             BGP Extensions of SR Policy for Composite Candidate Path
                  draft-li-idr-sr-policy-composite-path-00

Abstract

   Segment Routing is a source routing paradigm that explicitly
   indicates the forwarding path for packets at the ingress node. An SR
   Policy is associated with one or more candidate paths. A candidate
   path is either dynamic, explicit or composite. This document defines
   extensions to BGP to distribute SR policies carrying composite
   candidate path information. So that composite candidate paths can be
   installed when the SR policy is applied.

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1. Introduction

Segment routing (SR) [RFC8402] is a source routing paradigm that
explicitly indicates the forwarding path for packets at the ingress
node. The ingress node steers packets into a specific path according
to the Segment Routing Policy (SR Policy) as defined in
[I-D.ietf-spring-segment-routing-policy]. In order to distribute SR
policies to the headend, [I-D.ietf-idr-segment-routing-te-policy]
specifies a mechanism by using BGP.

An SR Policy is associated with one or more candidate paths. A
composite candidate path acts as a container for grouping of SR
Policies. As described in section 2.2 in
[I-D.ietf-spring-segment-routing-policy], the composite candidate
path construct enables combination of SR Policies, each with explicit
candidate paths and/or dynamic candidate paths with potentially
different optimization objectives and constraints, for a load-
balanced steering of packet flows over its constituent SR Policies.

This document defines extensions to Border Gateway Protocol (BGP) to
distribute SR policies carrying composite candidate path information.
So that composite candidate paths can be installed when the SR policy
is applied.

2. Terminology

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 BCP

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

3. Constituent SR Policy Attributes in SR Policy

As defined in [I-D.ietf-idr-segment-routing-te-policy], the SR policy
encoding structure is as follows:

```
SR Policy SAFI NLRI: <Distinguisher, Policy-Color, Endpoint>
    Attributes:
        Tunnel Encaps Attribute (23)
            Tunnel Type: SR Policy
                Binding SID
                SRv6 Binding SID
                Preference
                Priority
                Policy Name
                Policy Candidate Path Name
                Explicit NULL Label Policy (ENLP)
                Segment List
                    Weight
                    Segment
                    Segment
                    ...
                ...
```

As described in section 2.2 in
[I-D.ietf-spring-segment-routing-policy], the endpoints of the
constituent SR Policies and the parent SR Policy MUST be identical,
and the colors of each of the constituent SR Policies and the parent
SR Policy MUST be different. Therefore a constituent SR Policy is
referenced only by color in the composite candidate path since its
headend and endpoint are identical to the parent SR policy.

SR policy with composite candidate path information is expressed as
below:

```
SR Policy SAFI NLRI: <Distinguisher, Policy-Color, Endpoint>
    Attributes:
        Tunnel Encaps Attribute (23)
            Tunnel Type: SR Policy
                Binding SID
                SRv6 Binding SID
                Preference
                Priority
                Policy Name
                Policy Candidate Path Name
                Explicit NULL Label Policy (ENLP)
                Segment List
                    Weight
                    Segment
                    Segment
                    ...
                Constituent SR Policy
                    Weight
                ...
```

3.1. Constituent SR Policy Sub-TLV

The Constituent SR Policy sub-TLV encodes a single composite path
towards the endpoint. The Constituent SR Policy sub-TLV is an
optional sub-TLV of BGP Tunnel Encapsulation Attribute, and MAY
appear multiple times in the SR Policy encoding. The ordering of
Constituent SR Policy sub-TLVs does not matter. The Constituent SR
Policy sub-TLV MAY contain a Weight sub-TLV.

Since a candidate path is either dynamic, explicit or composite, the
Constituent SR Policy sub-TLV and the Segment List sub-TLV SHOULD NOT
appear in the same BGP Tunnel Encapsulation Attribute.

The Constituent SR Policy sub-TLV has the following format:

```
0                   1                   2                   3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     Type      |    Length     |            RESERVED           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                            Color                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                           sub-TLVs                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

where:

o Type: to be assigned by IANA.

o Length: the total length of the value field not including Type and
   Length fields.

o RESERVED: 2 octet of reserved bits. SHOULD be set to zero on
   transmission and MUST be ignored on receipt.

o Color: 4-octet value identifying the constituent SR policy.

o sub-TLVs currently defined:

   * An optional single Weight sub-TLV which is defined in section
      2.4.4.1 in [I-D.ietf-idr-segment-routing-te-policy]. According
      to [I-D.ietf-spring-segment-routing-policy], the fraction of
      flows steered into each constituent SR Policy is equal to the
      relative weight of each constituent SR Policy.

4. Operations

The document does not bring new operation beyond the description of
operations defined in [I-D.ietf-idr-segment-routing-te-policy]. The
existing operations defined in
[I-D.ietf-idr-segment-routing-te-policy] can apply to this document
directly.

Typically but not limit to, the SR policies carrying composite
candidate path information are configured by a controller.

After configuration, the SR policies carrying path composite
candidate path information will be advertised by BGP update messages.
The operation of advertisement is the same as defined in
[I-D.ietf-idr-segment-routing-te-policy], as well as the receiption.

5. Security Considerations

Procedures and protocol extensions defined in this document do not
affect the security considerations discussed in
[I-D.ietf-idr-segment-routing-te-policy].

6. IANA Considerations

This document defines a new Sub-TLV in registries "SR Policy List
Sub-TLVs" [I-D.ietf-idr-segment-routing-te-policy]:

```
+-------+------------------------------+--------------+
| Value | Description                  | Reference    |
+-------+------------------------------+--------------+
| TBA   | Constituent SR Policy Sub-TLV | This document |
+-------+------------------------------+--------------+
```

7. Contributors

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co-authors have also contributed to this document:

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8. References

8.1. Normative References

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8.2. Informative References

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