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Revised Validation Procedure for BGP Flow Specifications
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Abstract

This document describes a modification to the validation procedure defined in RFC 5575 for the dissemination of BGP flow specifications. RFC 5575 requires that the originator of the flow specification matches the originator of the best-match unicast route for the destination prefix embedded in the flow specification. This allows only BGP speakers within the data forwarding path (such as autonomous system border routers) to originate BGP flow specifications. Though it is possible to disseminate such flow specifications directly from border routers, it may be operationally cumbersome in an autonomous system with a large number of border routers having complex BGP policies. The modification proposed herein enables flow specifications to be originated from a centralized BGP route controller.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on October 28, 2018.

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1. Requirements Language

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 [RFC2119].

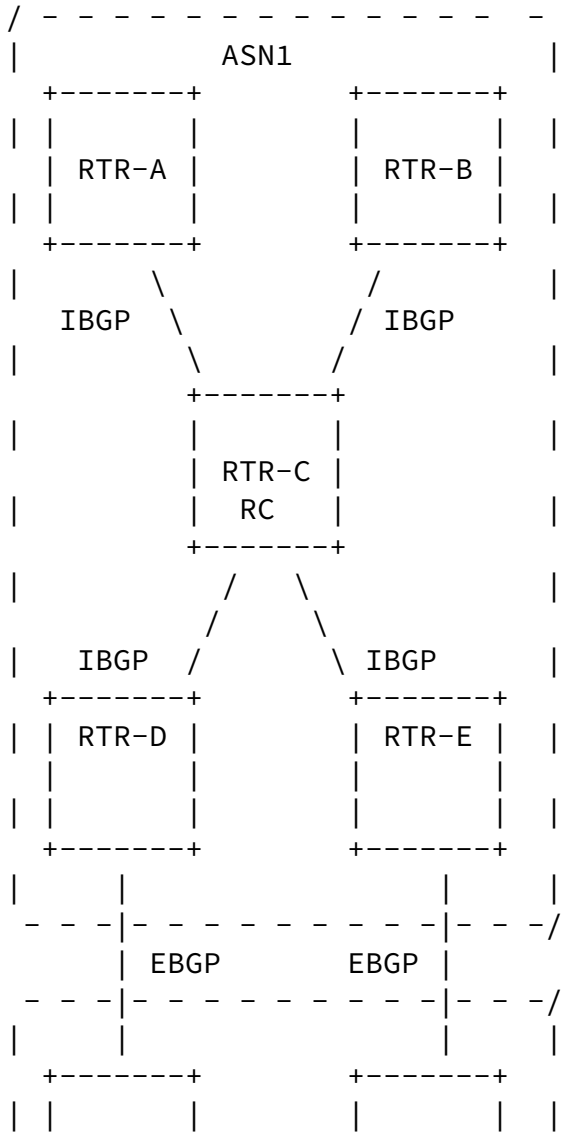
2. Motivation

Step (a) of the validation procedure in [RFC5575], section 6 is defined with the underlying assumption that the flow specification NLRI traverses the same path, in the inter-domain and intra-domain route distribution graph, as that of the longest-match unicast route for the destination prefix embedded in the flow specification.

In the case of inter-domain traffic filtering, for example, the flow specification originator at the egress border routers of ASN1 (RTR-D

and RTR-E in figure 1) matches the EBGP neighbor that advertised the longest match destination prefix (RTR-F and RTR-G respectively). Similarly, at the ingress border routers of ASN1 (RTR-A and RTR-B in figure 1), the flow specification originator matches the egress IBGP border routers that had advertised the unicast route for the best-

match destination prefix (RTR-D and RTR-E respectively). This is true even when ingress border routers select paths from different egress border routers as best path based upon IGP distance (as an example, RTR-A chooses RTR-D's path as best; RTR-B chooses RTR-E as the best path).



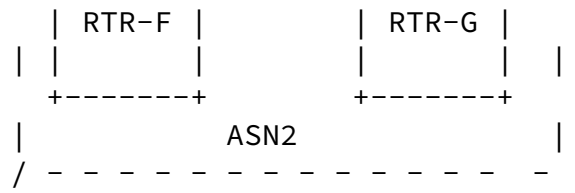


Figure 1

It is highly desirable that each ASN is able to protect itself independently from network security attacks using the BGP flow specification NLRI for intra-domain purposes only. Network operators often deploy a dedicated Security Operations Center (SOC) within

their ASN to monitor and detect such security attacks. To mitigate attacks in a scalable intra-domain manner, operators require the ability to originate intra-domain flow specification NLRIs from a central BGP route controller (or router reflector per [RFC4456]) that is not within the data forwarding plane. In this way, operators can direct border routers within their ASN with specific attack mitigation actions (drop the traffic, forward to a clean-pipe center, etc.). To originate a flow specification NLRI, a central BGP route controller (or route reflector) must set itself as the originator in the flowspec NLRI. This is necessary given the route controller is originating the flow specification not reflecting it, and to avoid the complexity of having to determine the egress border router whose path was chosen as the best in each of the ingress border routers. It thus becomes necessary to modify step (a) of the RFC 5575 validation procedure such that an IBGP peer that is not within the data forwarding plane may originate flow specification NLRIs.

3. Introduction

RFC 5575 defined a new BGP capability that can be used to distribute traffic flow specifications amongst BGP speakers in support of traffic filtering. The primary intention of RFC 5575 is to enable downstream autonomous systems to signal traffic filtering policies to upstream autonomous systems. In this way, traffic is filtered closer to the source and the upstream autonomous system(s) avoid carrying the traffic to the downstream autonomous system only to be discarded. RFC 5575 also enables more granular traffic filtering based upon upper layer protocol information (e.g., protocol port numbers) as opposed to coarse IP destination prefix-based filtering. Flow

specification NLRIs received from a BGP peer are subject to validity checks before being considered feasible and subsequently installed within the respective Adj-RIB-In. The validation procedure defined within RFC 5575 requires that the originator of the flow specification NLRI matches the originator of the best-match unicast route for the destination prefix embedded in the flow specification. This allows only BGP speakers [RFC4271] within the data forwarding path (such as autonomous system border routers) to originate BGP flow specification NLRIs. Though it is possible to disseminate such flow specification NLRIs directly from border routers, it may be operationally cumbersome in an autonomous system with a large number of border routers having complex BGP policies. This document describes a modification to the RFC 5575 validation procedure allowing flow specification NLRIs to be originated from a centralized BGP route controller within the local autonomous system that is neither in the data forwarding path nor serving as a BGP route reflector [RFC4456]. While the proposed modification cannot be used for inter-domain coordination of traffic filtering, it greatly simplifies distribution of intra-domain traffic filtering policies in

an autonomous system with a large number of border routers having complex BGP policies. By relaxing the validation procedure for IBGP, the proposed modification allows flow specifications to be distributed in a standard and scalable manner throughout an autonomous system.

4. Revised Validation Procedure

Step (a) of the validation procedure specified in RFC 5575, section 6 is redefined as follows:

a. One of the following conditions MUST hold true.

* The originator of the flow specification matches the originator of the best-match unicast route for the destination prefix embedded in the flow specification.

* The AS_PATH attribute of the flow specification does not contain AS_SET and AS_SEQUENCE segments.

An AS_PATH without AS_SET and AS_SEQUENCE segments indicates that the flow specification was originated inside the local AS [RFC4271] or

inside the local confederation (in the case that the local AS belongs to a confederation of ASes) [RFC5065]. With this modification to the RFC 5575 validation procedure, it is now possible for an IBGP peer that is not within the data forwarding path to originate flow specification NLRIs. This applies whether the AS belongs or not to a confederation of ASes. Checking the (newly introduced) second condition above MAY be disabled by configuration on a BGP speaker. However, it SHOULD be enabled by default. Disabling the condition may be a good practice when the administrator knows with certainty that there are not flow specification NLRI originated inside the local AS (or local confederation). Optionally, an implementation could be configured to allow only flow specification NLRIs containing only a subset of ASes. This could be useful, for example, with networks that consist of multiple ASes that operate under the same administrative domain.

Further, RFC 5575 states that "BGP (flow specification) implementations MUST also enforce that AS_PATH attribute of a route received via the External Border Gateway Protocol (EBGP) contains the neighboring AS in the left-most position of the AS_PATH attribute". This rule is not valid for all topologies. For example, it prevents the exchange of BGP flow specification NLRIs at Internet exchanges with BGP route servers. Therefore, this document also redefines the RFC 5575 AS_PATH validation procedure referenced above as follows.

BGP flow specification implementations MUST enforce that the last AS added within the AS_PATH attribute of a EBGP learned flow specification NLRI MUST match the last AS added within the AS_PATH attribute of the best-match unicast route for the destination prefix embedded in the flow specification. This proposed modification enables the exchange of BGP flow specification NLRIs at Internet exchanges with BGP route servers while at the same time, for security reasons, prevents an EBGP peer from advertising an inter-domain flow specification for a destination prefix that it does not provide reachability information for. Note, comparing only the last ASes is sufficient for EBGP learned flow specification NLRIs. Requiring a full AS_PATH match would limit origination of inter-domain flow specifications to the origin (or first) AS of the best-match unicast route for the destination prefix embedded in the flow specification only. As such, a full AS_PATH validity check may prevent transit

ASes from originating inter-domain flow specifications which is not desirable.

This document also clarifies proper handling when the BGP flow specification does not embed a destination prefix component. The default behavior SHOULD be not to perform any validation procedure. Further, support for two-octet AS number space is out of the scope of this document.

In this context, AS_PATH attribute is defined as the reconstructed AS Path information (by combining AS_PATH and AS4_PATH attributes, if the BGP speaker is a NEW speaker and receives the route from an OLD speaker), according to section 4.2.3 of RFC 6793.

RFC 5575 references "the best-match unicast route for the destination prefix embedded in the flow specification". For clarity, this route is defined hereby as the best path of the unicast network that covers destination prefix embedded in the flow specification with the longer prefix-length. In other words, we consider only the best-match network and we do not consider unicast non-best paths (even if it is received from the same peer than the flowspec route).

Note that, per RFC 5575, originator may refer to the BGP ORIGINATOR_ID attribute or the transport address of the peer from which we received the update. If the later, a network must be designed so it has a congruent topology. Otherwise, using two peering sessions between the same pair of BGP speakers, one for unicast and one for flowspec, will cause the flowspec validation procedure to fail. Consider, for example, the case where a BGP route reflector receives the NLRIs from a route reflector client, thus not receiving the ORIGINATOR_ID attribute. If the speaker belongs to a confederation [RFC5065] and we are receiving a flowspec route from different peers than its best match unicast route, the flowspec

validation procedure will fail as well. Consider also a misconfiguration where flowspec address-family is not configured for a particular peering between different member-AS (but it is configured for unicast). Even if we receive the flowspec route via a redundant peer, we may receive the unicast route and the flowspec from different peers, and thus flowspec validation will fail. With the (newly introduced) second condition above applied, uncongruent topologies are supported.

5. IANA Considerations

This memo includes no request to IANA.

6. Security Considerations

No new security issues are introduced by relaxing the validation procedure for IBGP learned flow specifications. With this proposal, the security characteristics of BGP flow specifications remain equivalent to the existing security properties of BGP unicast routing. Traffic flow specifications learned from IBGP peers are trusted, hence, it is not required to validate that the originator of an intra-domain traffic flow specification matches the originator of the best-match unicast route for the flow destination prefix. Conversely, this proposal continues to enforce the validation procedure for EBGP learned traffic flow specifications. In this way, the security properties of RFC 5575 are maintained such that an EBGP peer cannot cause a denial-of-service attack by advertising an inter-domain flow specification for a destination prefix that it does not provide reachability information for.

7. Acknowledgements

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8. Normative References

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