BGP FlowSpec Route-reflector Support

The BGP (Border Gateway Protocol) Flowspec (Flow Specification) Route Reflector feature enables service providers to control traffic flows in their network. This helps in filtering traffic and helps in taking action against distributed denial of service (DDoS) mitigation by dropping the DDoS traffic or diverting it to an analyzer.

BGP flow specification provides a mechanism to encode flow specification rules for traffic flows that can be distributed as BGP Network Layer Reachability Information (NLRI).

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for BGP FlowSpec Route-reflector Support

- In Cisco IOS 15.5(S) release, BGP flow specification is supported only on a route reflector.
- Mixing of address family matches and actions is not supported in flow spec rules. For example, IPv4 matches cannot be combined with IPv6 actions and vice versa.

Information About BGP FlowSpec Route-reflector Support

Overview of Flowspec

Flowspec specifies procedures for the distribution of flow specification rules as Border Gateway Protocol Network Layer Reachability Information (BGP NLRI) that can be used in any application. It also defines application for the purpose of packet filtering in order to mitigate distributed denial of service attacks.

A flow specification rule consists of a matching part encoded in the BGP NLRI field and an action part encoded as BGP extended community as defined in the RFC 5575. A flow specification rule is a set of data (represented in an n-tuple) consisting of several matching criteria that can be applied to IP packet data. BGP flow specification rules are internally converted to equivalent Cisco Common Classification Policy Language (C3PL) representing corresponding match and action parameters.

In Cisco IOS 15.5(S) release, Flowspec supports following functions for the BGP route reflector:

- Flowspec rules defined in RFC 5575
- IPv6 extensions
- Redirect IP extensions
- BGP flowspec validation

Matching Criteria

The following table lists the various Flowspec tuples that are supported for BGP.

BGP Flowspec NLRI Type	QoS Matching Field (IPv6)	QoS Matching Field (IPv4)	Input Value
Type 1	IPv6 destination address	IPv4 destination address	Prefix length
Type 2	IPv6 source address	IPv4 source address	Prefix length
Type 3	IPv6 next header	IPv4 protocol	Multi-value range
Type 4	IPv6 source or destination port	IPv4 source or destination port	Multi-value range
Type 5	IPv6 destination port	IPv4 destination port	Multi-value range
Type 6	IPv6 source port	IPv4 source port	Multi-value range
Type 7	IPv6 ICMP type	IPv4 ICMP type	Multi-value range
Type 8	IPv6 ICMP code	IPv4 ICMP code	Multi-value range
Type 9	IPv6 TCP flags	IPv4 TCP flags (2 bytes include reserved bits)	Bit mask
Type 10	IPv6 packet length	IPv4 packet length	Multi-value range
Type 11	IPv6 traffic class	IPv4 DSCP	Multi-value range

BGP Flowspec NLRI Type	QoS Matching Field (IPv6)	QoS Matching Field (IPv4)	Input Value
Type 12	Reserved	IPv4 fragment bits	Bit mask
Type 13	IPv6 flow label	—	Multi-value range

How to Configure BGP FlowSpec Route-reflector Support

Configuring BGP FlowSpec Route-reflector Support

Perform this task to configure BGP FlowSpec on a route reflector. This task specifies only the IPv4 address family but, other address families are also supported for BGP flow specifications.

Before you begin

Configure a BGP route reflector.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *autonomous-system-number*
4. **neighbor** *ip-address* **remote-as** *autonomous-system-number*
5. **address-family {ipv4 | ipv6 | vpnv4 | vpnv6} flowspec**
6. **neighbor** *ip-address* **activate**
7. **neighbor** *ip-address* **route-reflector-client**
8. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**router bgp** *autonomous-system-number* **Example:** `Device(config)# router bgp 1`	Enters router configuration mode for the BGP routing process.

	Command or Action	Purpose
Step 4	**neighbor** *ip-address* **remote-as** *autonomous-system-number* **Example:** Device(config-router)# neighbor 10.1.1.1 remote-as 1	Adds an entry to the BGP or multiprotocol BGP neighbor table.
Step 5	**address-family {ipv4 | ipv6 | vpnv4 | vpnv6} flowspec** **Example:** Device(config-router)# address-family ipv4 flowspec	Specifies the address family and enters address family configuration mode. • Flowspec is supported on IPv4, IPv6, VPNv4 and VPNv6 address families.
Step 6	**neighbor** *ip-address* **activate** **Example:** Device(config-router-af)# neighbor 10.1.1.1 activate	Enables the exchange of information with a BGP neighbor.
Step 7	**neighbor** *ip-address* **route-reflector-client** **Example:** Device(config-router-af)# neighbor 10.1.1.1 route-reflector-client	Configures the router as a BGP route reflector and configures the specified neighbor as its client.
Step 8	**end** **Example:** Device(config-router-af)# end	(Optional) Exits address family configuration mode and returns to privileged EXEC mode.

Disabling BGP FlowSpec Validation

Perform this task if you want to disable the BGP flow specification validations for eBGP peers. The validations are enabled by default.

To know more about BGP flow specification validations, see RFC 5575 (draft-ietf-idr-bgp-flowspec-oid-01-Revised Validation Procedure for BGP Flow Specifications).

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *autonomous-system-number*
4. **address-family {ipv4 | ipv6 | vpnv4 | vpnv6} flowspec**
5. **neighbor** *ip-address* **validation off**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: `Device> enable`	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**router bgp** *autonomous-system-number* **Example:** `Device(config)# router bgp 1`	Enters router configuration mode for the BGP routing process.
Step 4	**address-family {ipv4	ipv6	vpnv4	vpnv6} flowspec** **Example:** `Device(config-router)# address-family ipv4 flowspec`	Specifies the address family and enters address family configuration mode. • Flowspec is supported on IPv4, IPv6, VPNv4 and VPNv6 address families.
Step 5	**neighbor** *ip-address* **validation off** **Example:** `Device(config-router-af)# neighbor 10.1.1.1 validation off`	Disables validation of flow specification for eBGP peers.

Verifying BGP FlowSpec Route-reflector Support

The **show** commands can be entered in any order.

Before you begin

Configure BGP FlowSec on a route reflector.

SUMMARY STEPS

1. **show bgp ipv4 flowspec**
2. **show bgp ipv4 flowspec detail**
3. **show bgp ipv4 flowspec summary**
4. **show bgp ipv6 flowspec**
5. **show bgp ipv6 flowspec detail**
6. **show bgp ipv6 flowspec summary**
7. **show bgp vpnv4 flowspec**
8. **show bgp vpnv4 flowspec all detail**
9. **show bgp vpnv6 flowspec**
10. **show bgp vpnv6 flowspec all detail**

DETAILED STEPS

Step 1   **show bgp ipv4 flowspec**

This command displays the IPv4 flowspec routes.

Example:

```
Device# show bgp ipv4 flowspec

BGP table version is 3, local router ID is 10.10.10.2 Status codes: s suppressed, d damped, h
history,
* valid, > best, i - internal, r RIB-failure, S Stale,
m multipath, b backup-path, f RT-Filter, best-external, a additional-path,
c RIB-compressed, Origin codes: i - IGP, e - EGP, ? - incomplete RPKI validation codes: V valid,
I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
 *>i Dest:2.2.2.0/24  10.0.101.1                     100      0 i
 *>i Dest:3.3.3.0/24  10.0.101.1                     100      0 i
```

Step 2   **show bgp ipv4 flowspec detail**

This command displays the detailed information about IPv4 flowspec routes.

Example:

```
Device# show bgp ipv4 flowspec detail

BGP routing table entry for Dest:2.2.2.0/24, version 2
  Paths: (1 available, best #1, table IPv4-Flowspec-BGP-Table)
  Advertised to update-groups:
     1
  Refresh Epoch 1
  Local, (Received from a RR-client)
    10.0.101.1 from 10.0.101.1 (10.0.101.1)
      Origin IGP, localpref 100, valid, internal, best
      Extended Community: FLOWSPEC Redirect-IP:0x000000000001
      rx pathid: 0, tx pathid: 0x0
BGP routing table entry for Dest:3.3.3.0/24, version 3
  Paths: (1 available, best #1, table IPv4-Flowspec-BGP-Table)
  Advertised to update-groups:
     1
  Refresh Epoch 1
  Local, (Received from a RR-client)
    10.0.101.1 from 10.0.101.1 (10.0.101.1)
      Origin IGP, localpref 100, valid, internal, best
      rx pathid: 0, tx pathid: 0x0
```

Step 3   **show bgp ipv4 flowspec summary**

This command displays the IPv4 flowspec neighbors.

Example:

```
Device# show bgp ipv4 flowspec summary

BGP router identifier 10.10.10.2, local AS number 239 BGP table version is 3, main routing table
version 3
2 network entries using 16608 bytes of memory
```

```
2 path entries using 152 bytes of memory
2/2 BGP path/bestpath attribute entries using 304 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
2 BGP extended community entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory BGP using 17136 total bytes of memory BGP
activity 18/0
prefixes, 18/0 paths, scan interval 15 secs

Neighbor        V         AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down
State/PfxRcd
10.0.101.1      4        239      70      24       3    0    0 00:10:58
        2
10.0.101.2      4        239       0       0       1    0    0 never
Idle
10.0.101.3      4        240       0       0       1    0    0 never
Idle
10.10.10.1      4        239      19      23       3    0    0 00:10:53
```

Step 4   **show bgp ipv6 flowspec**

This command displays the IPv6 flowspec routes.

Example:

```
Device# show bgp ipv6 flowspec

BGP table version is 2, local router ID is 10.10.10.2 Status codes: s suppressed, d damped, h
history,
 * valid, > best, i - internal, r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
 x best-external, a additional-path, c RIB-compressed, Origin codes: i - IGP, e - EGP,
 ? - incomplete RPKI validation codes: V valid, I invalid, N Not found

    Network          Next Hop          Metric LocPrf Weight Path
 *>i Dest:3::/0-24,Source:4::/0-24
                    FEC0::1001                        100      0 i
```

Step 5   **show bgp ipv6 flowspec detail**

This command displays the detailed information about IPv6 flowspec routes.

Example:

```
Device# show bgp ipv6 flowspec detail

BGP routing table entry for Dest:3::/0-24,Source:4::/0-24, version 2
  Paths: (1 available, best #1, table Global-Flowspecv6-Table)
  Advertised to update-groups:
     2
  Refresh Epoch 1
  Local
    FEC0::1001 from FEC0::1001 (10.0.101.2)
      Origin IGP, localpref 100, valid, internal, best
      rx pathid: 0, tx pathid: 0x0
```

Step 6   **show bgp ipv6 flowspec summary**

This command displays the IPv6 flowspec neighbors.

Example:

```
Device# show bgp ipv6 flowspec summary

BGP router identifier 10.10.10.2, local AS number 239 BGP table version is 3, main routing table
version 3
2 network entries using 16608 bytes of memory
2 path entries using 152 bytes of memory
2/2 BGP path/bestpath attribute entries using 304 bytes of memory
1 BGP AS-PATH entries using 24 bytes of memory
2 BGP extended community entries using 48 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory BGP using 17136 total bytes of memory BGP
activity 18/0
prefixes, 18/0 paths, scan interval 15 secs

Neighbor        V         AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down
State/PfxRcd
10.0.101.1      4        239     70      24       3    0    0 00:10:58
        2
10.0.101.2      4        239      0       0       1    0    0 never
Idle
10.0.101.3      4        240      0       0       1    0    0 never
Idle
10.10.10.1      4        239     19      23       3    0    0 00:10:53
```

Step 7   **show bgp vpnv4 flowspec**

This command displays the VPNv4 flowspec neighbors.

Example:

```
Device# show bgp vpnv4 flowspec

BGP table version is 2, local router ID is 10.10.10.2 Status codes: s suppressed, d damped, h
history,
* valid, > best, i - internal,r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
x best-external, a additional-path, c RIB-compressed, Origin codes: i - IGP, e - EGP,
? - incomplete RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop          Metric LocPrf Weight Path
Route Distinguisher:  200:200
 *>i Dest:10.0.1.0/24 10.0.101.1                    100      0 i
```

Step 8   **show bgp vpnv4 flowspec all detail**

This command displays the VPNv4 flowspec details.

Example:

```
Device# show bgp vpnv4 flowspec all detail

Route Distinguisher: 200:200
BGP routing table entry for 200:200:Dest:10.0.1.0/24, version 2
  Paths: (1 available, best #1, table VPNv4-Flowspec-BGP-Table)
  Advertised to update-groups:
     3
  Refresh Epoch 1
  Local
    10.0.101.1 (via default) from 10.0.101.1 (10.0.101.1)
      Origin IGP, localpref 100, valid, internal, best
      Extended Community: RT:100:100
      rx pathid: 0, tx pathid: 0x0
```

Step 9 **show bgp vpnv6 flowspec**

This command displays the VPNv6 flowspec neighbors.

Example:

```
Device# show bgp vpnv6 flowspec

BGP table version is 2, local router ID is 10.10.10.2 Status codes: s suppressed, d damped, h
history, * valid, > best, i - internal,
              r RIB-failure, S Stale, m multipath, b backup-path, f RT-Filter,
            x best-external, a additional-path, c RIB-compressed, Origin codes: i - IGP, e - EGP,
 ? - incomplete RPKI validation codes: V valid, I invalid, N Not found

     Network          Next Hop            Metric LocPrf Weight Path
Route Distinguisher: 200:200
 *>i SPort:=20640     FEC0::1001                   100       0 i
```

Step 10 **show bgp vpnv6 flowspec all detail**

This command displays the VPNv6 flowspec details.

Example:

```
Device# show bgp vpnv6 flowspec all detail

Route Distinguisher: 200:200
BGP routing table entry for 200:200:SPort:=20640, version 2
  Paths: (1 available, best #1, table VPNv6-Flowspec-BGP-Table)
  Advertised to update-groups:
     3
  Refresh Epoch 1
  Local
    FEC0::1001 (via default) from FEC0::1001 (10.0.101.2)
      Origin IGP, localpref 100, valid, internal, best
      Extended Community: RT:100:100
      rx pathid: 0, tx pathid: 0x0
```
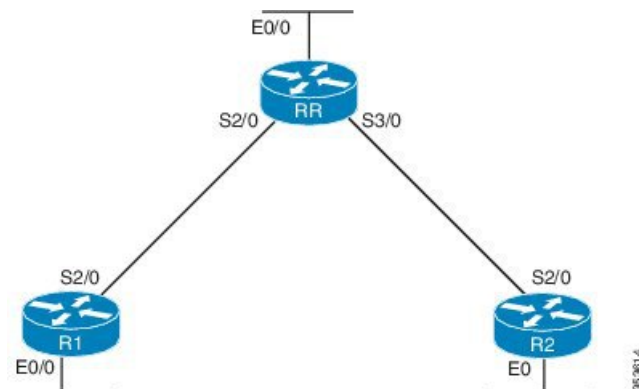
Configuration Examples for BGP FlowSpec Route-reflector Support

Example: BGP FlowSpec Route-reflector Support

Example: Configuring BGP FlowSpec on Route Reflector

Configure BGP route reflector and inject flowspec in the route reflector.

Figure 1: BGP Route Reflector Topology


```
! Configure the topology

!Configure the interfaces on RR

RR> enable
RR# configure terminal
RR(config)# interface E0/0
RR(config-if)# ip address 10.0.0.1 255.224.0.0
RR(config-if)# no shutdown
RR(config-if)# exit
RR(config)# interface S2/0
RR(config-if)# ip address 10.32.0.1 255.224.0.0
RR(config-if)# no shutdown
RR(config-if)# exit
RR(config)# interface S3/0
RR(config-if)# ip address 10.64.0.1 255.224.0.0
RR(config-if)# no shutdown

!Configure RR as the route reflector with S2/0(R1) and S2/0 (R2) as the neighbors

RR(config)# router bgp 333
RR(config-router)# no synchronization
RR(config-router)# network 10.0.0.0 mask 255.224.0.0
RR(config-router)# network 10.64.0.0 mask 255.224.0.0
RR(config-router)# network 10.32.0.0 mask 255.224.0.0
RR(config-router)# neighbor 10.64.0.2 remote-as 333
RR(config-router)# neighbor 10.32.0.2 remote-as  333


!Configure flowspec on route reflector

RR(config-router)# address-family ipv4 flowspec
RR(configure-router-af)# neighbor 10.64.0.2 activate
RR(config-router)# neighbor 10.64.0.2 route-reflector-client
RR(configure-router-af)# neighbor 10.32.0.2 activate
RR(config-router)# neighbor 10.32.0.2 route-reflector-client

!Verify the configuration

RR> show bgp ipv4 flowspec
```

Additional References for BGP FlowSpec Route-reflector Support

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
BGP commands	Cisco IOS IP Routing: BGP Command Reference

Standards and RFCs

Standard/RFC	Title
RFC 5575	*Dissemination of Flow Specification Rules*

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for BGP FlowSpec Route-reflector Support

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1: Feature Information for BGP FlowSpec Route-reflector Support

Feature Name	Releases	Feature Information
BGP FlowSpec Route-reflector Support	15.5(1)S	The BGP FlowSpec Route-reflector Support feature enables services providers to control traffic flows in their network and mitigate DDoS attack. The following command was introduced by this feature: **address-family {ipv4	ipv6	vpnv4	vpnv6} flowspec**.