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**BGP Flow-Spec Redirect to IP Action**  
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## Abstract

Flow-spec is an extension to BGP that allows for the dissemination of traffic flow specification rules. This has many possible applications but the primary one for many network operators is the distribution of traffic filtering actions for DDoS mitigation. The flow-spec standard [[RFC 5575](#)] defines a redirect-to-VRF action for policy-based forwarding but this mechanism can be difficult to use, particularly in networks without L3 VPN infrastructure.

This draft defines a new redirect-to-IP flow-spec action that provides a simpler method of policy-based forwarding. The details of the action, including the IPv4 or IPv6 target address, are encoded in newly defined BGP extended communities.

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## **1. Introduction**

Flow-spec is an extension to BGP that allows for the dissemination of traffic flow specification rules. This has many possible applications but the primary one for many network operators is the distribution of traffic filtering actions for DDoS mitigation.

Every flow-spec route is effectively a rule, consisting of a matching part (encoded in the NLRI field) and an action part (encoded in one or more BGP extended communities). The flow-spec standard [[RFC 5575](#)] defines widely-used filter actions such as discard and rate limit; it also defines a redirect-to-VRF action for policy-based forwarding. Using the redirect-to-VRF action for redirecting traffic towards an alternate destination is useful for DDoS mitigation but it can be complex and cumbersome, particularly in networks without L3 VPN infrastructure.

This draft proposes a new redirect-to-IP flow-spec action that provides a simpler method of policy-based forwarding. The details of the action, including the IPv4 or IPv6 target address, are encoded in newly defined BGP extended communities.

## **2. Terminology**

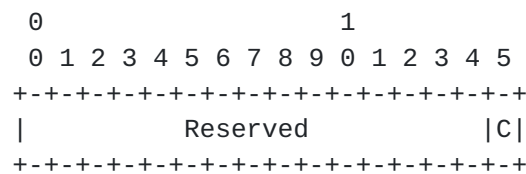
The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC-2119](#)].

## **3. Redirect to IP Extended Communities**

This document defines two new BGP extended communities. The extended communities have a type indicating they are transitive and IPv4-address-specific or IPv6-address-specific, depending on whether the redirection target address is IPv4 or IPv6. The sub-type value [to be assigned by IANA] indicates that the global administrator and local administrator fields encode a flow-spec 'redirect to IP' action. In the new extended communities the 4-byte or 16-byte global administrator field encodes the IPv4 or IPv6 address that is the redirection target address and the 2-byte local administrator field is formatted as shown in Figure 1.



Figure 1 : Local Administrator



In the local administrator field the least-significant bit is defined as the 'C' (or copy) bit. When the 'C' bit is set the redirection applies to copies of the matching packets and not to the original traffic stream.

All bits other than the 'C' bit in the local administrator field MUST be set to 0 by the originating BGP speaker and ignored by receiving BGP speakers.

When a BGP speaker receives a flow-spec route with a 'redirect to IP' extended community and this route represents the one and only best path, it installs a traffic filtering rule that matches the packets described by the NLRI field and redirects them (C=0) or copies them (C=1) towards the IPv4 or IPv6 address in the extended community's global administrator field (the 'target address'). The BGP speaker is expected to do a longest-prefix-match lookup of the 'target address' in its forwarding information base (FIB) and forward the redirected/copied packets based on the resulting route (the 'target route'). If the 'target route' has multiple ECMP next-hops the redirected/copied packets SHOULD be load-shared across these next-hops according to the router's ECMP configuration. If the 'target route' has one or more tunnel next-hops then the appropriate encapsulations SHOULD be added to the redirected/copied packets. If the 'target address' is invalid or unreachable then the extended community SHOULD be ignored.

If a BGP speaker receives a flow-spec route with multiple 'redirect to IP' extended communities and this route represents the one and only best path, it SHOULD load-share the redirected/copied packets across all the 'target addresses' according to its ECMP configuration. If the BGP speaker is not capable of redirecting and copying the same packet it SHOULD ignore the extended communities with C=0. If the BGP speaker is not capable of redirecting/copying a packet towards multiple 'target addresses' it SHOULD deterministically select one 'target address' and ignore the others.

If a BGP speaker receives multiple flow-spec routes for the same flow-spec NLRI and all of them are considered best and usable paths according to the BGP speaker's multipath configuration and each one carries one or more 'redirect to IP' extended communities, the BGP speaker SHOULD load-share the redirected/copied packets across all the 'target addresses', with the same fallback rules as discussed in the previous paragraph. Note that this situation does not require the BGP speaker to have multiple peers - i.e. Add-Paths could be used for the flow-spec address family.

If a BGP speaker receives a flow-spec route with one or more 'redirect to IP' extended communities and one or more 'redirect to VRF' extended communities, and this route represents the one and only best path, the 'redirect to IP' actions described above should be applied in the context of the 'target VRF' matching the 'redirect to VRF' extended community - i.e. the 'target addresses' should be looked up in the FIB of the 'target VRF'. If there are multiple 'redirect to VRF' extended communities in the route the 'target VRF' SHOULD be the one that matches the 'redirect to VRF' extended community with the highest numerical value. If the BGP speaker is not capable of 'redirect to VRF' followed by 'redirect to IP' then it SHOULD give preference to performing the 'redirect to VRF' action and doing only longest-prefix-match forwarding in the 'target VRF'.

If a BGP speaker receives multiple flow-spec routes for the same flow-spec NLRI and all of them are considered best and usable paths according to the BGP speaker's multipath configuration and they carry a combination of 'redirect to IP' and 'redirect to VRF' extended communities, the BGP speaker SHOULD apply the 'redirect to IP' actions in the context of the 'target VRF' as described above. Note that this situation does not require the BGP speaker to have multiple peers - i.e. Add-Paths could be used for the flow-spec address family.

### 3.1. Validation Procedures

The validation check described in [[RFC 5575](#)] and revised in [[VALIDATE](#)] SHOULD be applied by default to received flow-spec routes with a 'redirect to IP' extended community, as it is to all types of flow-spec routes. This means that a flow-spec route with a destination prefix subcomponent SHOULD NOT be accepted from an EBGp peer unless that peer also advertised the best path for the matching unicast route.

BGP speakers that support the extended communities defined in this draft MUST also, by default, enforce the following check when receiving a flow-spec route from an EBGp peer: if the received flow-





spec route has a 'redirect to IP' extended community with a 'target address' X (in the global administrator field) and the best matching route to X is not a BGP route with origin AS matching the peer AS then the extended community should be discarded and not propagated along with the flow-spec route to other peers. It MUST be possible to disable this additional validation check on a per-EBGP session basis.

#### **4. Security Considerations**

A system that originates a flow-spec route with a 'redirect to IP' extended community can cause many receivers of the flow-spec route to send traffic to a single next-hop, overwhelming that next-hop and resulting in inadvertent or deliberate denial-of-service. This is particularly a concern when the 'redirect to IP' extended community is allowed to cross AS boundaries. The validation check described in [section 3.1](#) significantly reduces this risk.

#### **5. IANA Considerations**

This document requests a new sub-type from the "Transitive IPv4-Address-Specific" extended community registry. The sub-type name shall be 'Flow-spec Redirect to IPv4'.

This document requests a new sub-type from the "Transitive IPv6-Address-Specific" extended community registry. The sub-type name shall be 'Flow-spec Redirect to IPv6'.

IANA is requested to deprecate the type 0x0800 type/sub-type.

#### **6. References**

##### 6.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.

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