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Authors: J. Dong
Huawei Technologies
Z. Hu
Huawei Technologies
R. Pang
China Unicom

BGP SR Policy Extensions for Network Resource Partition

Abstract

Segment Routing (SR) Policy is a set of candidate paths, each consisting of one or more segment lists and the associated information. The header of a packet steered in an SR Policy is augmented with an ordered list of segments associated with that SR Policy. A Network Resource Partition (NRP) is a collection of network resources allocated in the network which can be used to support one or a group of IETF network slice services.

In networks where there are multiple NRPs, an SR Policy may be associated with a particular NRP. The association between SR Policy and NRP needs to be specified, so that for service traffic which is steered into the SR Policy, the header of the packets can be augmented with the information associated with the NRP. An SR Policy candidate path can be distributed using BGP SR Policy. This document defines the extensions to BGP SR policy to specify the NRP which the SR Policy candidate path is associated with.

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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1. Introduction

The concept of Segment Routing (SR) policy is defined in [I-D.ietf-spring-segment-routing-policy]. An SR Policy is a set of candidate paths, each consisting of one or more segment lists. The head end of an SR Policy may learn multiple candidate paths for an SR Policy. The header of a packet steered in an SR Policy is augmented with an ordered list of segments associated with that SR Policy. The BGP extensions to distribute SR Policy candidate paths is defined in [I-D.ietf-idr-segment-routing-te-policy].

[I-D.ietf-teas-ietf-network-slices] introduces the concept and the characteristics of IETF network slice, and describes a general framework for IETF network slice management and operation. It also introduces the concept Network Resource Partition (NRP), which is a collection of resources identified in the underlay network. IETF network slice can be realized by mapping a set of connectivity constructs to a network resource partition (NRP). [I-D.ietf-teas-enhanced-vpn] describes the framework and the candidate component technologies for providing enhanced VPN (VPN+) services based on VPN

and Traffic Engineering (TE) technologies. Enhanced VPN (VPN+) can be used for the realization of IETF network slices. In the context of network slicing, an NRP is considered as an instantiation of the VTN as defined in [I-D.ietf-teas-enhanced-vpn].

As described in [I-D.dong-teas-nrp-scalability], one scalable data plane approach is to carry a dedicated NRP ID in the data packet to identify the NRP the packet belongs to, so that the packet can be processed and forwarded using the set of network resources allocated to the NRP.

In networks where there are multiple NRPs, an SR Policy may be associated with a particular NRP. The association between SR Policy and NRP needs to be specified, so that for service traffic which is steered into the SR Policy, the header of the packets can be augmented with the information associated with the NRP. An SR Policy candidate path can be distributed using BGP SR Policy. This document defines the extensions to BGP SR policy to specify the NRP which the SR Policy candidate path is associated with.

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 BCP14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

2. NRP Identifier of SR Policy

In order to specify the NRP the candidate path of SR policy is associated with, a new sub-TLV called "NRP sub-TLV" is defined in the BGP Tunnel Encapsulation Attribute [RFC9012]. The NRP sub-TLV can be carried in the BGP Tunnel Encapsulation Attribute with the tunnel type set to SR Policy.

The NRP sub-TLV is optional and MUST NOT appear more than once for one SR Policy candidate path. If the NRP sub-TLV appears more than once, the associated BGP SR Policy NLRI is considered malformed and the "treat-as-withdraw" strategy of [RFC7606] is applied.

The NRP sub-TLV has the following format:

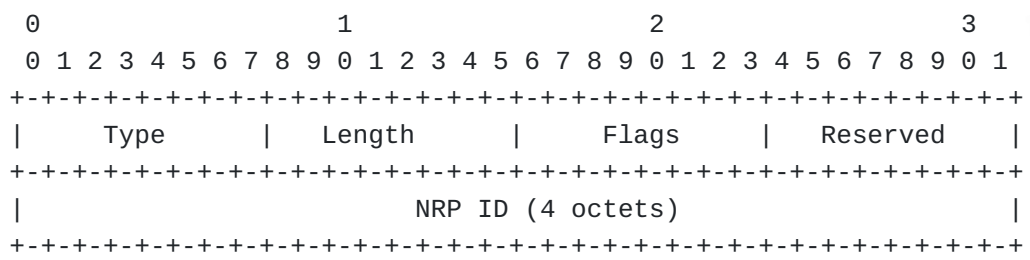

Figure 1. NRP Sub-TLV

where:

*Type: 123

*Length: 6

*Flags: 1-octet flag field. None is defined at this stage. The flags SHOULD be set to zero on transmission and MUST be ignored on receipt.

*RESERVED: 1 octet of reserved bits. It SHOULD be set to zero on transmission and MUST be ignored on receipt.

*NRP ID: A 32-bit domain significant identifier which is used to identify a NRP. Value 0 and 0xFFFFFFFF are reserved.

The encoding structure of BGP SR Policy with the NRP sub-TLV is expressed as below:

```
SR Policy SAFI NLRI: <Distinguisher, Policy-Color, Endpoint>
Attributes:
   Tunnel Encaps Attribute (23)
      Tunnel Type: SR Policy
          Binding SID
          Preference
          Priority
          Policy Name
          Explicit NULL Label Policy (ENLP)
          NRP
          Segment List
              Weight
              Segment
              Segment
              ...
          ...
```

3. Procedures

When a candidate path of SR Policy is instantiated with a specific NRP, the originating node of SR Policy SHOULD include the NRP sub-TLV in the BGP Tunnel Encapsulation Attribute of the BGP SR Policy.

The setting of other fields and attributes in BGP SR Policy SHOULD follow the mechanism as defined in [I-D.ietf-idr-segment-routing-te-policy].

When a BGP speaker receives an SR Policy which is acceptable and usable according to the rules as defined in [I-D.ietf-idr-segment-routing-te-policy], and the SR Policy candidate path selected as the best candidate path is associated with an NRP, the receiver node of the SR Policy SHOULD encapsulate the NRP ID in the header of packets which are steered to the SR Policy. For SR Policy with IPv6 data plane, the approach is to encapsulate the NRP ID in IPv6 Hop-by-Hop Options header using the mechanism as defined in [I-D.ietf-6man-enhanced-vpn-vtn-id]. For SR Policy with MPLS data plane, one possible mechanism to encapsulate the NRP ID to the packet is defined in [I-D.li-mpls-enhanced-vpn-vtn-id].

Although the proposed mechanism allows that different candidate paths in one SR policy be associated with different NRPs, in normal network scenarios it is considered that the association between an SR Policy and NRP is consistent, in such case all candidate paths of one SR policy SHOULD be associated with the same NRP.

4. Security Considerations

The security considerations of BGP and BGP SR policy apply to this document.

5. IANA Considerations

IANA has assigned the sub-TLV type as defined in Section 3 from "BGP Tunnel Encapsulation Attribute sub-TLVs" registry.

Value	Description	Reference
123	NRP	This document

6. Acknowledgments

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7. References

7.1. Normative References

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Authors' Addresses

Jie Dong
Huawei Technologies

Email: jie.dong@huawei.com

Zhibo Hu
Huawei Technologies

Email: huzhibo@huawei.com

Ran Pang
China Unicom

Email: pangran@chinaunicom.cn