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BGP Flowspec Redirects to SR Policy  
draft-li-idr-flowspec-sr-policy-03

## Abstract

BGP Flowspec, an extension of BGP, facilitates the distribution of traffic flow specification rules and supports steering traffic into Segment Routing (SR) Policies. However, current approaches that leverage Flowspec to direct traffic toward a SR Policy exhibit certain limitations (for detailed analysis, refer to Section 1).

Using the Community Container attribute, this document defines two new standard actions for the BGP Flowspec Version 2 (FSv2) protocol: the Redirect to SR Policy Action and the SRv6 SID Action. The former enables traffic to be directed to a designated SR Policy, while the latter supports encapsulating an additional SRv6 SID as required during redirection.

The Redirect to SR Policy Action may be used either independently or in conjunction with the SRv6 SID Action, depending on the specific application scenario. In addition, the SRv6 SID Action can be combined with other actions supported by FSv2, such as the Redirect to IPv6 Action.

## Status of This Memo

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## 1. Introduction

BGP Flow Specification (Flowspec) is defined in [RFC8955] and [RFC8956]. BGP Flowspec Version 2 (FSv2) is defined in [I-D.ietf-idr-flowspec-v2], and SR Policy is defined in [RFC9256].

BGP Flowspec can be used to steer specific traffic into a SR Policy, as illustrated in documents such as [I-D.ietf-idr-ts-flowspec-srv6-policy] and [I-D.ietf0-idr-srv6-flowspec-path-redirect].

The method proposed in [I-D.ietf-idr-ts-flowspec-srv6-policy] leverages the Redirect-to-IP action defined in [I-D.ietf-idr-flowspec-redirect-ip]. It embeds the endpoint information of the SR Policy within the Redirect-to-IP action, and in this scenario, requires the BGP Flowspec protocol to carry color information via BGP attributes, with prefix SID information included as needed. This method adds a new action (Redirect to SR Policy) to

the originally singular "Redirect to IP" action. While reusing attributes or fields defined for other purposes simplifies implementation, it can introduce ambiguity. Notably, the newly added "Redirect to SR Policy" action can only be distinguished by whether BGP attributes include the Color Extended Community attribute. Since the Color Extended Community attribute is optional, it may lead to errors in the following scenarios: (1) "Redirect to SR Policy" may fail if the Color Extended Community attribute is missing; (2) "Redirect to IP" may fail if the Color Extended Community attribute is present. Additionally, [I-D.ietf-idr-ts-flowspec-srv6-policy] is an informational document, not a standard solution for steering traffic into a SR Policy.

[I-D.ietf0-idr-srv6-flowspec-path-redirect] proposes a scheme that indirectly steers traffic into a SR Policy through a Binding SID (BSID). However, this approach requires prior knowledge of the BSID corresponding to the target SR Policy, which imposes significant operational overhead. Furthermore, as explicitly stated in [RFC9256], not all SR Policies are mandated to have a BSID, and the specific value of a BSID may change over time and with state. Therefore, [RFC9256] specifically notes that the BSID should not be used as an identifier for a SR Policy. Consequently, the scheme proposed in [I-D.ietf0-idr-srv6-flowspec-path-redirect] is technically unfeasible.

To address the drawbacks mentioned above, this document extends FSv2 by defining two new standard traffic filtering actions: the Redirect to SR Policy Action and the SRv6 SID Action. These actions are carried in the Community Container attribute [I-D.ietf-idr-wide-bgp-communities] and specifically defined for steering traffic into a SR Policy. The SRv6 SID Action is optional in this use case. It may be used in conjunction with the Redirect to SR Policy Action or other actions defined in FSv2 when needed.

The current version of this document focuses on FSv2 extensions for SRv6 Policy. FSv2 extensions for SR-MPLS Policy will be provided in a later version or written in a separate draft.

### 1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

## 2. FSv2 Extension

This document defines two new traffic filtering actions: the Redirect to SR Policy Action and the SRv6 SID Action. The SRv6 SID Action is optional for the redirect-to-SR Policy use case. It may be used in conjunction with the Redirect to SR Policy Action or other actions defined in FSv2 when needed.

The filtering actions defined in this document are encapsulated and carried via the BGP Community Container Attribute (also known as BGP Wide Communities) [I-D.ietf-idr-wide-bgp-communities]. The definition and format of an Action-SubTLV within the BGP Community Container Attribute are presented in Figure 1.

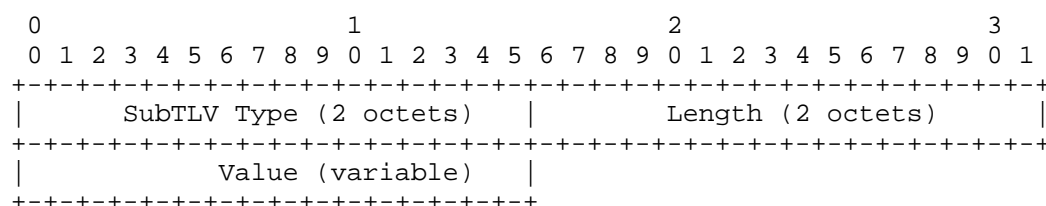


Figure 1: Format of the Action-SubTLV

### 2.1. Redirect to SR Policy Action

The newly defined Redirect to SR Policy Action in this document is represented by the Action-SubTLV.

Where:

SubTLV Type (2 octet): Used to indicate that this Action-SubTLV is a Redirect to SR Policy Action SubTLV. Its value is requested to be assigned by IANA.

Length (2 octet): Measured in byte, used to indicate the total length of the Redirect to SR Policy Action.

Value (variable): Used to specify the particular SR policy to which the traffic is to be directed. Its format is shown in Figure 2.

Conflicts/Interactions: Any redirection or traffic sampling actions:

- \* Traffic Action (action 0x8007, [RFC8955])
- \* Interface Set (action 0x0702, 0x4702, [I-D.ietf-idr-flowspec-interfaceset])

- \* Redirect to Route Target (action 0x8008, 0x8108, 0x8208, 0x000D, [RFC8955][RFC8956])
- \* Flow Specification for SFC Classifiers (action 0x800D, [RFC9015])
- \* Redirect to IPv4 (action 0x010C, [I-D.ietf-idr-flowspec-redirect-ip])
- \* Redirect to IPv6 (action 0x000C, [I-D.ietf-idr-flowspec-redirect-ip])
- \* Redirect to 32-bit Path-id (action 0x0900, [I-D.ietf-idr-flowspec-path-redirect])

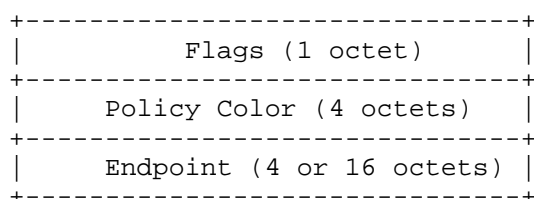


Figure 2: Format of the Value Field in the Redirect to SR Policy Action

Where:

Flags (1 octet): Currently, two bits are defined: the S bit and the F bit. The other bits are reserved. The S bit and the F bit are used to indicate the type of Endpoint, as shown in Figure 3.

Policy Color (4 octets): The color value of the SR policy [RFC9256] to which traffic is to be directed.

Endpoint (4 or 16 octets): The endpoint of the SR policy [RFC9256] to which traffic is to be directed. When the SR policy's endpoint is represented by an IPv6 address, the Endpoint field is 16 bytes in length, and the S bit in the Flags field is set to 1. When the SR policy's endpoint is represented by an IPv4 address, the Endpoint field is 4 bytes in length, and the F bit in the Flags field is set to 1.

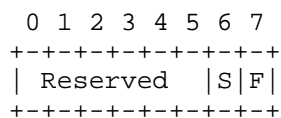


Figure 3: Format of the Flags Field

Where:

S Flag (1 bit): Means Six. When set to 1, it indicates that the Endpoint in the Value Field is represented by an IPv6 address.

F Flag (1 bit): Means Four. When set to 1, it indicates that the Endpoint in the Value Field is represented by an IPv4 address.

Reserved (6 bits): These bits are reserved for future use. They are set to 0 when sending and ignored when receiving.

Exactly one of the S bit and F bit SHOULD be set to 1.

## 2.2. SRv6 SID Action

In certain scenarios, when redirecting specific traffic to a SR Policy for forwarding, the headend node must also encapsulate an additional SRv6 SID. For instance, if the last SID in the SR policy path is not USD (Ultimate Segment Decapsulation) flavored [RFC8986], an additional SRv6 SID is required to be encapsulated by the headend node to instruct the endpoint node to decapsulate the outer packet header.

To address this requirement, we define the second new filtering action for the FSv2, the SRv6 SID Action. This action is optional and may be used in conjunction with the Redirect to SR Policy Action when necessary. It is important to note that the Redirect to SR Policy Action can be used independently, while the SRv6 SID Action may also be combined with other actions defined in FSv2.

The newly defined SRv6 SID Action in this document is represented by the Action-SubTLV (as shown in Figure 1).

Where:

SubTLV Type (2 octet): Used to indicate that this Action-SubTLV is a SRv6 SID Action SubTLV. Its value is requested to be assigned by IANA.

Length (2 octet): Measured in byte, used to indicate the total length of the SRv6 SID Action.

Value (variable): Used to carry the specific SRv6 SID information. Its format is shown in Figure 4.

Conflicts/Interactions: Any redirection actions:

- \* Redirect to SR Policy (action TBD, this document)

- \* Redirect to Route Target (action 0x8008, 0x8108, 0x8208, 0x000D, [RFC8955][RFC8956])
- \* Flow Specification for SFC Classifiers (action 0x800D, [RFC9015])
- \* Redirect to IPv4 (action 0x010C, [I-D.ietf-idr-flowspec-redirect-ip])
- \* Redirect to IPv6 (action 0x000C, [I-D.ietf-idr-flowspec-redirect-ip])
- \* Redirect to 32-bit Path-id (action 0x0900, [I-D.ietf-idr-flowspec-path-redirect])

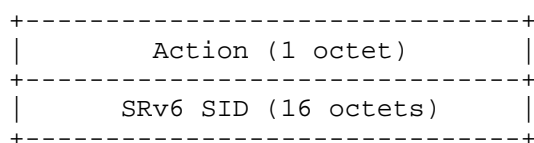


Figure 4: Format of the Value Field in the SRv6 SID Action

Where:

Action (1 octet): Currently, the value of 1 is defined, which represents encapsulation, indicating that the headend node SHOULD encapsulate an additional SRv6 SID carried in the SRv6 SID field when performing the redirect action. The other 255 possible values are reserved for future extensions.

SRv6 SID (16 octets): Its value represents a specific SRv6 SID. The type of this SRv6 SID may be DT4, DT6, DT46, etc., or alternatively an END SID with the USD flavor, as specified in [RFC8956].

### 3. Application Scenario

When the headend node receives a BGP Flowspec policy containing the Redirect to SR Policy Action issued through the extended FSv2 protocol, it configures the corresponding policy. Upon receiving traffic matching the policy, the headend node forwards the matching traffic to the corresponding SR Policy as required by the policy, i.e., encapsulates the traffic in SR and forwards the encapsulated traffic to the corresponding forwarding node via the interface specified by the policy. If the policy received by the headend node, issued through the extended FSv2 protocol, contains both the Redirect to SR Policy Action and the SRv6 SID Action, the headend node configures the policy accordingly. Upon receiving traffic matching the policy, the headend node performs both the redirection to the SR

policy and the action specified by the SRv6 SID action, such as further encapsulating the SRv6 SID carried in the SRv6 SID action.

The forwarding node forwards the packet based on the header information upon receiving the packet. This document does not introduce any new requirements or extensions for the forwarding node.

When traffic arrives at the endpoint node, the endpoint node processes and forwards the packet based on the header information of the received packet. This document introduces no new requirements or extensions for the endpoint node. Even if the received packet contains a SRv6 SID encapsulated by the headend node according to the SRv6 SID Action, the endpoint node will perform the operations corresponding to the instructions of the SRv6 SID. Examples of such operations include: removing the SRv6 Policy encapsulation (i.e., decapsulating the outer IPv6 header), looking up the destination address of the inner packet header in the routing table, and forwarding the packet accordingly. These operations are all part of the endpoint node's normal processing procedures. The endpoint node is unaware that the SID it processes was additionally encapsulated by the headend node per the SRv6 SID Action. In summary, this document imposes no new requirements or extensions on the endpoint node.

#### 4. IANA Considerations

IANA is requested to assign the following code points from the "BGP FSv2 Action types" Registry:

Code Point	Description	Reference
TBD1	Redirect to SR Policy Action	This document
TBD2	SRv6 SID Action	This document

Table 1: Code Point for the Actions

#### 5. Security Considerations

This document does not change the security properties of SR Policy [RFC9256] or BGP Flowspec [RFC8955][RFC8956][I-D.ietf-idr-flowspec-v2].

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