 unit 9 family inet address 10.10.10.9/30
user@E# set ge-1/2/1 unit 21 description to-D
user@E# set ge-1/2/1 unit 21 family inet address 10.21.7.1/30
```

2. Set the autonomous system (AS) number.

```
[edit routing-options]
user@E# set autonomous-system 17
```

3. Create the BGP group, and add the external neighbor addresses.

```
[edit protocols bgp group external-peers]
user@E# set neighbor 10.10.10.2
user@E# set neighbor 10.10.10.6
user@E# set neighbor 10.10.10.10
```

4. Specify the autonomous system (AS) number of the external AS.

```
[edit protocols bgp group external-peers]
user@E# set peer-as 22
```

5. Add Peer D, and set the AS number at the individual neighbor level.

   The neighbor configuration overrides the group configuration. So, while **peer-as 22** is set for all the other neighbors in the group, **peer-as 79** is set for neighbor 10.21.7.2.

   ```
   [edit protocols bgp group external-peers]
   user@E# set neighbor 10.21.7.2 peer-as 79
   ```

6. Set the peer type to external BGP (EBGP).

   ```
   [edit protocols bgp group external-peers]
   user@E# set type external
   ```

Results From configuration mode, confirm your configuration by entering the **show interfaces**, **show protocols**, and **show routing-options** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
[edit]
user@E# show interfaces
ge-1/2/0 {
  unit 0 {
    description to-A;
    family inet {
      address 10.10.10.1/30;
    }
  }
}
ge-0/0/1 {
  unit 5 {
    description to-B;
    family inet {
      address 10.10.10.5/30;
    }
  }
}
ge-0/1/0 {
  unit 9 {
    description to-C;
    family inet {
      address 10.10.10.9/30;
    }
  }
}
ge-1/2/1 {
  unit 21 {
    description to-D;
    family inet {
      address 10.21.7.1/30;
    }
  }
}
```

```
[edit]
user@E# show protocols
bgp {
  group external-peers {
    type external;
```

```
    peer-as 22;
    neighbor 10.10.10.2;
    neighbor 10.10.10.6;
    neighbor 10.10.10.10;
    neighbor 10.21.7.2 {
      peer-as 79;
    }
  }
}
```

```
[edit]
user@E# show routing-options
autonomous-system 17;
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

- Verifying BGP Neighbors on page 6
- Verifying BGP Groups on page 9
- Verifying BGP Summary Information on page 9

Verifying BGP Neighbors

Purpose Verify that BGP is running on configured interfaces and that the BGP session is active for each neighbor address.

Action From operational mode, run the **show bgp neighbor** command.

```
user@E> show bgp neighbor
Peer: 10.10.10.2+179 AS 22     Local: 10.10.10.1+65406 AS 17
  Type: External    State: Established    Flags: <Sync>
  Last State: OpenConfirm   Last Event: RecvKeepAlive
  Last Error: None
  Options: <Preference PeerAS Refresh>
  Holdtime: 90 Preference: 170
  Number of flaps: 0
  Peer ID: 10.10.10.2       Local ID: 10.10.10.1       Active Holdtime: 90
  Keepalive Interval: 30         Peer index: 0
  BFD: disabled, down
  Local Interface: ge-1/2/0.0
  NLRI for restart configured on peer: inet-unicast
  NLRI advertised by peer: inet-unicast
  NLRI for this session: inet-unicast
  Peer supports Refresh capability (2)
  Restart time configured on the peer: 120
  Stale routes from peer are kept for: 300
  Restart time requested by this peer: 120
  NLRI that peer supports restart for: inet-unicast
  NLRI that restart is negotiated for: inet-unicast
  NLRI of received end-of-rib markers: inet-unicast
  NLRI of all end-of-rib markers sent: inet-unicast
  Peer supports 4 byte AS extension (peer-as 22)
  Peer does not support Addpath
  Table inet.0 Bit: 10000
```

```
    RIB State: BGP restart is complete
    Send state: in sync
    Active prefixes:              0
    Received prefixes:            0
    Accepted prefixes:            0
    Suppressed due to damping:    0
    Advertised prefixes:          0
  Last traffic (seconds): Received 10   Sent 6    Checked 1
  Input messages:  Total 8522   Updates 1       Refreshes 0     Octets 161922
  Output messages: Total 8433   Updates 0       Refreshes 0     Octets 160290
  Output Queue[0]: 0

Peer: 10.10.10.6+54781 AS 22   Local: 10.10.10.5+179 AS 17
  Type: External    State: Established    Flags: <Sync>
  Last State: OpenConfirm   Last Event: RecvKeepAlive
  Last Error: None
  Options: <Preference PeerAS Refresh>
  Holdtime: 90 Preference: 170
  Number of flaps: 0
  Peer ID: 10.10.10.6       Local ID: 10.10.10.1       Active Holdtime: 90
  Keepalive Interval: 30         Peer index: 1
  BFD: disabled, down
  Local Interface: ge-0/0/1.5
  NLRI for restart configured on peer: inet-unicast
  NLRI advertised by peer: inet-unicast
  NLRI for this session: inet-unicast
  Peer supports Refresh capability (2)
  Restart time configured on the peer: 120
  Stale routes from peer are kept for: 300
  Restart time requested by this peer: 120
  NLRI that peer supports restart for: inet-unicast
  NLRI that restart is negotiated for: inet-unicast
  NLRI of received end-of-rib markers: inet-unicast
  NLRI of all end-of-rib markers sent: inet-unicast
  Peer supports 4 byte AS extension (peer-as 22)
  Peer does not support Addpath
  Table inet.0 Bit: 10000
    RIB State: BGP restart is complete
    Send state: in sync
    Active prefixes:              0
    Received prefixes:            0
    Accepted prefixes:            0
    Suppressed due to damping:    0
    Advertised prefixes:          0
  Last traffic (seconds): Received 12   Sent 6    Checked 33
  Input messages:  Total 8527   Updates 1       Refreshes 0     Octets 162057
  Output messages: Total 8430   Updates 0       Refreshes 0     Octets 160233
  Output Queue[0]: 0

Peer: 10.10.10.10+55012 AS 22  Local: 10.10.10.9+179 AS 17
  Type: External    State: Established    Flags: <Sync>
  Last State: OpenConfirm   Last Event: RecvKeepAlive
  Last Error: None
  Options: <Preference PeerAS Refresh>
  Holdtime: 90 Preference: 170
  Number of flaps: 0
  Peer ID: 10.10.10.10      Local ID: 10.10.10.1       Active Holdtime: 90
  Keepalive Interval: 30         Peer index: 2
  BFD: disabled, down
  Local Interface: fe-0/1/0.9
  NLRI for restart configured on peer: inet-unicast
```

```
  NLRI advertised by peer: inet-unicast
  NLRI for this session: inet-unicast
  Peer supports Refresh capability (2)
  Restart time configured on the peer: 120
  Stale routes from peer are kept for: 300
  Restart time requested by this peer: 120
  NLRI that peer supports restart for: inet-unicast
  NLRI that restart is negotiated for: inet-unicast
  NLRI of received end-of-rib markers: inet-unicast
  NLRI of all end-of-rib markers sent: inet-unicast
  Peer supports 4 byte AS extension (peer-as 22)
  Peer does not support Addpath
  Table inet.0 Bit: 10000
    RIB State: BGP restart is complete
    Send state: in sync
    Active prefixes:              0
    Received prefixes:            0
    Accepted prefixes:            0
    Suppressed due to damping:    0
    Advertised prefixes:          0
  Last traffic (seconds): Received 15   Sent 6    Checked 37
  Input messages:  Total 8527   Updates 1       Refreshes 0     Octets 162057
  Output messages: Total 8429   Updates 0       Refreshes 0     Octets 160214
  Output Queue[0]: 0

Peer: 10.21.7.2+61867 AS 79    Local: 10.21.7.1+179 AS 17
  Type: External    State: Established    Flags: <ImportEval Sync>
  Last State: OpenConfirm   Last Event: RecvKeepAlive
  Last Error: None
  Options: <Preference PeerAS Refresh>
  Holdtime: 90 Preference: 170
  Number of flaps: 0
  Peer ID: 10.21.7.2        Local ID: 10.10.10.1       Active Holdtime: 90
  Keepalive Interval: 30         Peer index: 3
  BFD: disabled, down
  Local Interface: ge-1/2/1.21
  NLRI for restart configured on peer: inet-unicast
  NLRI advertised by peer: inet-unicast
  NLRI for this session: inet-unicast
  Peer supports Refresh capability (2)
  Restart time configured on the peer: 120
  Stale routes from peer are kept for: 300
  Restart time requested by this peer: 120
  NLRI that peer supports restart for: inet-unicast
  NLRI that restart is negotiated for: inet-unicast
  NLRI of received end-of-rib markers: inet-unicast
  NLRI of all end-of-rib markers sent: inet-unicast
  Peer supports 4 byte AS extension (peer-as 79)
  Peer does not support Addpath
  Table inet.0 Bit: 10000
    RIB State: BGP restart is complete
    Send state: in sync
    Active prefixes:              0
    Received prefixes:            0
    Accepted prefixes:            0
    Suppressed due to damping:    0
    Advertised prefixes:          0
  Last traffic (seconds): Received 28   Sent 24   Checked 47
  Input messages:  Total 8521   Updates 1       Refreshes 0     Octets 161943
  Output messages: Total 8427   Updates 0       Refreshes 0     Octets 160176
  Output Queue[0]: 0
```

Verifying BGP Groups

Purpose Verify that the BGP groups are configured correctly.

Action From operational mode, run the **show bgp group** command.

```
user@E> show bgp group
Group Type: External                              Local AS: 17
  Name: external-peers  Index: 0                  Flags: <>
  Holdtime: 0
  Total peers: 4        Established: 4
  10.10.10.2+179
  10.10.10.6+54781
  10.10.10.10+55012
  10.21.7.2+61867
  inet.0: 0/0/0/0

Groups: 1  Peers: 4    External: 4    Internal: 0    Down peers: 0   Flaps: 0
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0                 0          0          0          0          0          0
```

Verifying BGP Summary Information

Purpose Verify that the BGP configuration is correct.

Action From operational mode, run the **show bgp summary** command.

```
user@E> show bgp summary
Groups: 1 Peers: 4 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/Dwn
State|#Active/Received/Accepted/Damped...
10.10.10.2               22       8559       8470       0       0 2d 16:12:56
0/0/0/0              0/0/0/0
10.10.10.6               22       8566       8468       0       0 2d 16:12:12
0/0/0/0              0/0/0/0
10.10.10.10              22       8565       8466       0       0 2d 16:11:31
0/0/0/0              0/0/0/0
10.21.7.2                79       8560       8465       0       0 2d 16:10:58
0/0/0/0              0/0/0/0
```

Related Documentation

- Routing Policy Configuration Guide
- Understanding External BGP Peering Sessions on page 2
- Example: Configuring Internal BGP Peer Sessions
- BGP Configuration Overview

Example: Configuring External BGP on Logical Systems with IPv6 Interfaces

This example shows how to configure external BGP (EBGP) point-to-point peer sessions on logical systems with IPv6 interfaces.

Requirements

In this example, no special configuration beyond device initialization is required.

Overview

Junos OS supports EBGP peer sessions by means of IPv6 addresses. An IPv6 peer session can be configured when an IPv6 address is specified in the **neighbor** statement. This example uses EUI-64 to generate IPv6 addresses that are automatically applied to the interfaces. An EUI-64 address is an IPv6 address that uses the IEEE EUI-64 format for the interface identifier portion of the address (the last 64 bits).

NOTE: Alternatively, you can configure EBGP sessions using manually assigned 128-bit IPv6 addresses.

If you use 128-bit link-local addresses for the interfaces, you must include the **local-interface** statement. This statement is valid only for 128-bit IPv6 link-local addresses and is mandatory for configuring an IPv6 EBGP link-local peer session.

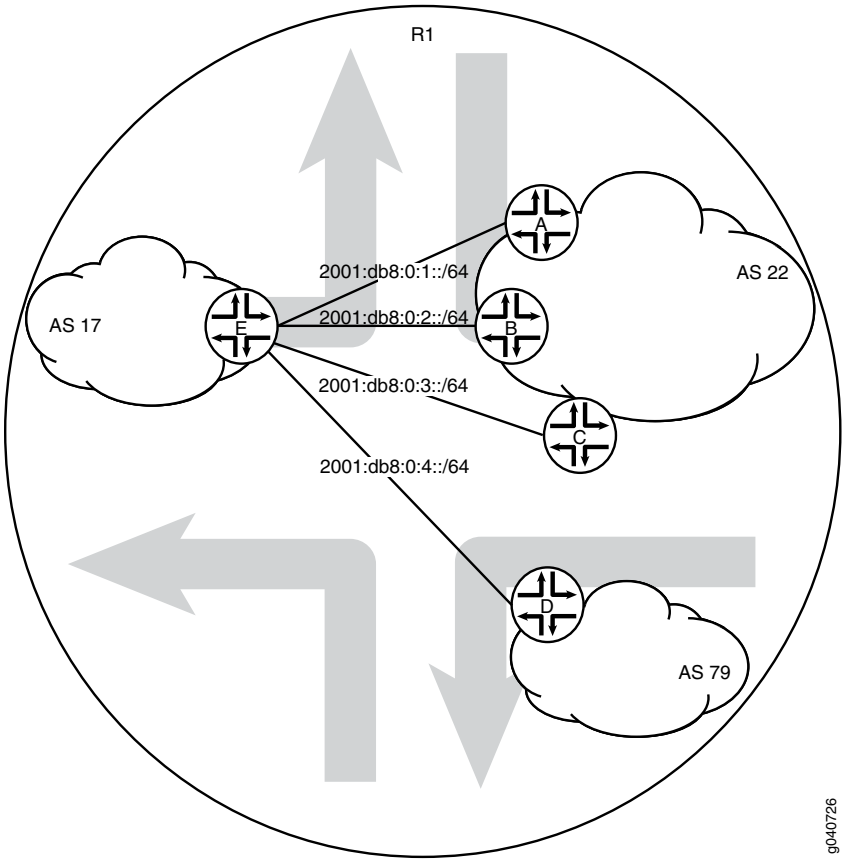
Configuring EBGP peering using link-local addresses is only applicable for directly connected interfaces. There is no support for multihop peering.

After your interfaces are up, you can use the **show interfaces terse** command to view the EUI-64-generated IPv6 addresses on the interfaces. You must use these generated addresses in the BGP **neighbor** statements. This example demonstrates the full end-to-end procedure.

In this example, Frame Relay interface encapsulation is applied to the logical tunnel (**lt**) interfaces. This is a requirement because only Frame Relay encapsulation is supported when IPv6 addresses are configured on the **lt** interfaces.

Figure 3 on page 11 shows a network with BGP peer sessions. In the sample network, Router R1 has five logical systems configured. Device E in autonomous system (AS) 17 has BGP peer sessions to a group of peers called **external-peers**. Peers A, B, and C reside in AS 22. This example shows the step-by-step configuration on Logical System A and Logical System E.

Figure 3: Typical Network with BGP Peer Sessions



Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

Device A

```
set logical-systems A interfaces lt-0/1/0 unit 1 description to-E
set logical-systems A interfaces lt-0/1/0 unit 1 encapsulation frame-relay
set logical-systems A interfaces lt-0/1/0 unit 1 dlci 1
set logical-systems A interfaces lt-0/1/0 unit 1 peer-unit 25
set logical-systems A interfaces lt-0/1/0 unit 1 family inet6 address 2001:db8:0:1::/64
  eui-64
set logical-systems A interfaces lo0 unit 1 family inet6 address 2001:db8::1/128
set logical-systems A protocols bgp group external-peers type external
set logical-systems A protocols bgp group external-peers peer-as 17
set logical-systems A protocols bgp group external-peers neighbor
  2001:db8:0:1:2a0:a502:0:19da
set logical-systems A routing-options router-id 1.1.1.1
set logical-systems A routing-options autonomous-system 22
```

Device B

```
set logical-systems B interfaces lt-0/1/0 unit 6 description to-E
set logical-systems B interfaces lt-0/1/0 unit 6 encapsulation frame-relay
set logical-systems B interfaces lt-0/1/0 unit 6 dlci 6
```

```
set logical-systems B interfaces lt-0/1/0 unit 6 peer-unit 5
set logical-systems B interfaces lt-0/1/0 unit 6 family inet6 address 2001:db8:0:2::/64
  eui-64
set logical-systems B interfaces lo0 unit 2 family inet6 address 2001:db8::2/128
set logical-systems B protocols bgp group external-peers type external
set logical-systems B protocols bgp group external-peers peer-as 17
set logical-systems B protocols bgp group external-peers neighbor
  2001:db8:0:2:2a0:a502:0:5da
set logical-systems B routing-options router-id 2.2.2.2
set logical-systems B routing-options autonomous-system 22
```

Device C

```
set logical-systems C interfaces lt-0/1/0 unit 10 description to-E
set logical-systems C interfaces lt-0/1/0 unit 10 encapsulation frame-relay
set logical-systems C interfaces lt-0/1/0 unit 10 dlci 10
set logical-systems C interfaces lt-0/1/0 unit 10 peer-unit 9
set logical-systems C interfaces lt-0/1/0 unit 10 family inet6 address 2001:db8:0:3::/64
  eui-64
set logical-systems C interfaces lo0 unit 3 family inet6 address 2001:db8::3/128
set logical-systems C protocols bgp group external-peers type external
set logical-systems C protocols bgp group external-peers peer-as 17
set logical-systems C protocols bgp group external-peers neighbor
  2001:db8:0:3:2a0:a502:0:9da
set logical-systems C routing-options router-id 3.3.3.3
set logical-systems C routing-options autonomous-system 22
```

Device D

```
set logical-systems D interfaces lt-0/1/0 unit 7 description to-E
set logical-systems D interfaces lt-0/1/0 unit 7 encapsulation frame-relay
set logical-systems D interfaces lt-0/1/0 unit 7 dlci 7
set logical-systems D interfaces lt-0/1/0 unit 7 peer-unit 21
set logical-systems D interfaces lt-0/1/0 unit 7 family inet6 address 2001:db8:0:4::/64
  eui-64
set logical-systems D interfaces lo0 unit 4 family inet6 address 2001:db8::4/128
set logical-systems D protocols bgp group external-peers type external
set logical-systems D protocols bgp group external-peers peer-as 17
set logical-systems D protocols bgp group external-peers neighbor
  2001:db8:0:4:2a0:a502:0:15da
set logical-systems D routing-options router-id 4.4.4.4
set logical-systems D routing-options autonomous-system 79
```

Device E

```
set logical-systems E interfaces lt-0/1/0 unit 5 description to-B
set logical-systems E interfaces lt-0/1/0 unit 5 encapsulation frame-relay
set logical-systems E interfaces lt-0/1/0 unit 5 dlci 6
set logical-systems E interfaces lt-0/1/0 unit 5 peer-unit 6
set logical-systems E interfaces lt-0/1/0 unit 5 family inet6 address 2001:db8:0:2::/64
  eui-64
set logical-systems E interfaces lt-0/1/0 unit 9 description to-C
set logical-systems E interfaces lt-0/1/0 unit 9 encapsulation frame-relay
set logical-systems E interfaces lt-0/1/0 unit 9 dlci 10
set logical-systems E interfaces lt-0/1/0 unit 9 peer-unit 10
set logical-systems E interfaces lt-0/1/0 unit 9 family inet6 address 2001:db8:0:3::/64
  eui-64
set logical-systems E interfaces lt-0/1/0 unit 21 description to-D
set logical-systems E interfaces lt-0/1/0 unit 21 encapsulation frame-relay
set logical-systems E interfaces lt-0/1/0 unit 21 dlci 7
set logical-systems E interfaces lt-0/1/0 unit 21 peer-unit 7
```

```
set logical-systems E interfaces lt-0/1/0 unit 21 family inet6 address 2001:db8:0:4::/64
  eui-64
set logical-systems E interfaces lt-0/1/0 unit 25 description to-A
set logical-systems E interfaces lt-0/1/0 unit 25 encapsulation frame-relay
set logical-systems E interfaces lt-0/1/0 unit 25 dlci 1
set logical-systems E interfaces lt-0/1/0 unit 25 peer-unit 1
set logical-systems E interfaces lt-0/1/0 unit 25 family inet6 address 2001:db8:0:1::/64
  eui-64
set logical-systems E interfaces lo0 unit 5 family inet6 address 2001:db8::5/128
set logical-systems E protocols bgp group external-peers type external
set logical-systems E protocols bgp group external-peers peer-as 22
set logical-systems E protocols bgp group external-peers neighbor
  2001:db8:0:1:2a0:a502:0:1da
set logical-systems E protocols bgp group external-peers neighbor
  2001:db8:0:2:2a0:a502:0:6da
set logical-systems E protocols bgp group external-peers neighbor
  2001:db8:0:3:2a0:a502:0:ada
set logical-systems E protocols bgp group external-peers neighbor
  2001:db8:0:4:2a0:a502:0:7da peer-as 79
set logical-systems E routing-options router-id 5.5.5.5
set logical-systems E routing-options autonomous-system 17
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see Using the CLI Editor in Configuration Mode in the CLI User Guide.

To configure the BGP peer sessions:

1. Run the **show interfaces terse** command to verify that the physical router has a logical tunnel (**lt**) interface.

```
user@R1> show interfaces terse
Interface               Admin Link Proto    Local                 Remote
...
lt-0/1/0                up    up
...
```

2. On Logical System A, configure the interface encapsulation, peer-unit number, and DLCI to reach Logical System E.

```
user@R1> set cli logical-system A
Logical system: A
[edit]
user@R1:A> edit
Entering configuration mode
[edit]
user@R1:A# edit interfaces
[edit interfaces]
user@R1:A# set lt-0/1/0 unit 1 encapsulation frame-relay
user@R1:A# set lt-0/1/0 unit 1 dlci 1
user@R1:A# set lt-0/1/0 unit 1 peer-unit 25
```

3. On Logical System A, configure the network address for the link to Peer E, and configure a loopback interface.

```
[edit interfaces]
user@R1:A# set lt-0/1/0 unit 1 description to-E
```

```
user@R1:A# set lt-0/1/0 unit 1 family inet6 address 2001:db8:0:1::/64 eui-64
user@R1:A# set lo0 unit 1 family inet6 address 2001:db8::1/128
```

4. On Logical System E, configure the interface encapsulation, peer-unit number, and DLCI to reach Logical System A.

```
user@R1> set cli logical-system E
Logical system: E
[edit]
user@R1:E> edit
Entering configuration mode
[edit]
user@R1:E# edit interfaces
[edit interfaces]
user@R1:E# set lt-0/1/0 unit 25 encapsulation frame-relay
user@R1:E# set lt-0/1/0 unit 25 dlci 1
user@R1:E# set lt-0/1/0 unit 25 peer-unit 1
```

5. On Logical System E, configure the network address for the link to Peer A, and configure a loopback interface.

```
[edit interfaces]
user@R1:E# set lt-0/1/0 unit 25 description to-A
user@R1:E# set lt-0/1/0 unit 25 family inet6 address 2001:db8:0:1::/64 eui-64
user@R1:E# set lo0 unit 5 family inet6 address 2001:db8::5/128
```

6. Run the **show interfaces terse** command to see the IPv6 addresses that are generated by EUI-64.

   The 2001 addresses are used in this example in the BGP **neighbor** statements.

NOTE: The fe80 addresses are link-local addresses and are not used in this example.

```
user@R1:A> show interfaces terse
Interface               Admin Link Proto    Local                 Remote
Logical system: A

betsy@tp8:A> show interfaces terse
Interface               Admin Link Proto    Local                 Remote
lt-0/1/0
lt-0/1/0.1              up    up   inet6    2001:db8:0:1:2a0:a502:0:1da/64
                                            fe80::2a0:a502:0:1da/64
lo0
lo0.1                   up    up   inet6    2001:db8::1
                                            fe80::2a0:a50f:fc56:1da

user@R1:E> show interfaces terse
Interface               Admin Link Proto    Local                 Remote
lt-0/1/0
lt-0/1/0.25             up    up   inet6    2001:db8:0:1:2a0:a502:0:19da/64

                                            fe80::2a0:a502:0:19da/64
lo0
```

```
lo0.5                  up    up   inet6    2001:db8::5
                                           fe80::2a0:a50f:fc56:1da
```

7. Repeat the interface configuration on the other logical systems.

Configuring the External BGP Sessions

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see Using the CLI Editor in Configuration Mode in the CLI User Guide.

To configure the BGP peer sessions:

1. On Logical System A, create the BGP group, and add the external neighbor address.

   ```
   [edit protocols bgp group external-peers]
   user@R1:A# set neighbor 2001:db8:0:1:2a0:a502:0:19da
   ```

2. On Logical System E, create the BGP group, and add the external neighbor address.

   ```
   [edit protocols bgp group external-peers]
   user@R1:E# set neighbor 2001:db8:0:1:2a0:a502:0:1da
   ```

3. On Logical System A, specify the autonomous system (AS) number of the external AS.

   ```
   [edit protocols bgp group external-peers]
   user@R1:A# set peer-as 17
   ```

4. On Logical System E, specify the autonomous system (AS) number of the external AS.

   ```
   [edit protocols bgp group external-peers]
   user@R1:E# set peer-as 22
   ```

5. On Logical System A, set the peer type to EBGP.

   ```
   [edit protocols bgp group external-peers]
   user@R1:A# set type external
   ```

6. On Logical System E, set the peer type to EBGP.

   ```
   [edit protocols bgp group external-peers]
   user@R1:E# set type external
   ```

7. On Logical System A, set the autonomous system (AS) number and router ID.

   ```
   [edit routing-options]
   user@R1:A# set router-id 1.1.1.1
   user@R1:A# set autonomous-system 22
   ```

8. On Logical System E, set the AS number and router ID.

   ```
   [edit routing-options]
   user@R1:E# set router-id 5.5.5.5
   user@R1:E# set autonomous-system 17
   ```

9. Repeat these steps for Peers A, B, C, and D.

Results From configuration mode, confirm your configuration by entering the **show logical-systems** command. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
[edit]
user@R1# show logical-systems
A {
  interfaces {
    lt-0/1/0 {
      unit 1 {
        description to-E;
        encapsulation frame-relay;
        dlci 1;
        peer-unit 25;
        family inet6 {
          address 2001:db8:0:1::/64 {
            eui-64;
          }
        }
      }
    }
    lo0 {
      unit 1 {
        family inet6 {
          address 2001:db8::1/128;
        }
      }
    }
  }
  protocols {
    bgp {
      group external-peers {
        type external;
        peer-as 17;
        neighbor 2001:db8:0:1:2a0:a502:0:19da;
      }
    }
    routing-options {
      router-id 1.1.1.1;
      autonomous-system 22;
    }
  }
  B {
    interfaces {
      lt-0/1/0 {
        unit 6 {
          description to-E;
          encapsulation frame-relay;
          dlci 6;
          peer-unit 5;
          family inet6 {
            address 2001:db8:0:2::/64 {
              eui-64;
            }
          }
```



```
    }
  }
  lo0 {
    unit 2 {
      family inet6 {
        address 2001:db8::2/128;
      }
    }
  }
}
protocols {
  bgp {
    group external-peers {
      type external;
      peer-as 17;
      neighbor 2001:db8:0:2:2a0:a502:0:5da;
    }
  }
  routing-options {
    router-id 2.2.2.2;
    autonomous-system 22;
  }
}
C {
  interfaces {
    lt-0/1/0 {
      unit 10 {
        description to-E;
        encapsulation frame-relay;
        dlci 10;
        peer-unit 9;
        family inet6 {
          address 2001:db8:0:3::/64 {
            eui-64;
          }
        }
      }
    }
    lo0 {
      unit 3 {
        family inet6 {
          address 2001:db8::3/128;
        }
      }
    }
  }
  protocols {
    bgp {
      group external-peers {
        type external;
        peer-as 17;
        neighbor 2001:db8:0:3:2a0:a502:0:9da;
      }
    }
  }
  routing-options {
```

```
    router-id 3.3.3.3;
    autonomous-system 22;
  }
}
D {
  interfaces {
    lt-0/1/0 {
      unit 7 {
        description to-E;
        encapsulation frame-relay;
        dlci 7;
        peer-unit 21;
        family inet6 {
          address 2001:db8:0:4::/64 {
            eui-64;
          }
        }
      }
    }
    lo0 {
      unit 4 {
        family inet6 {
          address 2001:db8::4/128;
        }
      }
    }
  }
  protocols {
    bgp {
      group external-peers {
        type external;
        peer-as 17;
        neighbor 2001:db8:0:4:2a0:a502:0:15da;
      }
    }
    routing-options {
      router-id 4.4.4.4;
      autonomous-system 79;
    }
  }
  E {
    interfaces {
      lt-0/1/0 {
        unit 5 {
          description to-B;
          encapsulation frame-relay;
          dlci 6;
          peer-unit 6;
          family inet6 {
            address 2001:db8:0:2::/64 {
              eui-64;
            }
          }
        }
        unit 9 {
          description to-C;
```

```
            encapsulation frame-relay;
            dlci 10;
            peer-unit 10;
            family inet6 {
              address 2001:db8:0:3::/64 {
                eui-64;
              }
            }
          }
          unit 21 {
            description to-D;
            encapsulation frame-relay;
            dlci 7;
            peer-unit 7;
            family inet6 {
              address 2001:db8:0:4::/64 {
                eui-64;
              }
            }
          }
          unit 25 {
            description to-A;
            encapsulation frame-relay;
            dlci 1;
            peer-unit 1;
            family inet6 {
              address 2001:db8:0:1::/64 {
                eui-64;
              }
            }
          }
        }
        lo0 {
          unit 5 {
            family inet6 {
              address 2001:db8::5/128;
            }
          }
        }
      }
      protocols {
        bgp {
          group external-peers {
            type external;
            peer-as 22;
            neighbor 2001:db8:0:1:2a0:a502:0:1da;
            neighbor 2001:db8:0:2:2a0:a502:0:6da;
            neighbor 2001:db8:0:3:2a0:a502:0:ada;
            neighbor 2001:db8:0:4:2a0:a502:0:7da {
              peer-as 79;
            }
          }
        }
      }
      routing-options {
        router-id 5.5.5.5;
```

```
        autonomous-system 17;
    }
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

Verifying BGP Neighbors

Purpose Verify that BGP is running on configured interfaces and that the BGP session is active for each neighbor address.

Action From operational mode, run the **show bgp neighbor** command.

```
user@R1:E> show bgp neighbor
Peer: 2001:db8:0:1:2a0:a502:0:1da+54987 AS 22 Local:
2001:db8:0:1:2a0:a502:0:19da+179 AS 17
  Type: External    State: Established    Flags: <Sync>
  Last State: OpenConfirm   Last Event: RecvKeepAlive
  Last Error: Open Message Error
  Options: <Preference PeerAS Refresh>
  Holdtime: 90 Preference: 170
  Number of flaps: 0
  Error: 'Open Message Error' Sent: 20 Recv: 0
  Peer ID: 1.1.1.1         Local ID: 5.5.5.5          Active Holdtime: 90
  Keepalive Interval: 30         Peer index: 0
  BFD: disabled, down
  Local Interface: lt-0/1/0.25
  NLRI for restart configured on peer: inet6-unicast
  NLRI advertised by peer: inet6-unicast
  NLRI for this session: inet6-unicast
  Peer supports Refresh capability (2)
  Stale routes from peer are kept for: 300
  Peer does not support Restarter functionality
  NLRI that restart is negotiated for: inet6-unicast
  NLRI of received end-of-rib markers: inet6-unicast
  NLRI of all end-of-rib markers sent: inet6-unicast
  Peer supports 4 byte AS extension (peer-as 22)
  Peer does not support Addpath
  Table inet6.0 Bit: 10000
    RIB State: BGP restart is complete
    Send state: in sync
    Active prefixes:              0
    Received prefixes:            0
    Accepted prefixes:            0
    Suppressed due to damping:    0
    Advertised prefixes:          0
  Last traffic (seconds): Received 7    Sent 18   Checked 81
  Input messages:  Total 1611   Updates 1       Refreshes 0     Octets 30660
```

```
  Output messages: Total 1594   Updates 0       Refreshes 0     Octets 30356
  Output Queue[0]: 0

Peer: 2001:db8:0:2:2a0:a502:0:6da+179 AS 22 Local:
2001:db8:0:2:2a0:a502:0:5da+55502 AS 17
  Type: External    State: Established    Flags: <Sync>
  Last State: OpenConfirm   Last Event: RecvKeepAlive
  Last Error: Open Message Error
  Options: <Preference PeerAS Refresh>
  Holdtime: 90 Preference: 170
  Number of flaps: 0
  Error: 'Open Message Error' Sent: 26 Recv: 0
  Peer ID: 2.2.2.2         Local ID: 5.5.5.5           Active Holdtime: 90
  Keepalive Interval: 30         Peer index: 2
  BFD: disabled, down
  Local Interface: lt-0/1/0.5
  NLRI for restart configured on peer: inet6-unicast
  NLRI advertised by peer: inet6-unicast
  NLRI for this session: inet6-unicast
  Peer supports Refresh capability (2)
  Stale routes from peer are kept for: 300
  Peer does not support Restarter functionality
  NLRI that restart is negotiated for: inet6-unicast
  NLRI of received end-of-rib markers: inet6-unicast
  NLRI of all end-of-rib markers sent: inet6-unicast
  Peer supports 4 byte AS extension (peer-as 22)
  Peer does not support Addpath
  Table inet6.0 Bit: 10000
    RIB State: BGP restart is complete
    Send state: in sync
    Active prefixes:              0
    Received prefixes:            0
    Accepted prefixes:            0
    Suppressed due to damping:    0
    Advertised prefixes:          0
  Last traffic (seconds): Received 15   Sent 8    Checked 8
  Input messages:  Total 1610   Updates 1       Refreshes 0     Octets 30601
  Output messages: Total 1645   Updates 0       Refreshes 0     Octets 32417
  Output Queue[0]: 0

Peer: 2001:db8:0:3:2a0:a502:0:ada+55983 AS 22 Local:
2001:db8:0:3:2a0:a502:0:9da+179 AS 17
  Type: External    State: Established    Flags: <Sync>
  Last State: OpenConfirm   Last Event: RecvKeepAlive
  Last Error: None
  Options: <Preference PeerAS Refresh>
  Holdtime: 90 Preference: 170
  Number of flaps: 0
  Peer ID: 3.3.3.3         Local ID: 5.5.5.5           Active Holdtime: 90
  Keepalive Interval: 30         Peer index: 3
  BFD: disabled, down
  Local Interface: lt-0/1/0.9
  NLRI for restart configured on peer: inet6-unicast
  NLRI advertised by peer: inet6-unicast
  NLRI for this session: inet6-unicast
  Peer supports Refresh capability (2)
  Stale routes from peer are kept for: 300
  Peer does not support Restarter functionality
  NLRI that restart is negotiated for: inet6-unicast
  NLRI of received end-of-rib markers: inet6-unicast
  NLRI of all end-of-rib markers sent: inet6-unicast
```

```
  Peer supports 4 byte AS extension (peer-as 22)
  Peer does not support Addpath
  Table inet6.0 Bit: 10000
    RIB State: BGP restart is complete
    Send state: in sync
    Active prefixes:              0
    Received prefixes:            0
    Accepted prefixes:            0
    Suppressed due to damping:    0
    Advertised prefixes:          0
  Last traffic (seconds): Received 21   Sent 21   Checked 67
  Input messages:  Total 1610   Updates 1       Refreshes 0     Octets 30641
  Output messages: Total 1587   Updates 0       Refreshes 0     Octets 30223
  Output Queue[0]: 0

Peer: 2001:db8:0:4:2a0:a502:0:7da+49255 AS 79 Local:
2001:db8:0:4:2a0:a502:0:15da+179 AS 17
  Type: External    State: Established    Flags: <Sync>
  Last State: OpenConfirm   Last Event: RecvKeepAlive
  Last Error: None
  Options: <Preference PeerAS Refresh>
  Holdtime: 90 Preference: 170
  Number of flaps: 0
  Peer ID: 4.4.4.4         Local ID: 5.5.5.5           Active Holdtime: 90
  Keepalive Interval: 30         Peer index: 1
  BFD: disabled, down
  Local Interface: lt-0/1/0.21
  NLRI for restart configured on peer: inet6-unicast
  NLRI advertised by peer: inet6-unicast
  NLRI for this session: inet6-unicast
  Peer supports Refresh capability (2)
  Stale routes from peer are kept for: 300
  Peer does not support Restarter functionality
  NLRI that restart is negotiated for: inet6-unicast
  NLRI of received end-of-rib markers: inet6-unicast
  NLRI of all end-of-rib markers sent: inet6-unicast
  Peer supports 4 byte AS extension (peer-as 79)
  Peer does not support Addpath
  Table inet6.0 Bit: 10000
    RIB State: BGP restart is complete
    Send state: in sync
    Active prefixes:              0
    Received prefixes:            0
    Accepted prefixes:            0
    Suppressed due to damping:    0
    Advertised prefixes:          0
  Last traffic (seconds): Received 6    Sent 17   Checked 25
  Input messages:  Total 1615   Updates 1       Refreshes 0     Octets 30736
  Output messages: Total 1593   Updates 0       Refreshes 0     Octets 30337
  Output Queue[0]: 0
```

Meaning IPv6 unicast network layer reachability information (NLRI) is being exchanged between the neighbors.

Verifying BGP Groups

Purpose Verify that the BGP groups are configured correctly.

Action From operational mode, run the **show bgp group** command.

```
user@R1:E> show bgp group
Group Type: External                              Local AS: 17
  Name: external-peers  Index: 0                  Flags: <>
  Holdtime: 0
  Total peers: 4        Established: 4
  2001:db8:0:1:2a0:a502:0:1da+54987
  2001:db8:0:2:2a0:a502:0:6da+179
  2001:db8:0:3:2a0:a502:0:ada+55983
  2001:db8:0:4:2a0:a502:0:7da+49255
  inet6.0: 0/0/0/0

Groups: 1  Peers: 4    External: 4    Internal: 0    Down peers: 0   Flaps: 0
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet6.0                0          0          0          0          0          0
inet6.2                0          0          0          0          0          0
```

Meaning The group type is external, and the group has four peers.

Verifying BGP Summary Information

Purpose Verify that the BGP that the peer relationships are established.

Action From operational mode, run the **show bgp summary** command.

```
user@R1:E> show bgp summary
Groups: 1 Peers: 4 Down peers: 0
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet6.0                0          0          0          0          0          0
inet6.2                0          0          0          0          0          0
Peer                     AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn
State|#Active/Received/Accepted/Damped...
2001:db8:0:1:2a0:a502:0:1da          22       1617       1600       0       0
 12:07:00 Establ
  inet6.0: 0/0/0/0
2001:db8:0:2:2a0:a502:0:6da          22       1616       1651       0       0
 12:06:56 Establ
  inet6.0: 0/0/0/0
2001:db8:0:3:2a0:a502:0:ada          22       1617       1594       0       0
 12:04:32 Establ
  inet6.0: 0/0/0/0
2001:db8:0:4:2a0:a502:0:7da          79       1621       1599       0       0
 12:07:00 Establ
  inet6.0: 0/0/0/0
```

Meaning The Down peers: 0 output shows that the BGP peers are in the established state.

Checking the Routing Table

Purpose Verify that the inet6.0 routing table is populated with local and direct routes.

Action From operational mode, run the **show route** command.

```
user@R1:E> show route
inet6.0: 15 destinations, 18 routes (15 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

2001:db8::5/128    *[Direct/0] 12:41:18
```

```
                    > via lo0.5
2001:db8:0:1::/64   *[Direct/0] 14:40:01
                    > via lt-0/1/0.25
2001:db8:0:1:2a0:a502:0:19da/128
                   *[Local/0] 14:40:01
                      Local via lt-0/1/0.25
2001:db8:0:2::/64   *[Direct/0] 14:40:02
                    > via lt-0/1/0.5
2001:db8:0:2:2a0:a502:0:5da/128
                   *[Local/0] 14:40:02
                      Local via lt-0/1/0.5
2001:db8:0:3::/64   *[Direct/0] 14:40:02
                    > via lt-0/1/0.9
2001:db8:0:3:2a0:a502:0:9da/128
                   *[Local/0] 14:40:02
                      Local via lt-0/1/0.9
2001:db8:0:4::/64   *[Direct/0] 14:40:01
                    > via lt-0/1/0.21
2001:db8:0:4:2a0:a502:0:15da/128
                   *[Local/0] 14:40:01
                      Local via lt-0/1/0.21
fe80::/64          *[Direct/0] 14:40:02
                    > via lt-0/1/0.5
                    [Direct/0] 14:40:02
                    > via lt-0/1/0.9
                    [Direct/0] 14:40:01
                    > via lt-0/1/0.21
                    [Direct/0] 14:40:01
                    > via lt-0/1/0.25
fe80::2a0:a502:0:5da/128
                   *[Local/0] 14:40:02
                      Local via lt-0/1/0.5
fe80::2a0:a502:0:9da/128
                   *[Local/0] 14:40:02
                      Local via lt-0/1/0.9
fe80::2a0:a502:0:15da/128
                   *[Local/0] 14:40:01
                      Local via lt-0/1/0.21
fe80::2a0:a502:0:19da/128
                   *[Local/0] 14:40:01
                      Local via lt-0/1/0.25
fe80::2a0:a50f:fc56:1da/128
                   *[Direct/0] 12:41:18
                    > via lo0.5
```

Meaning The inet6.0 routing table contains local and direct routes. To populate the routing table with other types of routes, you must configure routing policies.

Related Documentation

- Understanding External BGP Peering Sessions on page 2