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Advertising SRv6 SIDs for Layer 2 Bundle Member Links in IGP

Abstract

There are deployments where the Layer-3 interface on which IGP operates is a Layer-2 interface bundle. Existing IGP advertisements only support advertising link attributes of the Layer-3 interface. If entities external to IGP wish to control traffic flows on the individual physical links that comprise the Layer-2 interface bundle, link attribute information about the bundle members is advertised by IGP extensions for Layer-2 (L2) bundle.

When Segment Routing over IPv6 (SRv6) is used with Layer-2 interface bundle to control traffic flows on the individual member links, the SRv6 SIDs which represent the Layer 2 member links of the L2 bundle needs to be advertised in IGP.

This document proposes the IGP extensions to advertise the SRv6 SIDs of the Layer 2 (L2) bundle member links.

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

There are deployments where the Layer-3 interface on which an IGP adjacency is established is a Layer-2 interface bundle, for instance, a Link Aggregation Group (LAG) [[IEEE802.1AX](#)]. This reduces the number of adjacencies that need to be maintained by the routing protocol in cases where there are parallel links between the neighbors. Entities external to IS-IS such as Path Computation Elements (PCEs) [[RFC4655](#)] may wish to control traffic flows on individual members of the underlying Layer-2 bundle. In order to do so, link attribute information about individual bundle members is required.

[[RFC8668](#)] and [[I-D.ietf-lsr-ospf-l2bundles](#)] specify the IGP extensions to advertise link attribute information for each of the

L2 Bundle members which comprise the Layer-3 interface, in which the encoding and advertisement of SR-MPLS adjacency SIDs of each bundle member link is defined. When SRv6 is used with Layer-2 interface bundle, to control traffic flows on the individual member links, the SRv6 SIDs which represent the Layer-2 member links of the L2 bundle needs to be advertised.

This document proposes the IGP extensions to advertise the SRv6 SIDs of the Layer-2 (L2) bundle member links.

2. 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 [RFC 2119](#) [[RFC2119](#)] [RFC 8174](#) [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

3. SRv6 Function for L2 Bundle Member Links

As defined in [[RFC8986](#)], the SRv6 End.X behavior means "Endpoint with cross-connect to an array of layer-3 adjacencies". An SRv6 SID associated with a Layer 2 bundle member link of an L3 adjacency is considered a variant of the End.X behavior. In order to distinguish it from the SIDs associated with a L3 adjacency, it is considered that a different type of SRv6 function needs to be used.

[[I-D.dong-spring-srv6-inter-layer-programming](#)] defines a new End.XU function which means "Endpoint with cross-connect to an underlay interface", this function can be used for the L2 bundle member links.

4. Advertising SRv6 SIDs for L2 Bundle Members

4.1. SRv6 SIDs Encodings for IS-IS L2 Bundle

This section defines the IS-IS sub-TLVs to advertise SRv6 SIDs for L2 Bundle Members. Following the encoding mechanism used in [[RFC8668](#)] for the advertisement of SR-MPLS adj-SIDs for L2 Bundle Members, this allows the advertisement of a set of SRv6 SIDs (one per L2 Bundle Member) in a single sub-TLV.

4.1.1. L2 Bundle Member SRv6 End.XU SID Sub-TLV

[[I-D.ietf-lsr-isis-srv6-extensions](#)] defines the SRv6 End.X SID sub-TLV to advertise an SRv6 SID associated with a point to point adjacency. This document defines a new sub-TLV of called "L2 Bundle Member SRv6 End.XU SIDs" to advertise the SRv6 End.XU SIDs for the L2 Bundle Members. This sub-TLV is allowed to be carried in TLV 25

"L2 Bundle Member Attributes" only. The format of the sub-TLV is as below:

```

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            |   Algorithm         |    Weight     |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|             Endpoint Behavior              |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
| SID #1 (128 bits)                                           |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
| SID #2 (128 bits)                                           |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
| ...                                                         |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
| SID #n (128 bits)                                           |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|Sub-sub-tlv-len|                Sub-sub-TLVs (variable) . . . |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+

```

Where:

*Type: TBA.

*Length: Variable.

*Flags: 1 octet. The format is the same as the Flags field in the SRv6 End.X SID sub-TLV as defined in [[I-D.ietf-lsr-isis-srv6-extensions](#)].

*Algorithm: 1 octet. The algorithm values are defined in the IGP Algorithm Type registry.

*Weight: 1 octet. The value represents the weight of the SID for the purpose of load balancing.

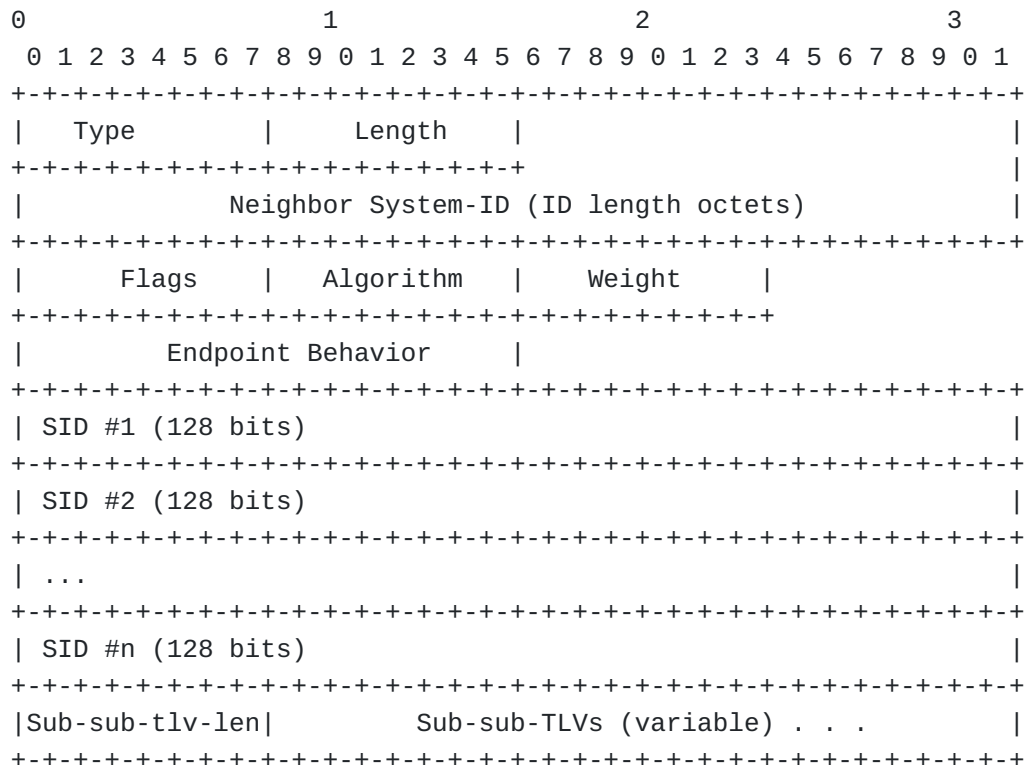
*Endpoint Behavior: 2 octets. It SHOULD be set to the Endpoint functions as defined in [[I-D.dong-spring-srv6-inter-layer-programming](#)].

*SIDs. One or multiple 16-octet SRv6 SIDs. The number of the SIDs is determined by the "Number of L2 Bundle Member Descriptors" field as defined in [RFC8668].

*Sub-sub-tlv-length: 1 octet. Number of octets used by sub-sub-TLVs.

4.1.2. L2 Bundle Member SRv6 LAN End.XU SID Sub-TLV

[[I-D.ietf-lsr-isis-srv6-extensions](#)] defines the SRv6 LAN End.X SID sub-TLV to advertise an SRv6 SID associated with a LAN adjacency. This document defines a new sub-TLV called "L2 Bundle Member SRv6 LAN End.XU SIDs" to advertise the SRv6 LAN End.XU SIDs for the L2 Bundle Members. The format of the sub-TLV is as below:



Where:

*Type: TBA.

*Length: Variable.

*Neighbor System-ID: IS-IS System-ID of length "ID Length" as defined in [ISO10589].

*Flags: 1 octet, the format is the same as the Flags field in the SRv6 End.X SID sub-TLV as defined in [[I-D.ietf-lsr-isis-srv6-extensions](#)].

*Algorithm: 1 octet. The algorithm values are defined in the IGP Algorithm Type registry.

*Weight: 1 octet. The value represents the weight of the End.X SID for the purpose of load balancing.

*Endpoint Behavior: 2 octets. It SHOULD be set to the Endpoint functions as defined in [[I-D.dong-spring-srv6-inter-layer-programming](#)].

*SIDs. One or multiple 16-octet SRv6 SIDs. The number of the SIDs is determined by the "Number of L2 Bundle Member Descriptors" field as defined in [[RFC8668](#)].

*Sub-sub-tlv-length: 1 octet. Number of octets used by sub-sub-TLVs.

4.2. SRv6 SIDs Encodings for OSPF L2 Bundle

This section defines the mechanism to advertise SRv6 SIDs for L2 Bundle Members. In [[I-D.ietf-lsr-ospf-l2bundles](#)], the SR-MPLS Adjacency SID sub-TLVs for the L3 adjacency is reused for the advertisement of Adjacency SIDs of L2 Bundle Members. For SRv6 data plane , the SRv6 End.X SID sub-TLV and SRv6 LAN End.X SID Sub-TLV as defined in [[I-D.ietf-lsr-ospfv3-srv6-extensions](#)] are reused for the advertisement of SRv6 End.XU SIDs of L2 Bundle Members, the Endpoint Behavior in the sub-TLV SHOULD be set to the Endpoint functions as defined in [[I-D.dong-spring-srv6-inter-layer-programming](#)].

5. IANA Considerations

IANA is requested to assign two new code points from the IS-IS "Sub-TLVs for TLVs 22, 23, 25, 141, 222, and 223" registry.

Type	Description	22	23	25	141	222	223
TBD	L2 Bundle Member SRv6 End.XU SID	n	n	y	n	n	n
TBD	L2 Bundle Member SRv6 LAN End.XU SID	n	n	y	n	n	n

6. Security Considerations

The security considerations in [[RFC8668](#)] and [[I-D.ietf-lsr-ospf-l2bundles](#)] apply. This document introduces no additional security vulnerabilities to IS-IS and OSPF.

7. Acknowledgements

The authors would like to thank Zhenbin Li for the review and discussion of this document.

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