Traffic Steering using BGP Flowspec with SRv6 Policy
draft-jiang-idr-ts-flowspec-srv6-policy-04

Abstract

   BGP Flow Specification (FlowSpec) [RFC8955] has been proposed to
   distribute BGP FlowSpec NLRI to FlowSpec clients to mitigate
   (distributed) denial-of-service attacks, and to provide traffic
   filtering in the context of a BGP/MPLS VPN service. Recently,
   traffic steering applications in the context of SRv6 using FlowSpec
   aslo attract attention. This document introduces the usage of BGP
   FlowSpec to steer packets into an SRv6 Policy.

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].

Table of Contents

1. Introduction

   Segment Routing IPv6 (SRv6) is a protocol designed to forward IPv6
   data packets on a network using the source routing model. SRv6
   enables the ingress to add a segment routing header (SRH) [RFC8754]
   to an IPv6 packet and push an explicit IPv6 address stack into the
   SRH. After receiving the packet, each transit node updates the IPv6
   destination IP address in the packet and segment list to implement
   hop-by-hop forwarding.

   SRv6 Policy [I-D.ietf-spring-segment-routing-policy] is a tunneling
   technology developed based on SRv6. An SRv6 Policy is a set of
   candidate paths consisting of one or more segment lists, that is,
   segment ID (SID) lists. Each SID list identifies an end-to-end path
   from the source to the destination, instructing a device to forward
   traffic through the path rather than the shortest path computed using
   an IGP. The header of a packet steered into an SRv6 Policy is
   augmented with an ordered list of segments associated with that SRv6

Policy, so that other devices on the network can execute the
instructions encapsulated into the list.

The headend of an SRv6 Policy may learn multiple candidate paths for
an SRv6 Policy. Candidate paths may be learned via a number of
different mechanisms, e.g., CLI, NetConf, PCEP, or BGP.

[RFC8955] defines the flow specification (FlowSpec) that allows to
convey flow specifications and traffic Action/Rules associated (rate-
limiting, redirect, remark ...). BGP Flow specifications are encoded
within the MP_REACH_NLRI and MP_UNREACH_NLRI attributes. Rules
(Actions associated) are encoded in Extended Community attribute.
The BGP Flow Specification function allows BGP Flow Specification
routes that carry traffic policies to be transmitted to BGP Flow
Specification peers to steer traffic.

This document proposes BGP flow specification usage that are used to
steer data flow into an SRv6 Policy as well as to indicate Tailend
function.

2. Definitions and Acronyms

o FlowSpec: Flow Specification

o SR: Segment Routing

o SRv6: IPv6 Segment Routing

o SID: Segment Identifier

o SRH: Segment Routing Header

o TE: Traffic Engineering

3. Operations

An SRv6 Policy [I-D.ietf-spring-segment-routing-policy] is identified
through the tuple <headend, color, endpoint>. In the context of a
specific headend, one may identify an SRv6 policy by the <color,
endpoint> tuple. The headend is the node where the SRv6 policy is
instantiated/implemented. The headend is specified as an IPv4 or
IPv6 address and is expected to be unique in the domain. The
endpoint indicates the destination of the SRv6 policy. The endpoint
is specified as an IPv6 address and is expected to be unique in the
domain. The color is a 32-bit numerical value that associates the
SRv6 Policy, and it defines an application-level network Service
Level Agreement (SLA) policy.

Assume one or multiple SRv6 Policies are already setup in the SRv6
HeadEnd device. In order to steer traffic into a specific SRv6
policy at the Headend, one can use the SRv6 color extended community
and endpoint to map to a satisfying SRv6 policy, and steer traffic
into this specific policy.

[I-D.ietf-idr-flowspec-redirect-ip] defines the redirect to IPv4 and
IPv6 Next-hop action. The IPv6 next-hop address in the Flow-spec
Redirect to IPv6 Extended Community can be used to specify the
endpoint of the SRv6 Policy. When the packets reach to the TailEnd
device, some specific function imformation identifiers can be used
decide how to further process the flows. Several endpoint functions
are already defined, e.g., End.DT6: Endpoint with decapsulation and
IPv6 table lookup, and End.DX6: Endpoint with decapsulation and IPv6
cross-connect. The BGP Prefix-SID defined in [RFC8669] is utilized
to enable SRv6 VPN services [I-D.ietf-bess-srv6-services]. SRv6
Services TLVs within the BGP Prefix-SID Attribute can be used to
indicate the endpoint functions.

This document proposes to carry the Color Extended Community and BGP
Prefix-SID Attribute in the context of a Flowspec NLRI [RFC8955] to
an SRv6 Headend to steer traffic into one SRv6 policy, as well as to
indicate specific Tailend functions.

In this document, the usage of at most one Color Extended Community
in combination at most one BGP Prefix SID Attribute is discussed.
For the case that a flowspec route carries multiple Color Extend
Communities and/or a BGP Prefix SID Attribute, a protocol extension
to Flowspec is required, and is thus out of the scope of this
document.

However, the method proposed in this document still supports load
balancing to the tailend device. To achieve that, the headend device
CAN set up multiple paths in one SRv6 policy, and use a Flowspec
route to indicate the specific SRv6 policy.

4. Application Example

In following scenario, BGP FlowSpec Controller signals the function
imformation (SRv6 SID: Service_id_x) to the HeadEnd device.

```
  +------------+
  |  BGP FS    |
  | Controller |
  +------------+
     | Flowspec route to HeadEnd:
     |   NLRI: Filter Rules
     |   Redirect to IPv6 Nexthop: TailEnd's Address
     |   Policy Color: C1
     |   PrefixSID: Service_id_x
     |          .-----.
     |        (        )
     V     .--(          )--.
 +-------+ (                  ) +-------+
 |       |_( SRv6 Core Network )_|       |
 |HeadEnd| ( ================> ) |TailEnd|
 +-------+  (SR List<S1,S2,S3>)  +-------+
          '--(          )--'   Service SID: Service_id_x
             (        )        (e.g.: End.DT4 or End.DT6 or others)
              '-----'
```

           Figure 1: Steering the Flow into SRv6 Policy

   When the headend device (as a Flowspec client) receives such
   instructions, it will steer the flows matching the criteria in the
   Flowspec route into the SRv6 Policy matching the tuple (Endpoint:
   TailEnd's Address, Color: C1). And the packets of such flows will be
   encapsulated with SRH using the SR List<S1, S2, S3, Service_id_x>.
   When the packets reach to the TailEnd device, they will be further
   procetssed per the function denoted by the Service_id_x.

   For the cases of intra-AS and inter-AS traffic steering using this
   method, the usages of Flowspec Color Extended Community with BGP
   prefix SID are the same for both scenarios. The difference lie
   between the local SRv6 policy configurations. For the inter-domain
   case, the operator can configure an inter-domain SRv6 policy/path at
   the Headend device. For the intra-domain case, the operator can
   configure an intra-domain SRv6 policy/path at the Headend device.

[5]. IANA Considerations

   No IANA actions are required for this document.

[6]. Security Considerations

   This document does not change the security properties of SRv6 and
   BGP.

[7](#). **Contributors**

The following people made significant contributions to this document:

Yunan Gu
Huawei
Email: guyunan@huawei.com

Shunwan Zhaung
Huawei
Email: zhuangshunwan@huawei.com

Haibo Wang
Huawei
Email: rainsword.wang@huawei.com

Jie Dong
Huawei
Email: jie.dong@huawei.com

[8](#). **Acknowledgements**

TBD.

[9](#). **References**

[9.1](#). **Normative References**

[I-D.ietf-bess-srv6-services]
          Dawra, G., Filsfils, C., Talaulikar, K., Raszuk, R.,
          Decraene, B., Zhuang, S., and J. Rabadan, "SRv6 BGP based
          Overlay Services", draft-ietf-bess-srv6-services-07 (work
          in progress), April 2021.

[I-D.ietf-idr-flowspec-redirect-ip]
          Uttaro, J., Haas, J., Texier, M., Karch, A., Ray, S.,
          Simpson, A., and W. Henderickx, "BGP Flow-Spec Redirect to
          IP Action", draft-ietf-idr-flowspec-redirect-ip-02 (work
          in progress), February 2015.

[I-D.ietf-idr-segment-routing-te-policy]
          Previdi, S., Filsfils, C., Talaulikar, K., Mattes, P.,
          Rosen, E., Jain, D., and S. Lin, "Advertising Segment
          Routing Policies in BGP", draft-ietf-idr-segment-routing-
          te-policy-11 (work in progress), November 2020.

[I-D.ietf-idr-tunnel-encaps]
          Patel, K., Velde, G. V. D., Sangli, S. R., and J. Scudder,
          "The BGP Tunnel Encapsulation Attribute", draft-ietf-idr-
          tunnel-encaps-22 (work in progress), January 2021.

[I-D.ietf-spring-segment-routing-policy]
          Filsfils, C., Talaulikar, K., Voyer, D., Bogdanov, A., and
          P. Mattes, "Segment Routing Policy Architecture", draft-
          ietf-spring-segment-routing-policy-11 (work in progress),
          April 2021.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
           Requirement Levels", BCP 14, RFC 2119,
           DOI 10.17487/RFC2119, March 1997,
           <https://www.rfc-editor.org/info/rfc2119>.

[RFC8669] Previdi, S., Filsfils, C., Lindem, A., Ed., Sreekantiah,
           A., and H. Gredler, "Segment Routing Prefix Segment
           Identifier Extensions for BGP", RFC 8669,
           DOI 10.17487/RFC8669, December 2019,
           <https://www.rfc-editor.org/info/rfc8669>.

[RFC8955] Loibl, C., Hares, S., Raszuk, R., McPherson, D., and M.
           Bacher, "Dissemination of Flow Specification Rules",
           RFC 8955, DOI 10.17487/RFC8955, December 2020,
           <https://www.rfc-editor.org/info/rfc8955>.

9.2. Informative References

[RFC4456] Bates, T., Chen, E., and R. Chandra, "BGP Route
           Reflection: An Alternative to Full Mesh Internal BGP
           (IBGP)", RFC 4456, DOI 10.17487/RFC4456, April 2006,
           <https://www.rfc-editor.org/info/rfc4456>.

[RFC8754] Filsfils, C., Ed., Dukes, D., Ed., Previdi, S., Leddy, J.,
           Matsushima, S., and D. Voyer, "IPv6 Segment Routing Header
           (SRH)", RFC 8754, DOI 10.17487/RFC8754, March 2020,
           <https://www.rfc-editor.org/info/rfc8754>.

Authors' Addresses

   Wenying Jiang
   China Mobile
   Beijing
   China

   Email: jiangwenying@chinamobile.com

Yisong Liu
China Mobile
Beijing
China

Email: liuyisong@chinamobile.com

Shuanglong Chen
Huawei
Beijing
China

Email: chenshuanglong@huawei.com