JUNIPER NETWORKS

# Network Configuration Example

## Configuring BGP Confederations

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*Network Configuration Example Configuring BGP Confederations*
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## Introduction

This document provides an overview of BGP confederations and describes how to configure a confederated BGP network. A BGP confederation breaks up a large autonomous system (AS) into subautonomous systems (sub-ASs). This is one method that can be used to resolve scaling issues that can result from the full mesh requirement of BGP.

## Understanding BGP Confederations

BGP confederations are another way to solve the scaling problems created by the BGP full mesh requirement. BGP confederations effectively break up a large autonomous system (AS) into subautonomous systems (sub-ASs). Each sub-AS must be uniquely identified within the confederation AS by a sub-AS number. Typically, sub-AS numbers are taken from the private AS numbers between 64,512 and 65,535.

Within a sub-AS, the same internal BGP (IBGP) full mesh requirement exists. Connections to other confederations are made with standard external BGP (EBGP), and peers outside the sub-AS are treated as external. To avoid routing loops, a sub-AS uses a confederation sequence, which operates like an AS path but uses only the privately assigned sub-AS numbers.

The confederation AS appears whole to other confederation ASs. The AS path received by other ASs shows only the globally assigned AS number. It does not include the confederation sequence or the privately assigned sub-AS numbers. The sub-AS numbers are removed when the route is advertised out of the confederation AS. Figure 1 on page 1 shows an AS divided into four confederations.

### Figure 1: BGP Confederations

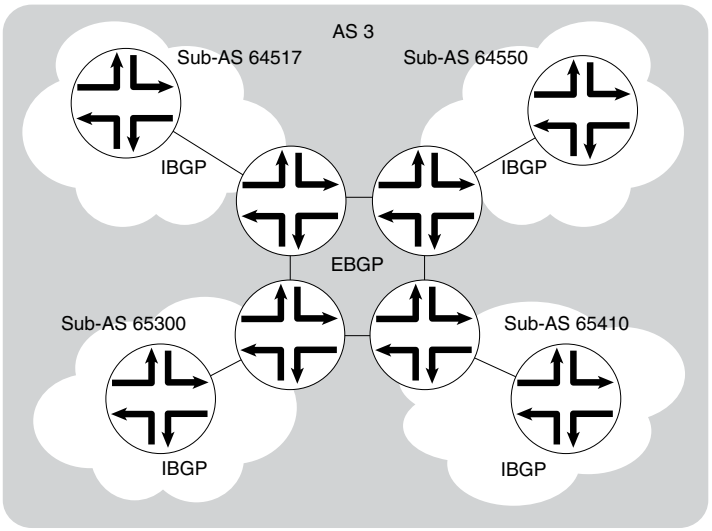



Figure 1 on page 1 shows AS 3 divided into four sub-ASs, 64517, 64550, 65300, and 65410, which are linked through EBGP sessions. Because the confederations are

connected by EBGP, they do not need to be fully meshed. EBGP routes are readvertised to other sub-ASs.

**Related Documentation**

- *Junos OS Feature Support Reference for SRX Series and J Series Devices*
- Understanding BGP
- Example: Configuring BGP Confederations on page 2

## Example: Configuring BGP Confederations

This example shows how to configure BGP confederations.



### Requirements

- Configure network interfaces.
- Configure external peer sessions. See Example: Configuring External BGP Point-to-Point Peer Sessions.
- Configure interior gateway protocol (IGP) sessions between peers.
- Configure a routing policy to advertise the BGP routes.

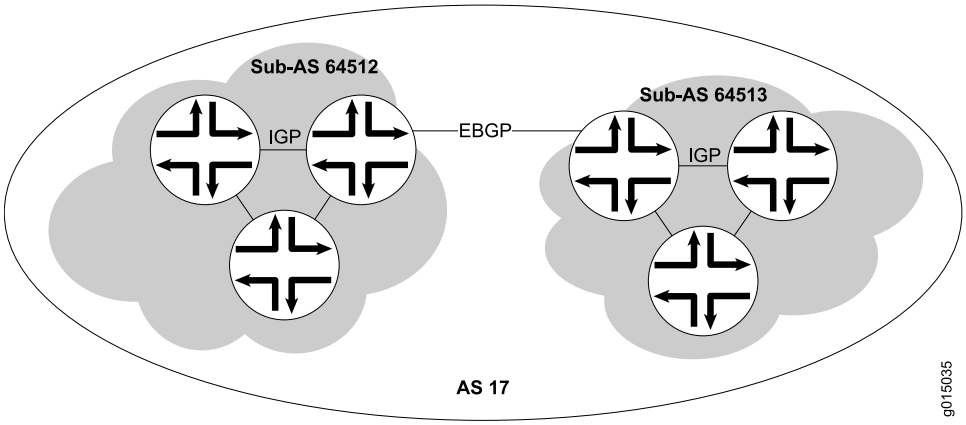
### Overview

Within a BGP confederation, the links between the confederation member autonomous systems (ASs) must be external BGP (EBGP) links, not internal BGP (IBGP) links.

Similar to route reflectors, BGP confederations reduce the number of peer sessions and TCP sessions to maintain connections between IBGP routing devices. BGP confederation is one method used to solve the scaling problems created by the IBGP full mesh requirement. BGP confederations effectively break up a large AS into subautonomous systems. Each sub-AS must be uniquely identified within the confederation AS by a sub-AS number. Typically, sub-AS numbers are taken from the private AS numbers between 64512 and 65535. Within a sub-AS, the same IBGP full mesh requirement exists. Connections to other confederations are made with standard EBGP, and peers outside the sub-AS are treated as external. To avoid routing loops, a sub-AS uses a confederation sequence, which operates like an AS path but uses only the privately assigned sub-AS numbers.

Figure 2 on page 3 shows a sample network in which AS 17 has two separate confederations: sub-AS 64512 and sub-AS 64513, each of which has multiple routers. Within a sub-AS, an IGP is used to establish network connectivity with internal peers. Between sub-ASs, an EBGP peer session is established.

Figure 2: Typical Network Using BGP Confederations




## 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.

**All Devices in Sub-AS 64512**

```
set routing-options autonomous-system 64512
set routing-options confederation 17 members 64512
set routing-options confederation 17 members 64513
set protocols bgp group sub-AS-64512 type internal
set protocols bgp group sub-AS-64512 local-address 192.168.5.1
set protocols bgp group sub-AS-64512 neighbor 192.168.8.1
set protocols bgp group sub-AS-64512 neighbor 192.168.15.1
```

**Border Device in Sub-AS 64512**

```
set protocols bgp group to-sub-AS-64513 type external
set protocols bgp group to-sub-AS-64513 peer-as 64513
set protocols bgp group to-sub-AS-64513 neighbor 192.168.5.2
```

**All Devices in Sub-AS 64513**

```
set routing-options autonomous-system 64513
set routing-options confederation 17 members 64512
set routing-options confederation 17 members 64513
set protocols bgp group sub-AS-64513 type internal
set protocols bgp group sub-AS-64513 local-address 192.168.5.2
set protocols bgp group sub-AS-64513 neighbor 192.168.9.1
set protocols bgp group sub-AS-64513 neighbor 192.168.16.1
```

**Border Device in Sub-AS 64513**

```
set protocols bgp group to-sub-AS-64512 type external
set protocols bgp group to-sub-AS-64512 peer-as 64512
set protocols bgp group to-sub-AS-64512 neighbor 192.168.5.1
```

**Step-by-Step Procedure**

This procedure shows the steps for the devices that are in sub-AS 64512.

The **autonomous-system** statement sets the sub-AS number of the device.

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 BGP confederations:

1. Set the sub-AS number for the device.

   ```
   [edit routing-options]
   user@host# set autonomous-system 64512
   ```

2. In the confederation, include all sub-ASs in the main AS.

   The number 17 represents the main AS. The **members** statement lists all the sub-ASs in the main AS.

   ```
   [edit routing-options confederation]
   user@host# set 17 members 64512
   user@host# set 17 members 64513
   ```

3. On the border device in sub-AS 64512, configure an EBGP connection to the border device in AS 64513.

   ```
   [edit protocols bgp group to-sub-AS-64513]
   user@host# set type external
   user@host# set neighbor 192.168.5.2
   user@host# set peer-as 64513
   ```

4. Configure an IBGP group for peering with the devices within sub-AS 64512.

   ```
   [edit protocols bgp group sub-AS-64512]
   user@host# set type internal
   user@host# set local-address 192.168.5.1
   user@host# neighbor 192.168.8.1
   user@host# neighbor 192.168.15.1
   ```

**Results**

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

```
user@host# show routing-options
autonomous-system 64512;
confederation 17 members [ 64512 64513 ];

user@host# show protocols
bgp {
  group to-sub-AS-64513 { # On the border devices only
    type external;
    peer-as 64513;
    neighbor 192.168.5.2;
  }
  group sub-AS-64512 {
    type internal;
    local-address 192.168.5.1;
```

```
        neighbor 192.168.8.1;
        neighbor 192.168.15.1;
    }
}
```

If you are done configuring the device, enter **commit** from configuration mode. Repeat these steps for sSub-AS 64513.

## 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 the CLI, enter the **show bgp neighbor** command.

## Sample Output

```
user@host> show bgp neighbor
Peer: 10.255.245.12+179 AS 35  Local: 10.255.245.13+2884 AS 35
  Type: Internal    State: Established  (route reflector client)Flags: Sync
  Last State: OpenConfirm   Last Event: RecvKeepAlive
  Last Error: None
  Options: Preference LocalAddress HoldTime Cluster AddressFamily Rib-group Refresh

  Address families configured: inet-vpn-unicast inet-labeled-unicast
  Local Address: 10.255.245.13 Holdtime: 90 Preference: 170
  Flags for NLRI inet-vpn-unicast: AggregateLabel
  Flags for NLRI inet-labeled-unicast: AggregateLabel
  Number of flaps: 0
  Peer ID: 10.255.245.12    Local ID: 10.255.245.13    Active Holdtime: 90
  Keepalive Interval: 30
  NLRI advertised by peer: inet-vpn-unicast inet-labeled-unicast
  NLRI for this session: inet-vpn-unicast inet-labeled-unicast
  Peer supports Refresh capability (2)
Restart time configured on the peer: 300
  Stale routes from peer are kept for: 60
  Restart time requested by this peer: 300
  NLRI that peer supports restart for: inet-unicast inet6-unicast
  NLRI that restart is negotiated for: inet-unicast inet6-unicast
  NLRI of received end-of-rib markers: inet-unicast inet6-unicast
  NLRI of all end-of-rib markers sent: inet-unicast inet6-unicast
  Table inet.0 Bit: 10000
    RIB State: restart is complete
    Send state: in sync
    Active prefixes: 4
    Received prefixes: 6
    Suppressed due to damping: 0
  Table inet6.0 Bit: 20000
    RIB State: restart is complete
    Send state: in sync
    Active prefixes: 0
    Received prefixes: 2
    Suppressed due to damping: 0
  Last traffic (seconds): Received 3    Sent 3    Checked 3
  Input messages:  Total 9      Updates 6       Refreshes 0     Octets 403
  Output messages: Total 7      Updates 3       Refreshes 0     Octets 365
  Output Queue[0]: 0
  Output Queue[1]: 0
  Trace options: detail packets
  Trace file: /var/log/bgpgr size 131072 files 10
```

**Meaning** The output shows a list of the BGP neighbors with detailed session information. Verify the following information:

- Each configured peering neighbor is listed.
- For **State**, each BGP session is **Established**.
- For **Type**, each peer is configured as the correct type (either internal or external).
- For **AS**, the AS number of the BGP neighbor is correct.

### Verifying BGP Groups

**Purpose** Verify that the BGP groups are configured correctly.

**Action** From the CLI, enter the **show bgp group** command.

## Sample Output

```
user@host> show bgp group
Group Type: Internal    AS: 10045       Local AS: 10045
  Name: pe-to-asbr2                                  Flags: Export Eval
  Export: [ match-all ]
  Total peers: 1        Established: 1
  10.0.0.4+179
  bgp.l3vpn.0: 1/1/0
  vpn-green.inet.0: 1/1/0

Groups: 1   Peers: 1    External: 0    Internal: 1    Down peers: 0   Flaps: 0
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
bgp.l3vpn.0            1          1          0          0          0          0
```

**Meaning** The output shows a list of the BGP groups with detailed group information. Verify the following information:

- Each configured group is listed.
- For **AS**, each group's remote AS is configured correctly.
- For **Local AS**, each group's local AS is configured correctly.
- For **Group Type**, each group has the correct type (either internal or external).
- For **Total peers**, the expected number of peers within the group is shown.
- For **Established**, the expected number of peers within the group have BGP sessions in the **Established** state.
- The IP addresses of all the peers within the group are present.

### Verifying BGP Summary Information

**Purpose** Verify that the BGP configuration is correct.

**Action** From the CLI, enter the **show bgp summary** command.

## Sample Output

```
user@host> show bgp summary
Groups: 1 Peers: 3 Down peers: 0
Table          Tot Paths  Act Paths Suppressed    History Damp State    Pending
inet.0                 6          4          0          0          0          0
Peer               AS      InPkt     OutPkt    OutQ   Flaps Last Up/Dwn
State|#Active/Received/Damped...
10.0.0.2        65002      88675      88652       0       2       42:38 2/4/0
            0/0/0
10.0.0.3        65002      54528      54532       0       1     2w4d22h 0/0/0
            0/0/0
10.0.0.4        65002      51597      51584       0       0     2w3d22h 2/2/0
            0/0/0
```

**Meaning** The output shows a summary of BGP session information. Verify the following information:

- For **Groups**, the total number of configured groups is shown.
- For **Peers**, the total number of BGP peers is shown.
- For **Down Peers**, the total number of unestablished peers is 0. If this value is not zero, one or more peering sessions are not yet established.
- Under **Peer**, the IP address for each configured peer is shown.
- Under **AS**, the peer AS for each configured peer is correct.
- Under **Up/Dwn State**, the BGP state reflects the number of paths received from the neighbor, the number of these paths that have been accepted, and the number of routes being damped (such as 0/0/0). If the field is **Active**, it indicates a problem in the establishment of the BGP session.

**Related Documentation**

- Routing Policy Configuration Guide
- Understanding BGP Confederations on page 1
- BGP Configuration Overview