# Configure BGP IPv6 Flowspec

## Contents

## Introduction

This document describes how to configure Border Gateway Protocol (BGP) IPv6 Flowspec on ASR1K.

## Prerequisites

### Requirements

Cisco recommends that you have knowledge of this topic:

- Platform Independent

### Components Used

The information in this document is based on these software and hardware versions:

- IOS-XE
- ASR1000
- ASR9K
- ASR1K
- BGP
- Flowspec
- IPv6

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, ensure that you understand the potential impact of any command.

# Background Information

Flowspec specifies procedures for the distribution of flow specification rules via BGP and defines the procedure to encode flow specification rules as Border Gateway Protocol Network Layer Reachability Information (BGP NLRI) which 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.

# Limitations

These are the limitations for the configuration:

- A mix of address families is not allowed in flowspec rules.
- In multiple match scenario, only the first matching flowspec rule is applied.
- A maximum of 3000 flowspec rules is supported per system.

# Configure

In this example, we have configured ASR9K as a controller and ASR1K as a PE, RR and Flowspec client.

This is the minimum configuration required for IPv6 Flowspec to work.

```
On controller to push the policy to PE/client:
class-map type traffic match-all FLOWSPEC
 match destination-address ipv6 2001:db8::/32    <<<<< Match destination address/subnet.
 end-class-map
!
policy-map type pbr FS_P
 class type traffic FLOWSPEC                      <<<<< Apply class-map under policy-map.
  drop
 !
flowspec
 address-family ipv4
  service-policy type pbr FSP_V4
 !
 address-family ipv6
  service-policy type pbr FS_P                    <<<<< Apply policy-map inside Flowspec under AF.
 !

On PE/client is to enable IPv6 flowspec AF under BGP.
 address-family ipv6 flowspec                     <<<<< Under ipv6 flowspec AF, activate the
neighbor.
  neighbor 10.192.202.5 activate
  neighbor 10.192.202.5 validation off

To apply the flowspec policy on interface, "local-install interface-all" command is must under
flowspec.
flowspec
 local-install interface-all                      <<<<< Push the policy on interface.
```

- Based on the controller configuration, any traffic destined to 2001:db8::/32 should get dropped
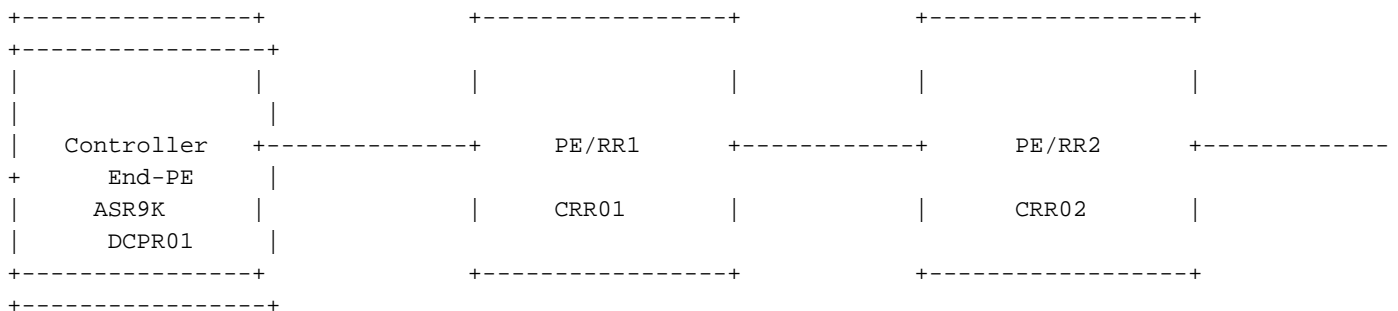
according to the policy.

- Keep the validation off for the neighbor under ipv6 address-family so that ASR1K doesn't check for the next-hop.

- Ideally, if the policy is in action, the counter is seen in the controller but in case if you want to see it on any other device, install flowspec policy on all user interfaces for which **local-install interface-all** command is required under flowspec.

# Challenges During Troubleshoot

- If the underlay network is IPv4 and BGP flowspec runs for IPv6 then there is an issue of validation check on every-hop and causes an issue for IPv6 Flowspec policy. Hence, keep the **validation off** so that neighbor doesn't do validation check.

- Other than a controller, you cannot see the flowspec policy match/action counter. In order to check the counters, **local-install interface-all** is must under Flowspec (under AF). This command pushes the flow specification policy configuration on all interfaces of a device for the IPv4 and IPv6 address families, and on interfaces within a VRF instance.

**Network Diagram**

```
+----------------+              +----------------+           +-----------------+
+----------------+
|                |              |                |           |                 |
|                |
|                |              |                |           |                 |
|    Controller  +--------------+    PE/RR1       +------------+    PE/RR2       +-------------
+     End-PE     |              |                |           |                 |
|     ASR9K      |              |     CRR01       |           |     CRR02       |
|     DCPR01     |              |                |           |                 |
+----------------+              +----------------+           +-----------------+
+----------------+
```

# Configurations

This configuration is based on the network diagram, the same as your setup.

**Controller:**
```
RP/0/RSP0/CPU0:Controller# show running-config
Mon Apr  8 16:33:36.578 UTC
Building configuration...
!! IOS XR Configuration 5.3.4
!! Last configuration change at Wed Apr  3 17:34:59 2019 by admin
!
hostname Controller
cdp
cdp advertise v1
!
class-map type traffic match-all FLOWSPEC
 match destination-address ipv6 2001:db8::/32
 end-class-map
```

```
!
class-map type traffic match-all V4_FLOWSPEC
 match source-address ipv4 102.102.102.102 255.255.255.255
 end-class-map
!
policy-map type pbr FS_P
 class type traffic FLOWSPEC
  drop
 !
 class type traffic class-default
 !
 end-policy-map
!
policy-map type pbr FSP_V4
 class type traffic V4_FLOWSPEC
  set dscp ef
 !
 class type traffic class-default
 !
 end-policy-map
!
interface Loopback0
 ipv4 address 10.192.202.5 255.255.255.255
!
interface Loopback100
 ipv4 address 102.102.102.102 255.255.255.255
 ipv6 address 2001:db8::1/32
!
interface TenGigE0/0/0/0
 ipv4 address 10.10.12.1 255.255.255.0
 ipv6 address 2001:10:10:12::1/64
!
route-policy ALL
  pass
end-policy
!
router static
 address-family ipv4 unicast
  203.202.143.33/32 TenGigE0/0/0/0
 !
 address-family ipv6 unicast
  2003::/64 2001:10:10:12::2
 !
!
router ospfv3 1
 area 0
  interface TenGigE0/0/0/0
   network point-to-point
  !
 !
!
router bgp 64696
 bgp router-id 10.192.202.5
 address-family ipv4 unicast
  network 102.102.102.102/32
 !
 address-family vpnv4 unicast
 !
 address-family ipv4 flowspec
 !
 address-family ipv6 flowspec
 !
 neighbor 203.202.143.33
  remote-as 7474
```

```
  ebgp-multihop 10
  update-source Loopback0
  address-family ipv4 unicast
   route-policy ALL in
   route-policy ALL out
   !
  address-family vpnv4 unicast
   !
  address-family ipv4 flowspec
   route-policy ALL in
   route-policy ALL out
   !
  address-family ipv6 flowspec
   route-policy ALL in
   route-policy ALL out
   !
  !
!
flowspec
 local-install interface-all
 address-family ipv4
  service-policy type pbr FSP_V4
 !
 address-family ipv6
  service-policy type pbr FS_P
 !
!
end
```

**PE/RR1:**
```
CRR01#show running-config
Building configuration...

!
ipv6 unicast-routing
mpls label protocol ldp
!
spanning-tree extend system-id
flowspec
 local-install interface-all
diagnostic bootup level minimal
!
interface Loopback0
 ip address 203.202.143.33 255.255.255.255
 ip ospf 1 area 0
!
interface Loopback1010
 no ip address
 ipv6 address 2001:DB8::10/32
!
interface TenGigabitEthernet0/0/0
 ip address 10.10.12.2 255.255.255.0
 ip ospf network point-to-point
 cdp enable
 ipv6 address 2001:10:10:12::2/64
!
interface TenGigabitEthernet0/0/3
 ip address 10.10.23.2 255.255.255.0
 ip ospf network point-to-point
 ip ospf 1 area 0
 cdp enable
 ipv6 address 2003::1/64
```

```
 mpls ip
!
router ospf 1
 mpls ldp autoconfig
!
router bgp 7474
 bgp router-id 203.202.143.33
 bgp log-neighbor-changes
 neighbor 10.192.202.5 remote-as 64696
 neighbor 10.192.202.5 ebgp-multihop 10
 neighbor 10.192.202.5 update-source Loopback0
 neighbor 2001:10:10:12::1 remote-as 64696
 neighbor 203.202.143.44 remote-as 7474
 neighbor 203.202.143.44 update-source Loopback0
 !
 address-family ipv4
  neighbor 10.192.202.5 activate
  no neighbor 2001:10:10:12::1 activate
  neighbor 203.202.143.44 activate
  neighbor 203.202.143.44 route-reflector-client
 exit-address-family
 !
 address-family ipv4 flowspec
  neighbor 10.192.202.5 activate
  neighbor 203.202.143.44 activate
  neighbor 203.202.143.44 send-community both
  neighbor 203.202.143.44 route-reflector-client
 exit-address-family
 !
 address-family ipv6
  neighbor 10.192.202.5 activate
  neighbor 203.202.143.44 activate
  neighbor 203.202.143.44 route-reflector-client
  neighbor 203.202.143.44 send-label
 exit-address-family
 !
 address-family ipv6 flowspec
  neighbor 10.192.202.5 activate
  neighbor 10.192.202.5 validation off
  neighbor 203.202.143.44 activate
  neighbor 203.202.143.44 send-community both
  neighbor 203.202.143.44 route-reflector-client
  neighbor 203.202.143.44 next-hop-self
 exit-address-family
!
ip route 10.192.202.5 255.255.255.255 10.10.12.1
!
!
ipv6 route 2001:DB8::1/128 2001:10:10:12::1
!
end
```

**PE/RR2:**
```
CRR02#show running-config
Building configuration...

Current configuration : 7227 bytes
!
! Last configuration change at 18:21:29 UTC Mon Apr 8 2019
!
hostname CRR02
!
```

```
boot-start-marker
boot system flash bootflash:asr1000rpx86-universalk9.16.10.01a.SPA.bin
boot-end-marker
!
ipv6 unicast-routing
multilink bundle-name authenticated
!
spanning-tree extend system-id
flowspec
diagnostic bootup level minimal
!
interface Loopback0
 ip address 203.202.143.44 255.255.255.255
 ip ospf 1 area 0
!
interface TenGigabitEthernet1/0/0
 ip address 10.10.23.3 255.255.255.0
 ip ospf network point-to-point
 ip ospf 1 area 0
 cdp enable
 ipv6 address 2003::2/64
 mpls ip
!
interface TenGigabitEthernet1/0/1
 ip address 10.10.34.3 255.255.255.0
 ip ospf network point-to-point
 ip ospf 1 area 0
 cdp enable
!
router ospf 1
 mpls ldp autoconfig
!
router bgp 7474
 bgp router-id 203.202.143.44
 bgp log-neighbor-changes
 neighbor 203.202.143.33 remote-as 7474
 neighbor 203.202.143.33 update-source Loopback0
 neighbor 203.202.143.45 remote-as 7474
 neighbor 203.202.143.45 update-source Loopback0
 !
 address-family ipv4
  neighbor 203.202.143.33 activate
  neighbor 203.202.143.45 activate
 exit-address-family
 !
 address-family ipv4 flowspec
  neighbor 203.202.143.33 activate
  neighbor 203.202.143.45 activate
  neighbor 203.202.143.45 send-community both
  neighbor 203.202.143.45 route-reflector-client
 exit-address-family
 !
 address-family ipv6
  neighbor 203.202.143.33 activate
  neighbor 203.202.143.33 send-label
 exit-address-family
 !
 address-family ipv6 flowspec
  neighbor 203.202.143.33 activate
  neighbor 203.202.143.33 validation off
  neighbor 203.202.143.45 activate
  neighbor 203.202.143.45 send-community both
  neighbor 203.202.143.45 route-reflector-client
 exit-address-family
```

```
!
ipv6 route 2001:10:10:12::/64 2003::1
ipv6 route 2001:DB8::1/128 2003::1
!
end
```

**End-PE:**
```
DCPR01#show running-config
Building configuration...
!
hostname DCPR01
!
subscriber templating
!
ipv6 unicast-routing
!
flowspec
diagnostic bootup level minimal
!
interface Loopback0
 ip address 203.202.143.45 255.255.255.255
 ip ospf 1 area 0
!
interface TenGigabitEthernet1/3/0
 ip address 10.10.34.4 255.255.255.0
 ip ospf network point-to-point
 ip ospf 1 area 0
 cdp enable
 ipv6 address 2001::1/64
!
router ospf 1
 mpls ldp autoconfig
!
router bgp 7474
 bgp router-id 203.202.143.45
 bgp log-neighbor-changes
 neighbor 203.202.143.44 remote-as 7474
 neighbor 203.202.143.44 update-source Loopback0
 !
 address-family ipv4 flowspec
  neighbor 203.202.143.44 activate
 exit-address-family
 !
 address-family ipv6 flowspec
  neighbor 203.202.143.44 activate
  neighbor 203.202.143.44 validation off
 exit-address-family
!
ipv6 route ::/0 TenGigabitEthernet1/3/0
!
end
```

# Verify

```
PE/RR2:
CRR02#ping 2001:db8::1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 2001:DB8::1, timeout is 2 seconds:
.....
```

```
Success rate is 0 percent (0/5)
CRR02#


Controller:
RP/0/RSP0/CPU0:Controller#show bgp ipv6 flowspec
Mon Apr  8 17:55:17.041 UTC
BGP router identifier 10.192.202.5, local AS number 64696
BGP generic scan interval 60 secs
Non-stop routing is enabled
BGP table state: Active
Table ID: 0x0   RD version: 20
BGP main routing table version 20
BGP NSR Initial initsync version 0 (Reached)
BGP NSR/ISSU Sync-Group versions 0/0
BGP scan interval 60 secs


Status codes: s suppressed, d damped, h history, * valid, > best
              i - internal, r RIB-failure, S stale, N Nexthop-discard
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network          Next Hop          Metric LocPrf Weight Path
*> Dest:2001:db8::/0-32/56
                      ::                                    0 i


Processed 1 prefixes, 1 paths
RP/0/RSP0/CPU0:Controller#show flowspec ipv6 detail
Mon Apr  8 17:55:36.786 UTC


AFI: IPv6
  Flow           :Dest:2001:db8::/0-32
    Actions      :Traffic-rate: 0 bps  (policy.1.FS_P.FLOWSPEC)
    Statistics                    (packets/bytes)
      Matched          :                14/1652
      Dropped          :                14/1652
RP/0/RSP0/CPU0:BGL14.1.J.05-ASR-9000-1#


PE/RR1:
CRR01#show bgp ipv6 flowspec
BGP table version is 2, local router ID is 203.202.143.33
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,
              t secondary path,
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found


    Network          Next Hop          Metric LocPrf Weight Path
 *>   Dest:2001:DB8::/0-32
                      ::                                    0 64696 i
CRR01#
CRR01#show flowspec ipv6 detail
AFI: IPv6
  Flow           :Dest:2001:DB8::/0-32
    Actions      :Traffic-rate: 0 bps  (bgp.1)
    Statistics                    (packets/bytes)
      Matched          :                 4/456
      Dropped          :                 4/456


CRR01#
```

# Troubleshoot


There is currently no specific troubleshooting information available for this configuration.

**Tip**: If you open a case with 3.16.5S and hit with [CSCva55510](#) bug id. Though it's not documented in the bug yet it applies for IPv6. This is confirmed from ASR1K BGP BU and is validated. Another bug [CSCvp18767](#) is also filed for show command which is fixed in 16.12.1 hence better to use this release. However, IPv6 flowspec can work in any 16.x release.