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**SR Policy Extensions for Path Segment and Bidirectional Path  
draft-li-idr-sr-policy-path-segment-01**

Abstract

A Segment Routing (SR) policy is a set of candidate SR paths consisting of one or more segment lists with necessary path attributes. For each SR path, it may also have its own path attributes, and Path Segment is one of them. A Path Segment is defined to identify an SR path, which can be used for performance measurement, path correlation, and end-2-end path protection. Path Segment can be also used to correlate two unidirectional SR paths into a bidirectional SR path which is required in some scenarios, for example, mobile backhaul transport network.

This document defines extensions to BGP to distribute SR policies carrying Path Segment and bidirectional path information.

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](#)].

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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]. For distributing SR policies to the headend, [I-D.ietf-idr-segment-routing-te-policy]



specifies a mechanism by using BGP, and new sub-TLVs are defined for SR Policies in BGP UPDATE message.

In many use cases such as performance measurement, the path to which the packets belong is required to be identified. Furthermore, in some scenarios, for example, mobile backhaul transport network, there are requirements to support bidirectional path. However, there is no path identification information for each Segment List in the SR Policies defined in [[I-D.ietf-spring-segment-routing-policy](#)]. Also, the SR Policies defined in [[I-D.ietf-spring-segment-routing-policy](#)] only supports unidirectional SR paths.

Therefore, this document defines the extension to SR policies that carry Path Segment in the Segment List and support bidirectional path. The Path Segment can be a Path Segment in SR-MPLS [[I-D.ietf-spring-mpls-path-segment](#)], or other IDs that can identify a path. Also, this document defines extensions to BGP to distribute SR policies carrying Path Segment and bidirectional path information.

## 2. Terminology

This memo makes use of the terms defined in [[RFC8402](#)] and [[I-D.ietf-idr-segment-routing-te-policy](#)].

## 3. Path Segment 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
      Preference
      Priority
      Policy Name
      Explicit NULL Label Policy (ENLP)
      Segment List
        Weight
        Segment
        Segment
        ...
      ...
```

An SR path can be specified by an Segment List sub-TLV that contains a set of segment sub-TLVs and other sub-TLVs as shown above. As



defined in [[I-D.ietf-spring-segment-routing-policy](#)], a candidate path includes multiple SR paths specified by SID list. The Path Segment can be used for identifying an SR path(specified by SID list). Also, it can be used for identifying an SR candidate path or an SR Policy in some use cases if needed. New SR Policy encoding structure 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)
    Path Segment
    Segment List
      Weight
      Path Segment
      Segment
      Segment
      ...
    Segment List
      Weight
      Path Segment
      Segment
      Segment
      ...
  ...

```

The Path Segment can appear at both segment-list level and candidate path level, and generally it SHOULD also appear only at one level depending upon use case. Path segment at segment list level and at candidate path level may be same or may be different based on usecase and the ID allocation scope. When multiple Path Segments appear in both levels, it means the the Path Segment associated with candidate path and segment list SHOULD both be inserted into the SID list.

### 3.1. SR Path Segment Sub-TLV

This section defines an SR Path Segment sub-TLV.

An SR Path Segment sub-TLV can be included in the segment list sub-TLV to identify an SID list, and it MUST appear only once within a Segment List sub-TLV. It has the following format:



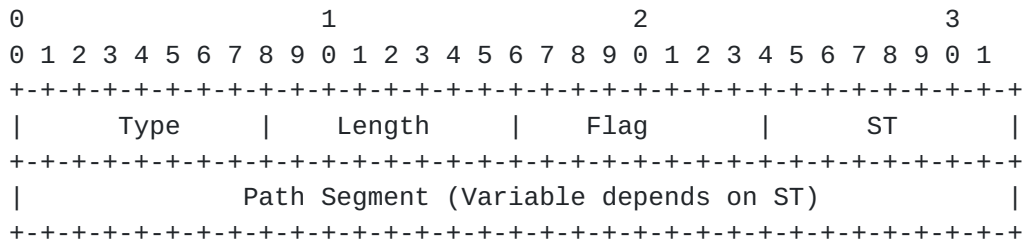


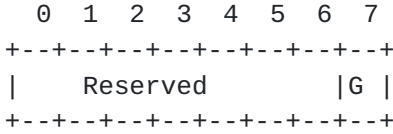
Figure 1. Path Segment sub-TLV

Where:

Type: to be assigned by IANA (suggested value 10).

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

Flag: 8 bits of flags. Following flags are defined:



G-Flag: Global flag. Set when the Path Segment is global within an SR domain.

Reserved: 5 bits reserved and MUST be set to 0 on transmission and MUST be ignored on receipt.

ST: Segment type, specifies the type of the Path Segment, and it has following types:

- o 0: SR-MPLS Path Segment
- o 1-255:Reserved

Path Segment: The Path Segment of an SR path. The Path Segment type is indicated by the Segment Type(ST) field. It can be a Path Segment in SR-MPLS [[I-D.ietf-spring-mpls-path-segment](#)], which is 32-bits value, which is a 128-bits value, or other IDs that can identify a path.

**4. SR Policy for Bidirectional Path**

In some scenarios, for example, mobile backhaul transport network, there are requirements to support bidirectional path. In SR, a bidirectional path can be represented as a binding of two unidirectional SR paths. This document also defines new sub-TLVs to





describe an SR bidirectional path. An SR policy carrying SR bidirectional 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
    Preference
    Priority
    Policy Name
    Explicit NULL Label Policy (ENLP)
    Bidirectional Path
      Segment List
        Weight
        Path Segment
        Segment
        Segment
        ...
      Reverse Segment List
        Weight
        Path Segment
        Segment
        Segment
        ...

```

**4.1. SR Bidirectional Path Sub-TLV**

This section defines an SR bidirectional path sub-TLV to specify a bidirectional path, which contains a Segment List sub-TLV [[I-D.ietf-idr-segment-routing-te-policy](#)] and an associated Reverse Path Segment List as defined at [section 4.2](#). The SR bidirectional path sub-TLV has the following format:

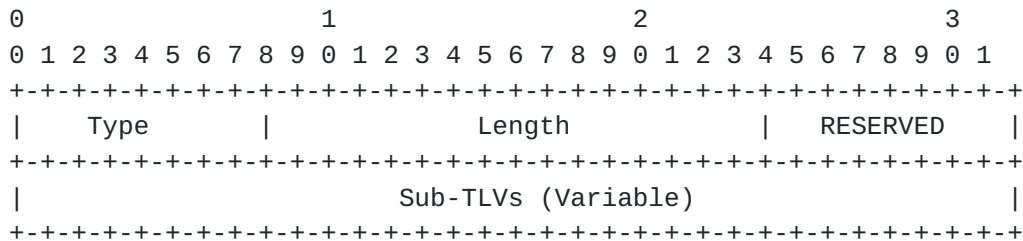


Figure 2. SR Bidirectional path sub-TLV

Where:

Type: TBA, and the suggest value is 14.



Length: the total length of the sub-TLVs encoded within the SR Bidirectional Path Sub-TLV not including Type and Length fields.

RESERVED: 1 octet of reserved bits. SHOULD be unset on transmission and MUST be ignored on receipt.

Sub-TLVs:

- o An Segment List sub-TLV
- o An associated Reverse Path Segment List sub-TLV

**4.2. SR Reverse Path Segment List Sub-TLV**

An SR Reverse Path Segment List sub-TLV is defined to specify an SR reverse path associated with the path specified by the Segment List in the same SR Bidirectional Path Sub-TLV, and it has the following format:

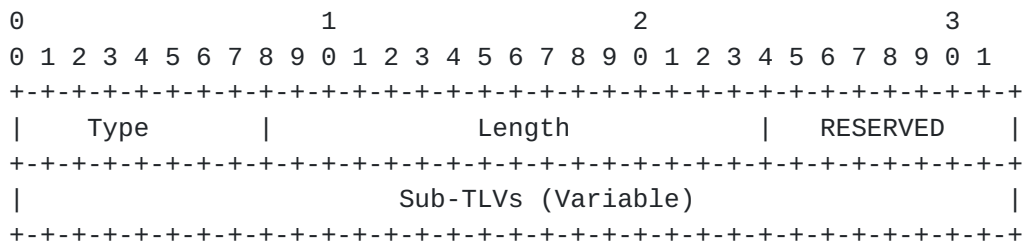


Figure 2. SR Reverse Path Segment List Sub-TLV

where:

Type: TBA, and suggest value is 127.

Length: the total length of the sub-TLVs encoded within the SR Reverse Path Segment List Sub-TLV not including the Type and Length fields.

RESERVED: 1 octet of reserved bits. SHOULD be unset on transmission and MUST be ignored on receipt.

sub-TLVs, reuse the sub-TLVs in Segment List defined in [\[I-D.ietf-idr-segment-routing-te-policy\]](#).

- o An optional single Weight sub-TLV.
- o An mandatory SR Path Segment sub-TLV that contains the Path Segment of the reverse SR path.
- o Zero or more Segment sub-TLVs to specify the reverse SR path.



The Segment sub-TLVs in the Reverse Path Segment List sub-TLV provides the information of the reverse SR path, which can be used for directing egress BFD peer to use specific path for the reverse direction of the BFD session [[I-D.ietf-mpls-bfd-directed](#)] or other applications.

## 5. 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 unidirectional or bidirectional SR policies carrying path identification information are configured by a controller.

After configuration, the unidirectional or bidirectional SR policies carrying path identification 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 reception.

The consumer of the unidirectional or bidirectional SR policies is not the BGP process, it can be any applications, such as performance measurement [[I-D.gandhi-spring-udp-pm](#)]. The operation of sending information to consumers is out of scope of this document.

## 6. IANA Considerations

This document defines new Sub-TLVs in following registries:

### 6.1. Existing Registry: BGP Tunnel Encapsulation Attribute sub-TLVs

This document defines new sub-TLVs in the registry "BGP Tunnel Encapsulation Attribute sub-TLVs" to be assigned by IANA:

Codepoint	Description	Reference
14	Path Segment sub-TLV	This document
15	SR Bidirectional Path sub-TLV	This document
127	Reverse Segment List sub-TLV	This document

This document defines new sub-TLVs in the registry "SR Policy List Sub-TLVs" [[I-D.ietf-idr-segment-routing-te-policy](#)] to be assigned by IANA:



Codepoint	Description	Reference
14	Path Segment sub-TLV	This document

## 7. Security Considerations

TBA

## 8. Acknowledgements

Many thanks to Shraddha Hedge for her detailed review and professional comments.

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