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Q. Liang
J. You
Huawei
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Carrying Label Information for BGP FlowSpec
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Abstract

This document specifies a method in which the label mapping information for a particular FlowSpec rule is piggybacked in the same Border Gateway Protocol (BGP) Update message that is used to distribute the FlowSpec rule. Based on the proposed method, the Label Switching Routers (LSRs) (except the ingress LSR) on the Label Switched Path (LSP) can use label to indentify the traffic matching a particular FlowSpec rule; this facilitates monitoring and traffic statistics for FlowSpec rules. Meanwhile, using label for FlowSpec rule can improve forwarding performance in BGP VPN/MPLS networks.

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 [RFC2119].

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 January 6, 2016.

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1. Introduction

[RFC5575] defines the flow specification (FlowSpec) that is an n-tuple consisting of several matching criteria that can be applied to IP traffic. The matching criteria can include elements such as source and destination address prefixes, IP protocol, and transport protocol port numbers. A given IP packet is said to match the defined flow if it matches all the specified criteria. [RFC5575] also defines filtering actions, such as rate limit, redirect, marking, associated with each flow specification. A new Border Gateway Protocol Network Layer Reachability Information (BGP NLRI) (AFI/SAFI: 1/133 for IPv4, AFI/SAFI: 1/134 for VPNv4) encoding format is used to distribute traffic flow specifications.

[RFC3107] specifies the way in which the label mapping information for a particular route is piggybacked in the same Border Gateway Protocol Update message that is used to distribute the route itself. Label mapping information is carried as part of the Network Layer Reachability Information (NLRI) in the Multiprotocol Extensions attributes. The Network Layer Reachability Information is encoded as one or more triples of the form <length, label, prefix>. The NLRI

contains a label is indicated by using Subsequent Address Family Identifier (SAFI) value 4.

[RFC4364] describes a method in which each route within a Virtual Private Network (VPN) is assigned a Multiprotocol Label Switching (MPLS) label. If the Address Family Identifier (AFI) field is set to 1, and the SAFI field is set to 128, the NLRI is an MPLS-labeled VPN-IPv4 address.

In BGP VPN/MPLS networks, label switching is more efficient than IP routing. As FlowSpec rules are used for packet processing and forwarding, label-based forwarding can effectively improve the route lookup performance in the data plane. When FlowSpec rules on multiple forwarding devices in the network bound with labels form one or more LSPs, only the ingress LSR (Label Switching Router) needs to identify a particular traffic flow based on the matching criteria and then steers the packet to a corresponding LSP (Label Switched Path). Other LSRs of the LSP just need to forward the packet according to the label carried in it.

Though the FlowSpec rule could use the label(s) bound with the best-match unicast route for the destination prefix embedded in the FlowSpec rule or the best-match route to the target IP in the 'redirect to IP' action, this way means that if two or more FlowSpec rules have the same best-match unicast route for the embedded destination prefix or the same best-match route to target IP in the 'redirect to IP' action; they would be mapped to the same label. This would affect monitoring and traffic statistics facilities, because each FlowSpec rule requires an independent statistic and log data, which is described in Section 9 [RFC5575]. The LSRs (except the ingress LSR) on the LSP can use label to indentify the traffic matching a particular FlowSpec rule; this facilitates monitoring and traffic statistics for FlowSpec rules.

So this document proposes that the BGP router supports to allocate a unique label to a FlowSpec rule, the forwarding path is still decided by the best-match unicast route for the embedded destination prefix or the best-match route to target IP in the 'redirect to IP' action. Figure 1 gives an example that FlowSpec rule bound with a label is disseminated in the network.

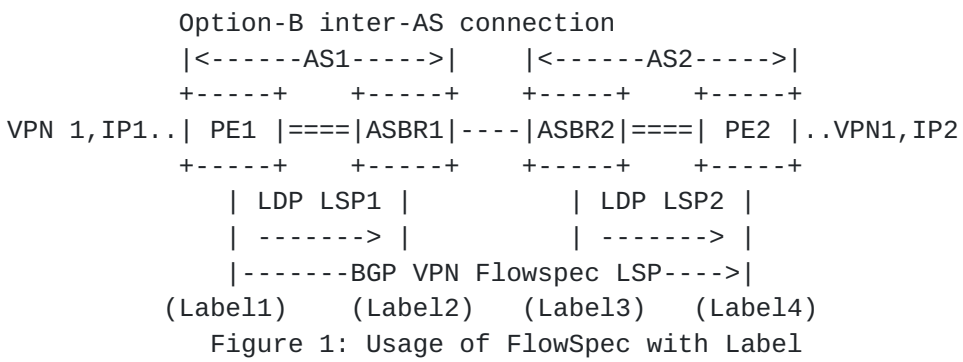


Figure 1: Usage of FlowSpec with Label

FlowSpec rule1 (injected in PE2):

Filters:

destination ip prefix:IP2/32

source ip prefix:IP1/32

Actions:

traffic-marking: 1

Labels allocated for FlowSpec1:

Label4 allocated by PE2

Label3 allocated by ASBR2

Label2 allocated by ASBR1

Label1 allocated by PE1

PE2 disseminates the FlowSpec1 bound with Label4 to ASBR2.
ASBR2 disseminates the FlowSpec1 bound with Label3 to ASBR1.
ASBR1 disseminates the FlowSpec1 bound with Label2 to PE1.

Forwarding information for the traffic from IP1 to IP2 in the Routers:

PE1: in(<IP2,IP1>) --> out(Label2)

ASBR1: in(Label2) --> out(Label3)

ASBR2: in(Label3) --> out(Label4)

PE2: in(Label4) --> out(--)

So ASBR1 can do traffic statistics for FlowSpec rule 1 based on Label2; ASBR2 can do it based on Label3; and PE2 can do it based on Label4.

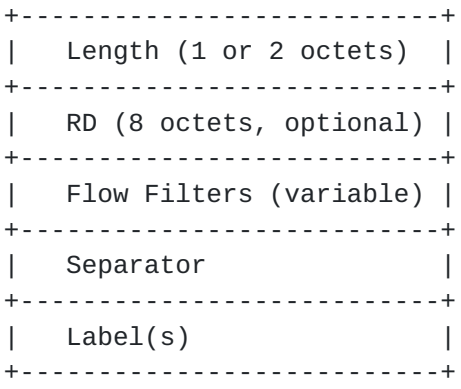
2. Terminology

This section contains definitions of terms used in this document.

Flow Specification (FlowSpec): A flow specification is an n-tuple consisting of several matching criteria that can be applied to IP traffic, including filters and actions. Each FlowSpec consists of a set of filters and a set of actions.

3. Protocol Extensions

In this document, BGP is used to distribute the FlowSpec rule bound with label(s). Two new SAFIs should be defined, i.e. SAFI: TBD1 for IP FlowSpec rule bound with label(s), SAFI: TBD2 for VPN FlowSpec rule bound with label(s). The Network Layer Reachability Information for this FlowSpec rule is encoded as one or more triples of the form <length, RD (optional), FlowSpec, label(s) (optional)>, whose fields are described below:



The use and the meaning of these fields are as follows:

Length: The Length field indicates the length in bytes of the flow filters, the RD, the separator and the label(s).

RD: Route Distinguisher (8 bytes), when SAFI=TBD2.

Separator: This field is the constant bit pattern 0xfe (hex),which indicates the separation between the flow filters field and lable(s) field. This value should not be used by flow filters.

Label(s): This field carries zero or more labels (that corresponds to the stack of labels [RFC3032]). Each label is encoded as 3 octets, where the high-order 20 bits contain the label value, and the low order bit contains "Bottom of Stack" [RFC3032].

Flow Filters: This field consists of several optional subcomponents defined in section 4 [RFC5575]. The combination of RD and Flow Filters is equal to the flow-spec NLRI defined in [RFC5575].

For the purpose of BGP route key processing, only the Route Distinguisher, Flow Filters fields are considered to be part of the prefix in the NLRI.

4. IANA Considerations

For the purpose of this work, IANA should allocate values for two SAFIs:

SAFI TBD1 for IP FlowSpec rule bound with label(s).

SAFI TBD2 for VPN FlowSpec rule bound with label(s).

5. Security considerations

This extension to BGP does not change the underlying security issues inherent in the existing BGP.

6. Acknowledgement

The authors would like to thank Shunwan Zhuang, Zhenbin Li and Peng Zhou for their comments.

7. Normative References

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Authors' Addresses

Qiandeng Liang
Huawei
101 Software Avenue, Yuhuatai District
Nanjing, 210012
China

Email: liangqiandeng@huawei.com

Jianjie You
Huawei
101 Software Avenue, Yuhuatai District
Nanjing, 210012
China

Email: youjianjie@huawei.com