



## BGP Flow Specification Client

The Border Gateway Protocol (BGP) flow specification client feature enables a device to perform the role of a BGP flow specification client and receive flow specification rules from a BGP flow specification controller. Flow specification rules contain a set of match criteria and actions (also called *flows*). The flows are configured on a controller (device), which advertises the flows to the client device, or specific interfaces on the client.



### Attention

IOS XE software supports BGP flow specification client function and does not support BGP flow specification controller function.

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## 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](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

## Prerequisites for BGP Flow Specification Client

- Identify and configure flow specification rules on the controller.

**Note**

When the flow specification client is enabled, the matching criteria and corresponding actions in the controller's flows are remotely injected into the client device, and the flows are programmed into the platform hardware of the client device.

## Restrictions for BGP Flow Specification Client

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

## Information About BGP Flow Specification Client

### BGP Flow Specification Model

The BGP protocol is used for flow specifications due to unique advantages it offers. The three elements that are used to route flow specifications through BGP enabled devices are: controller, client, and route-reflector (which is optional). This document is specific to the client element function.

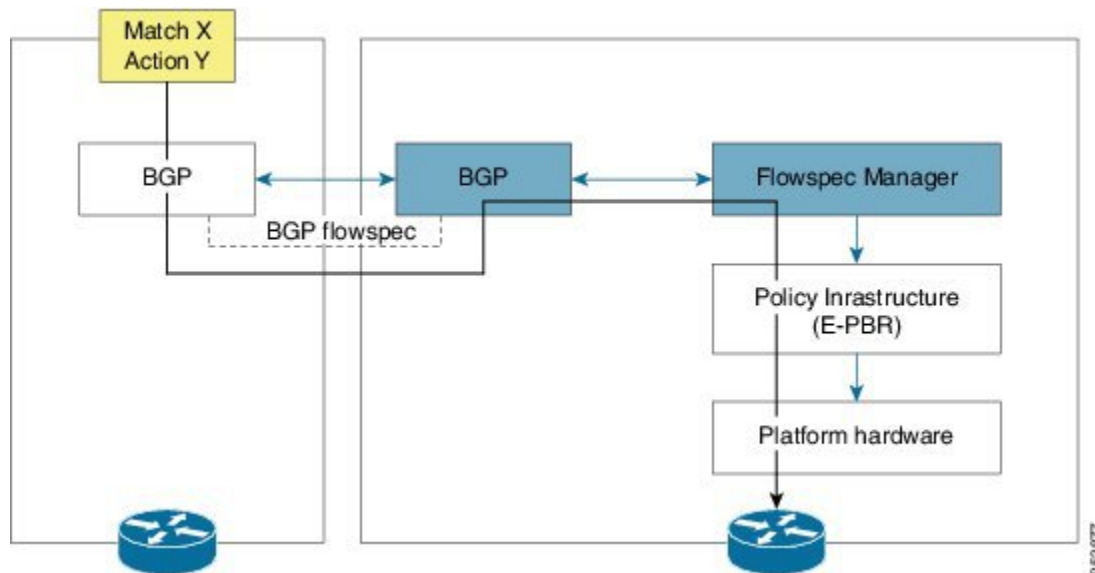
Though devices with the IOS XE software (such as ASR 1000, and so on) can perform BGP flow specification client role and not the controller role, a brief outline of the BGP flow specification process is given below for better understanding.

The BGP flow specification functionality allows you to rapidly deploy and propagate filtering and policing functionality among a large number of BGP peer devices to mitigate the effects of a distributed denial-of-service (DDoS) attack over your network.

The BGP flow specification model comprises of a client and a controller (route-reflector usage is optional). The controller is responsible for sending or injecting the flow specification NRLI entry. The client (acting as

a BGP speaker) receives the NLRI and programs the hardware forwarding to act on the instruction from the controller. An illustration of this model is provided below.

**Figure 1: BGP Flow Specification Model**



In the above topology, the controller on the left-hand side injects the flow specification NLRI into the client on the right-hand side. The client receives the information, sends it to the flow specification manager component, configures the ePBR (Enhanced Policy Based Routing) infrastructure, which in turn programs the platform hardware of the device. This way, you can create rules to handle DDoS attacks on your network.

## Sample Flow Specification Client Configuration

First, associate the device to a BGP autonomous system and enable flow specification policy mapping capability for various address families. Then, identify a neighbor (through its IP address) as a BGP peer and enable the capability to exchange information between the devices through the **neighbor activate** command. This way, flow specification information can be exchanged between the client, controller, and any other flow specification client device.

```
!
router bgp 100
  address-family ipv4 flowspec
    neighbor 10.1.1.1 activate
  !
```

## Matching Criteria and Actions

The flow specification NLRI type consists of several optional sub-components. A specific packet is considered to match the flow specification when it matches the intersection (AND) of all the components present in the specification. The following are the supported component types or tuples that you can define:

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
Type 12	Reserved	IPv4 fragment bits	Bit mask

## How to Configure BGP Flow Specification Client

### Configuring a Device As a Flow Specification Client and Establishing a BGP Peer Relationship With Neighbor

The following task explains configuration of a device as a BGP flow specification client. A device interface within a VRF instance can also perform the role of a BGP flow specification client.

#### Before You Begin

Before configuring a device as a flow specification client, it is a good practice to identify and configure the flow specification controller device (and a route reflector, if required). When flow specification rules are configured on the controller, the rules are remotely injected into the client and the matching criteria and corresponding actions are programmed into the platform hardware of the client.

## SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router bgp** *as-number*
4. **address-family** {*ipv4* | *ipv6*} **flowspec**
5. **neighbor** *ip-address* **activate**
6. **exit**
7. **address-family** {*ipv4* | *ipv6*} **flowspec vrf** *vrf-name*
8. **neighbor** *ip-address* **remote-as** *as-number*
9. **neighbor** *ip-address* **activate**
10. **exit**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Device> enable	Enables privileged EXEC mode.  • Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Device# configure terminal	Enters global configuration mode
<b>Step 3</b>	<b>router bgp</b> <i>as-number</i>  <b>Example:</b> Device(config)# router bgp 100	Specifies the autonomous system number and enters the BGP configuration mode, allowing you to configure the BGP routing process.
<b>Step 4</b>	<b>address-family</b> { <i>ipv4</i>   <i>ipv6</i> } <b>flowspec</b>  <b>Example:</b> Device(config-bgp)# address-family ipv4 flowspec	Specifies either the IPv4 or IPv6 address family and enters BGP address family configuration mode, and initializes the global address family for flow specification policy mapping.
<b>Step 5</b>	<b>neighbor</b> <i>ip-address</i> <b>activate</b>  <b>Example:</b> Device(config-bgp-af)# neighbor 10.1.1.1 activate	Places the device in neighbor configuration mode for BGP routing and configures the neighbor IP address as a BGP peer. Enables the device to advertise (and receive information), including its IP address, to its BGP neighbor.
<b>Step 6</b>	<b>exit</b>  <b>Example:</b> Device(config-bgp-af)# exit	Exits BGP address family configuration mode and enters BGP configuration mode.

	Command or Action	Purpose
<b>Step 7</b>	<b>address-family {ipv4   ipv6} flowspec vrf <i>vrf-name</i></b>  <b>Example:</b> Device(config-bgp)# address-family ipv4 flowspec vrf vrf1	Specifies either the IPv4 or IPv6 address family for the VRF, enters BGP address family configuration mode, and initializes the global address family for flow specification policy mapping.
<b>Step 8</b>	<b>neighbor <i>ip-address</i> remote-as <i>as-number</i></b>  <b>Example:</b> Device(config-bgp-af)# neighbor 2001:DB8:1::1 remote-as 100	Places the device in neighbor configuration mode for BGP routing and configures the neighbor (IP address) as a BGP peer. The <b>remote-as</b> keyword assigns the specified remote autonomous system number to the neighbor.
<b>Step 9</b>	<b>neighbor <i>ip-address</i> activate</b>  <b>Example:</b> Device(config-bgp-af)# neighbor 2001:DB8:1::1 activate	Enables the device to advertise (and receive information), including its IP address, to its BGP neighbor.
<b>Step 10</b>	<b>exit</b>  <b>Example:</b> Device(config-bgp-af)# exit	Exits BGP address family configuration mode and enters BGP configuration mode.

## Configuring a Flow Specification Policy On All Interfaces Of a Device

The following configuration task explains flow specification policy configuration on all interfaces of a device for the IPv4 and IPv6 address families, and on interfaces within a VRF instance.

## SUMMARY STEPS

1. enable
2. configure terminal
3. flowspec
4. address-family ipv4
5. local-install interface-all
6. exit
7. address-family ipv6
8. local-install interface-all
9. exit
10. vrf *vrf-name*
11. address-family ipv4
12. local-install interface-all
13. exit
14. address-family ipv6
15. local-install interface-all
16. exit

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b>  <b>Example:</b> Device> enable	Enables privileged EXEC mode.  • Enter your password if prompted.
Step 2	<b>configure terminal</b>  <b>Example:</b> Device# configure terminal	Enters global configuration mode
Step 3	<b>flowspec</b>  <b>Example:</b> Device(config)# flowspec	Enters flowspec configuration mode.
Step 4	<b>address-family ipv4</b>  <b>Example:</b> Device(config-flowspec)# address-family ipv4	Specifies the IPv4 address family and enters flow specification address family configuration mode.
Step 5	<b>local-install interface-all</b>  <b>Example:</b> Device(config-flowspec-af)# local-install interface-all	Installs the flowspec policy on all interfaces.

	Command or Action	Purpose
<b>Step 6</b>	<b>exit</b>  <b>Example:</b> Device(config-flowspec-af) # exit	Exits flow specification address family configuration mode and enters flowspec configuration mode.
<b>Step 7</b>	<b>address-family ipv6</b>  <b>Example:</b> Device(config-flowspec) # address-family ipv6	Specifies the IPv6 address family and enters flow specification address family configuration mode.
<b>Step 8</b>	<b>local-install interface-all</b>  <b>Example:</b> Device(config-flowspec-af) # local-install interface-all	Installs the flowspec policy on all interfaces.
<b>Step 9</b>	<b>exit</b>  <b>Example:</b> Device(config-flowspec-af) # exit	Exits flow specification address family configuration mode and enters flowspec configuration mode.
<b>Step 10</b>	<b>vrf vrf-name</b>  <b>Example:</b> Device(config-flowspec) # vrf vrf10	Configures a VRF instance and enters flow specification VRF configuration mode.
<b>Step 11</b>	<b>address-family ipv4</b>  <b>Example:</b> Device(config-flowspec-vrf) # address-family ipv4	Specifies the IPv4 address family and enters VRF flow specification address family configuration mode.
<b>Step 12</b>	<b>local-install interface-all</b>  <b>Example:</b> Device(config-flowspec-vrf-af) # local-install interface-all	Installs the flowspec policy on all interfaces.
<b>Step 13</b>	<b>exit</b>  <b>Example:</b> Device(config-flowspec-vrf-af) # exit	Exits VRF flow specification address family configuration mode and enters VRF flow specification configuration mode.
<b>Step 14</b>	<b>address-family ipv6</b>  <b>Example:</b> Device(config-flowspec-vrf) # address-family ipv6	Specifies the IPv6 address family and enters VRF flow specification address family configuration mode.
<b>Step 15</b>	<b>local-install interface-all</b>  <b>Example:</b> Device(config-flowspec-vrf-af) # local-install interface-all	Installs the flowspec policy on all interfaces.

	Command or Action	Purpose
<b>Step 16</b>	<b>exit</b>  <b>Example:</b> Device(config-flowspec-vrf-af)# exit	Exits VRF flow specification address family configuration mode and enters VRF flow specification configuration mode.

## Verifying BGP Flow Specification Client

These commands display flow specification configuration details:

### SUMMARY STEPS

1. **show flowspec summary**
2. **show bgp ipv4 flowspec**
3. **show flowspec vrf vrf-name afi-all**

### DETAILED STEPS

#### Step 1 **show flowspec summary**

##### Example:

```
Device # show flowspec summary
```

```
FlowSpec Manager Summary:
Tables: 2
Flows: 1
```

Provides a summary of the flow specification rules present on the node.

In this example, the **Tables** field indicates that the flow specification policy mapping capability is enabled for IPv4 and IPv6 address families.

The **Flows** field indicates that a single flow has been defined across the entire table.

#### Step 2 **show bgp ipv4 flowspec**

##### Example:

```
Device # show bgp ipv4 flowspec
```

```
Dest:192.0.2.0/24, Source:10.1.1.0/24, DPort:>=120&=<=130, SPort:>=25&=<=30, DSCP:=30/208
BGP routing table entry for Dest:192.0.2.0/24,
Source:10.1.1.0/24, Proto:=47, DPort:>=120&=<=130, SPort:>=25&=<=30, DSCP:=30/208 <snip>
Paths: (1 available, best #1)
  Advertised to update-groups (with more than one peer):
    0.3
  Path #1: Received by speaker 0
  Advertised to update-groups (with more than one peer):
    0.3 Local
    0.0.0.0 from 0.0.0.0 (3.3.3.3)
```

```
Origin IGP, localpref 100, valid, redistributed, best, group-best
Received Path ID 0, Local Path ID 1, version 42
Extended community: FLOWSPEC Traffic-rate:100,0
```

Use this command to verify if a flow specification rule configured on the flow specification controller (device) is available on the BGP side. In this example, *redistributed* indicates that the flow specification rule is not internally originated, but one that has been redistributed from the flow specification process to BGP. The extended community (the BGP attribute used to send the match and action criteria to peer devices) that is configured is also displayed.

In this example, the action defined is to rate limit the traffic.

### Step 3 **show flowspec vrf vrf-name afi-all**

#### Example:

```
Device # show flowspec vrf vrf100 afi-all
```

```
VRF: vrf100      AFI: IPv4
  Flow           :DPort:=101,SPort:=101,TCPFlags:~0xFF,Length:>=100&lt;=1500,DSCP:=63
  Actions        :Redirect: VRF vrf200 Route-target: ASN2-200:2 (bgp.1)
  Flow           :DPort:=102,SPort:=102,TCPFlags:~0xFF,Length:>=100&lt;=1500,DSCP:=63
  Actions        :Redirect: VRF vrf200 Route-target: ASN2-200:2 (bgp.1)
```

Use this command to verify if a flow specification rule is in a specific VRF associated with the flow specification client (device).

## Configuration Examples for BGP Flow Specification Client

### Example: Configuring a Device As a Flow Specification Client and Establishing a BGP Peer Relationship With Neighbor

```
Device> enable
Device# configure terminal
Device (config)# router bgp 100
Device (config-bgp)# address-family ipv4 flowspec
Device (config-bgp-af)# neighbor 10.1.1.1 activate
Device (config-bgp-af)# exit
Device (config-bgp)# address-family ipv4 flowspec vrf vrf1
Device (config-bgp-af)# neighbor 2001:DB8:1::1 remote as 100
Device (config-bgp-af)# neighbor 2001:DB8:1::1 activate
Device (config-bgp-af)# exit
```

### Example: Configuring a Flow Specification Policy On All Interfaces Of a Device

```
Device> enable
Device# configure terminal
Device (config)# flowspec
Device (config-flowspec)# address-family ipv4
Device (config-flowspec-af)# local-install interface-all
Device (config-flowspec-af)# exit
```

```

Device(config-flowspec)# address-family ipv6
Device(config-flowspec-af)# local-install interface-all
Device(config-flowspec-af)# exit
Device(config-flowspec)# vrf vrf10
Device(config-flowspec-vrf)# address-family ipv4
Device(config-flowspec-vrf-af)# local-install interface-all
Device(config-flowspec-vrf-af)# exit
Device(config-flowspec-vrf)# address-family ipv6
Device(config-flowspec-vrf-af)# local-install interface-all
Device(config-flowspec-vrf-af)# exit

```

## Additional References for BGP Flow Specification Client

### Related Documents

Related Topic	Document Title
Cisco IOS commands	<a href="#">Cisco IOS Master Commands List, All Releases</a>
BGP commands	<a href="#">Cisco IOS IP Routing: BGP Command Reference</a>
BGP Flow Specification Route-reflector Support	<i>IP Routing: BGP Configuration Guide</i>

### Standards and RFCs

Standard/RFC	Title
RFC 5575	<i>Dissemination of Flow Specification Rules</i>

### MIBs

MIB	MIBs Link
<ul style="list-style-type: none"> <li>CISCO-MIB</li> </ul>	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

**Technical Assistance**

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>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.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a>

## Feature Information for BGP Flow Specification Client

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 [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 1: Feature Information for BGP Flow Specification Client**

Feature Name	Releases	Feature Information
BGP Flow Specification Client	Cisco IOS XE 3.15S	<p>The BGP flow specification client feature enables a device to perform the role of a BGP flow specification client and receive flow specification rules from a BGP flow specification controller.</p> <p>The following command was introduced or modified: <b>flowspec, local-install interface-all</b>.</p>