IDR Y. Liu
Internet-Draft S. Peng
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Advertising SID Algorithm Information in BGP
draft-peng-idr-segment-routing-te-policy-attr-02

Abstract

This document proposes extensions of BGP and defines some new Segment Types with algorithm information to meet more requirements when delivering SR Policy via BGP.

Status of This Memo

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1. Introduction

Segment Routing (SR) [RFC8402] allows a headend node to steer a packet flow along any path. [I-D.ietf-spring-segment-routing-policy] details the concepts of SR Policy and steering into an SR Policy. These apply equally to the MPLS and IPv6 data plane instantiations of Segment Routing with their respective representations of segments as SR-MPLS SID and SRv6 SID as described in [RFC8402].

[I-D.ietf-idr-segment-routing-te-policy] specifies the way to use BGP to distribute one or more of the candidate paths of an SR Policy to the headend of that policy. It defines a new BGP address family (SAFI), i.e., SR Policy SAFI NLRI. In UPDATE messages of that address family, the NLRI identifies an SR Policy Candidate Path, and the attributes encode the segment lists and other details of that SR Policy Candidate Path. 11 Segment Types (from A to K) are defined to encode SR-MPLS or SRv6 segments.

As specified in [I-D.ietf-idr-segment-routing-te-policy], the SR algorithm can be optionally specified for Segment Types C(IPv4 Node and SID), D(IPv6 Node and SID for SR-MPLS), I(IPv6 Node and SID for SRv6), J(IPv6 Node, index for remote and local pair, and SID for SRv6), and K(IPv6 Local/Remote addresses and SID for SRv6). That is, currently the algorithm can be carried along with SR-MPLS prefix SID, SRv6 prefix SID and SRv6 adjacency SID when delivering SR Policy via BGP.

This document proposes extensions of BGP and defines some new Segment Types with algorithm information to meet more requirements when delivering SR Policy via BGP.

2. 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].

3. New Segment Types for SR-MPLS Adjacency with optional Algorithm

[I-D.ietf-lsr-algorithm-related-adjacency-sid] complements that besides Prefix-SID, the algorithm can be also included as part of an Adjacency-SID advertisement for SR-MPLS, in scenarios where multiple algorithm share the same link resource. In this case, an SR-MPLS Policy advertised to the headend may also contain algorithm specific Adjacency-SID.

This section defines 4 new Segment Sub-TLVs of Segment List Sub-TLV to provide algorithm information for SR-MPLS Adjacency-SID.

The processing procedures for SID with algorithm specified in [I-D.ietf-spring-segment-routing-policy] and [I-D.ietf-idr-segment-routing-te-policy] are still applicable for the new segment types. When the algorithm is not specified for the SID types above which optionally allow for it, the headend SHOULD use the

Strict Shortest Path algorithm if available; otherwise, it SHOULD use the default Shortest Path algorithm.

3.1. Type M: IPv4 Address + Local Interface ID with optional Algorithm

The Type M Segment Sub-TLV is similar with existed Type E Segment Sub-TLV, it also encodes an IPv4 node address, a local interface Identifier (Local Interface ID) and an optional SR-MPLS SID, but with additional algorithm information. The format is as follows:


```
 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     |     Flags     | SR Algorithm  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                 Local Interface ID (4 octets)                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                 IPv4 Node Address (4 octets)                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                SR-MPLS SID (optional, 4 octets)               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Where:

Type: TBD1

SR Algorithm: 1 octet specifying SR Algorithm as described in section 3.1.1 in [RFC8402] when A-Flag as defined in section 2.4.4.2.12 [I-D.ietf-idr-segment-routing-te-policy] is present. SR Algorithm is used by SRPM as described in section 4 in [I-D.ietf-spring-segment-routing-policy]. When A-Flag is not encoded, this field SHOULD be set to zero on transmission and MUST be ignored on receipt.

Other fields have the same meaning as the existing Type E Segment Sub-TLV.

3.2. Type N: IPv4 Local and Remote addresses with optional Algorithm

The Type N Segment Sub-TLV is similar with existed Type F Segment Sub-TLV, it also encodes an adjacency local address, an adjacency remote address and an optional SR-MPLS SID, but with additional algorithm information. The format is as follows:

```
 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     |     Flags     | SR Algorithm |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                Local IPv4 Address (4 octets)                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                Remote IPv4 Address  (4 octets)                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                SR-MPLS SID (optional, 4 octets)               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Where:

Type: TBD2

SR Algorithm: 1 octet specifying SR Algorithm as described in section 3.1.1 in [RFC8402] when A-Flag as defined in section 2.4.4.2.12 [I-D.ietf-idr-segment-routing-te-policy] is present. SR Algorithm is used by SRPM as described in section 4 in [I-D.ietf-spring-segment-routing-policy]. When A-Flag is not encoded, this field SHOULD be set to zero on transmission and MUST be ignored on receipt.

Other fields have the same meaning as existed Type F Segment Sub-TLV.

3.3. Type O: IPv6 Address + Interface ID for local and remote pair with optional Algorithm related SID for SR MPLS

The Type O Segment Sub-TLV is similar with existed Type G Segment Sub-TLV, it also encodes an IPv6 Link Local adjacency with IPv6 local node address, a local interface identifier (Local Interface ID), IPv6 remote node address , a remote interface identifier (Remote Interface ID) and an optional SR-MPLS SID, but with additional algorithm information. The format is as follows:

```
 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      |     Flags     | SR Algorithm |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                Local Interface ID (4 octets)                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
//               IPv6 Local Node Address (16 octets)           //
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                Remote Interface ID (4 octets)                 |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
//               IPv6 Remote Node Address (16 octets)          //
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               SR-MPLS SID (optional, 4 octets)                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Where:

Type: TBD3

SR Algorithm: 1 octet specifying SR Algorithm as described in section 3.1.1 in [RFC8402] when A-Flag as defined in section 2.4.4.2.12 [I-D.ietf-idr-segment-routing-te-policy] is present. SR Algorithm is used by SRPM as described in section 4 in [I-D.ietf-spring-segment-routing-policy]. When A-Flag is not encoded, this field SHOULD be set to zero on transmission and MUST be ignored on receipt.

Other fields have the same meaning as existed Type G Segment Sub-TLV.

3.4. Type P: IPv6 Local and Remote addresses with optional Algorithm for SR MPLS

The Type P Segment Sub-TLV is similar with existed Type H Segment Sub-TLV, it also encodes an adjacency local address, an adjacency remote address and an optional SR-MPLS SID, but with additional algorithm information. The format is as follows:

```
 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     |     Flags     | SR Algorithm |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
//               Local IPv6 Address (16 octets)                 //
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
//               Remote IPv6 Address  (16 octets)               //
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                SR-MPLS SID (optional, 4 octets)               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Where:

Type: TBD4

SR Algorithm: 1 octet specifying SR Algorithm as described in section 3.1.1 in [RFC8402] when A-Flag as defined in section 2.4.4.2.12 [I-D.ietf-idr-segment-routing-te-policy] is present. SR Algorithm is used by SRPM as described in section 4 in [I-D.ietf-spring-segment-routing-policy]. When A-Flag is not encoded, this field SHOULD be set to zero on transmission and MUST be ignored on receipt.

Other fields have the same meaning as existed Type H Segment Sub-TLV.

4. New Segment Types for SID only, with optional Algorithm

Segment Sub-TLV for Type A defined in section 2.4.4.2.1 [I-D.ietf-idr-segment-routing-te-policy] carries only the SID information in the form of MPLS Label. Segment Sub-TLV for Type B defined in section 2.4.4.2.2 [I-D.ietf-idr-segment-routing-te-policy] carries only the SID information in the form of IPv6 address.

If the algorithm information is carried along with the SIDs, it's useful in the scenarios below:

Scenario 1: The algorithm may be optionally provided to the headend for verification purposes. The headend can check if the SID value and the related algorithm received can be found in its SR-DB if requested to do so.

Scenario 2: The headend may not know about the SID-related algorithm especially in the inter-domain scenario. Providing the algorithm information benefits troubleshooting and network management.

This section defines 2 new Segment Sub-TLVs of Segment List Sub-TLV to provide algorithm information for SR-MPLS/SRv6 SID.

4.1. Type L: MPLS SID only, with optional Algorithm

The Type L Segment Sub-TLV is similar with the Type A Segment Sub-TLV, it also encodes a single SR-MPLS SID, but with additional algorithm information. The format is as follows:

```
 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     |     Flags     | SR Algorithm |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Label                        | TC  |S|      TTL      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Where:

Type: TBD5

SR Algorithm: 1 octet specifying SR Algorithm as described in section 3.1.1 in [RFC8402] when A-Flag as defined in section 2.4.4.2.12 [I-D.ietf-idr-segment-routing-te-policy] is present. When A-Flag is not encoded, this field SHOULD be set to zero on transmission and MUST be ignored on receipt.

Other fields have the same meaning as Type A Segment Sub-TLV.

4.2. Type Q: SRv6 SID only, with optional Algorithm

The Type Q Segment Sub-TLV is similar with existed Type B Segment Sub-TLV, it also encodes a single SRv6 SID, but with additional algorithm, endpoint behavior and SID strucutre information. The format is as follows:

```
 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     |     Flags     | SR Algorithm |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
//                       SRv6 SID (16 octets)                   //
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
//     SRv6 Endpoint Behavior and SID Structure (optional)      //
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Where:

Type: TBD6

Length is variable.

SR Algorithm: 1 octet specifying SR Algorithm as described in section 3.1.1 in [RFC8402] when A-Flag as defined in section 2.4.4.2.12 [I-D.ietf-idr-segment-routing-te-policy] is present. When A-Flag is not encoded, this field SHOULD be set to zero on transmission and MUST be ignored on receipt.

Other fields have the same meaning as the Type B Segment Sub-TLV.

5. IANA Considerations

This document requests codepoint allocations for new Segment Sub-TLVs in the "SR Policy List Sub-TLVs" registry.

Value	Description	Reference
TBD1	Type L MPLS Algorithm related SID sub-TLV	This document
TBD2	Type M IPv4 Node, index and Algorithm related SID sub-TLV	This document
TBD3	Type N IPv4 Local/Remote addresses and Algorithm related SID sub-TLV	This document
TBD4	Type O IPv6 Node, index for remote and local pair and Algorithm related SID for SR-MPLS sub-TLV	This document
TBD5	Type P IPv6 Local/Remote addresses and Algorithm related SID sub-TLV	This document
TBD6	Type Q SRv6 Algorithm related SID sub-TLV	This document

6. 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].

7. References

7.1. Normative References

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Authors' Addresses

Yao Liu
ZTE
Nanjing
China
Email: liu.yao71@zte.com.cn

Shaofu Peng
ZTE
Nanjing
China
Email: peng.shaofu@zte.com.cn