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IS-IS Extensions to Support Transport Network Slices using Segment Routing
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Abstract

[I-D.nsdt-teas-ns-framework] provides a framework of transport slices.

This draft describes the IS-IS extensions required to support transport slices using Segment Routing.

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1. Introduction

[I-D.nsdt-teas-ns-framework] provides a framework for discussing transport slices.

For a Transport Network, transport network slicing requires the underlying network to support partitioning of the network resources to provide the client with dedicated (private) networking, computing, and storage resources drawn from a shared pool. [I-D.peng-teas-network-slicing] defines a unified TN-slice identifier to indicate the topology, computing, storage resources of the dedicated virtual network for both intra-domain and inter-domain network slicing scenarios, and how to compute SR-BE or SR-TE path according to TN-slice Identifier combined with other creteria.

This draft describes the IS-IS extensions required to distribute TN-slice Identifier(that is AII in this draft) information in an AS.

2. Conventions used in this document

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. Router Capabilities for TN-slice Identifier

Although a router can deduce which TN-slices it has participated in according to the AII(administrative instance identifier) configuration of all links, an ISIS instance can explicitly control which TN-slices it wants to enable (or join), to explicitly control which SPT (shortest path tree) for a specific AII to be created. It is possible for a route process not to join any TN-slices (except the default AII 0) in despite of any AII configuration of any links. Especially, it is hard to deduce the participated TN-slice according to the AII configuration of L2 Bundle Member.

This section defines AII Participation sub-TLV which is inserted into the IS-IS Router Capability TLV-242 that is defined in [RFC7981], to explicitly advertise which TN-slice a router wants to take part in.

The TN-slice identifier Participation sub-TLV has the following format:

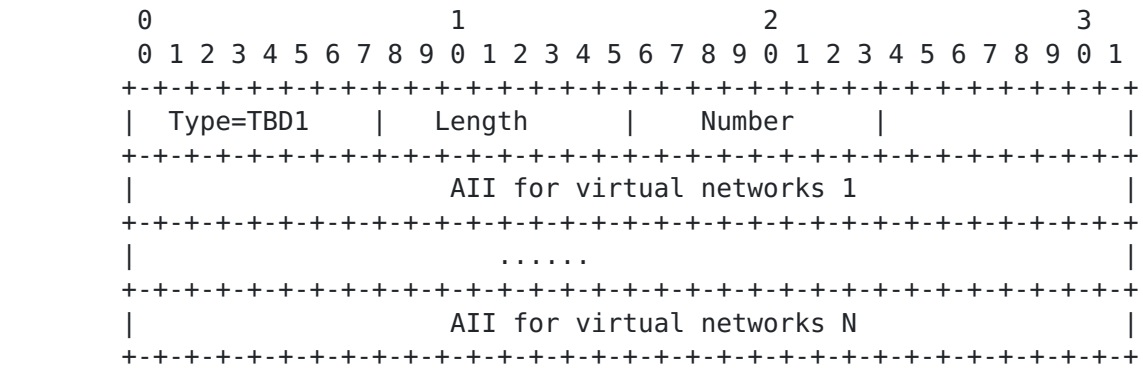

Figure 1

where:

Type: TBD1 (Suggested value to be assigned by IANA)

Length: variable.

Number:Number of virtual networks.

AII for VN: allocate different TN-slice identifier (AII) for different virtual networks. AII is used to distinguish different virtual network resources.

4. Advertising TN-slice Identifier as a new TE parameter of a link

[RFC5305] describes extensions to the Intermediate System to Intermediate System (IS-IS) protocol to support Traffic Engineering (TE).

TN-slice Identifier can be used to color links to partition underlay resource. This document defines a new extension of the existing IGP-TE mechanisms[RFC5305] to distribute TN-slice Identifier information in an AS as a new TE parameter of a link.

The TN-slice Identifier list sub-TLV has the following format:

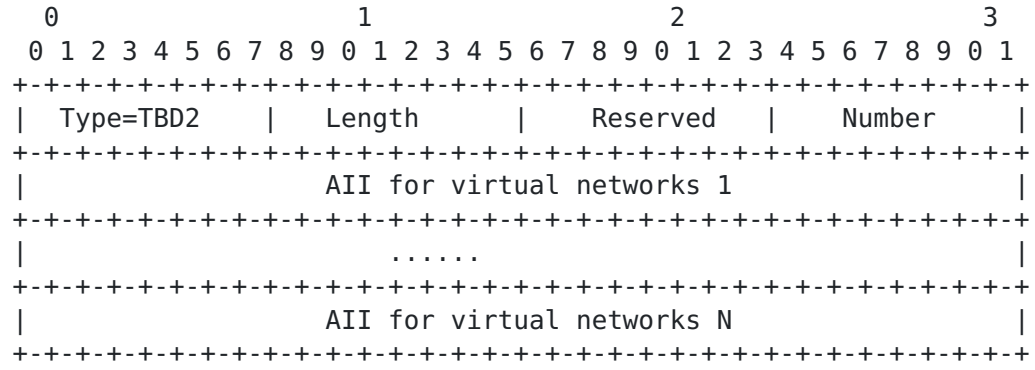

Figure 2

Type: TBD2 (Suggested value to be assigned by IANA)

Length: variable.

Number:Number of virtual networks.

AII for VN: allocate different TN-slice identifier (AII) for different virtual networks. AII is used to distinguish different virtual network resources.

This sub-TLV MAY be present in any of the following TLVs:

TLV-22 (Extended IS reachability) [RFC5305].

TLV-222 (Multitopology IS)[RFC5120].

TLV-23 (IS Neighbor Attribute)[RFC5311].

TLV-223 (Multitopology IS Neighbor Attribute)[RFC5311].

TLV-141 (inter-AS reachability information)[RFC5316].

This sub-TLV SHOULD appear once at most in each TLV. Indicates that a link MAY belong to multiple virtual networks.

Note that AII 0 does not require notification, and all links are always in AII 0 at the same time.

5. Advertising TN-slice Identifier for L2 Bundle Member

[RFC8668] defines a sub-TLV of L2 Bundle Attribute Descriptors, and the sub-TLV may define an attribute common to all of the bundle members listed or a sub-TLV may define an attribute unique to each bundle member. This document defines a new sub-TLV: L2 Bundle Member TN-slice Identifier sub-TLV.

This sub-TLV is used to advertise TN-slice Identifier for L2 Bundle Member associated with a parent L3 adjacency which is Point-to-Point.The following format is defined for this sub-TLV:

Type: TBD3.

Length: variable

L2 Bundle Member TN-slice Identifier.There MUST be one TN-slice Identifier(AII) for each of the L2 Bundle Members advertised under the preceding L2 Bundle Member Attribute Descriptor.

This sub-TLV MAY be present in the following TLVs:

TLV-25 (L2 Bundle Member Attributes) [RFC8668].

This sub-TLV SHOULD appear once at most in the TLV. Indicates that the TN-slice Identifier for L2 Bundle Member.

6. Advertising prefix-SID per TN-slice Identifier

[RFC8667] defines a new IS-IS sub-TLV: the Prefix Segment Identifier sub-TLV (Prefix-SID sub-TLV). The Prefix-SID sub-TLV carries the Segment Routing IGP-Prefix-SID as defined in [RFC8402], and is associated to a prefix advertised by a node.

To distinguish forwarding behavior of different virtual networks, Prefix-SID need to be allocated per TN-slice Identifier and

advertised in the IGP domain. This document defines a new extension of the existing Prefix-SID sub-TLV.

The Prefix-SID for TN-slice Identifier sub-TLV has the following format:

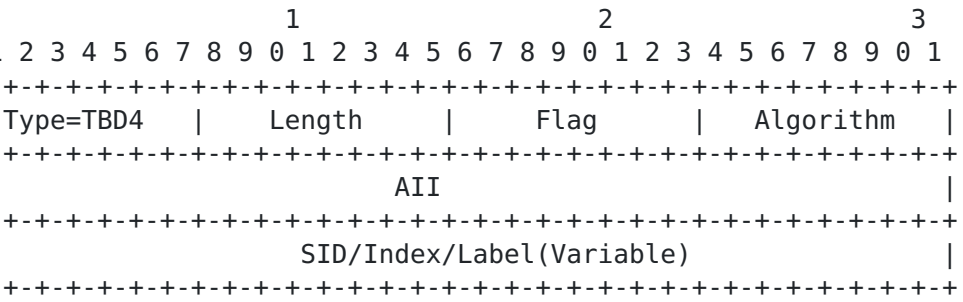

Figure 3

where:

Type:TBD4 (Suggested value to be assigned by IANA)

Length: Variable. Depending on the size of the SID.

The "Flags" and "SID/Index/Label" fields are the same as the Prefix-SID sub-TLV [RFC8667] .

Algorithm: Accoridng to section "3.2. SR-Algorithm Sub-TLV" of [RFC8667] , two values can be set in this field.

o 0: Shortest Path First (SPF) algorithm based on link metric.

o 1: Strict Shortest Path First (SPF) algorithm based on link metric.

Note that[I-D.ietf-lsr-flex-algo].also allows user to define other algorithm values, i.e., FA-id within [128, 255], for the purpose of constraint based path computation. However, an FA-id algorithm value MUST not be set in this field, the reason is that FA-id has not semantic local within AII.

AII: Identifies the TN-slice (AII) information corresponding to the Prefix-SID.

This sub-TLV MAY be present in any of the following TLVs:

TLV-135 (Extended IPv4 reachability) defined in [RFC5305].

TLV-235 (Multitopology IPv4 Reachability) defined in [RFC5120].

TLV-236 (IPv6 IP Reachability) defined in [RFC5308].

TLV-237 (Multitopology IPv6 IP Reachability) defined in [RFC5120].

This sub-TLV MAY appear multiple times in each TLV.

7. Advertising Adjacency-SID per TN-slice Identifier

[RFC8667] defines the IS-IS sub-TLV: the Adjacency Segment Identifier sub-TLV (Adj-SID sub-TLV).The Adj-SID sub-TLV is an optional sub-TLV carrying the Segment Routing IGP-Adjacency-SID as defined in [RFC8402].

To distinguish forwarding behavior of different virtual networks, Adjacency-SID need to be allocated per TN-slice Identifier and advertised in the IGP domain. This document defines a new extension of the existing Adjacency-SID sub-TLV.

The Adjacency-SID for TN-slice Identifier sub-TLV has the following format:

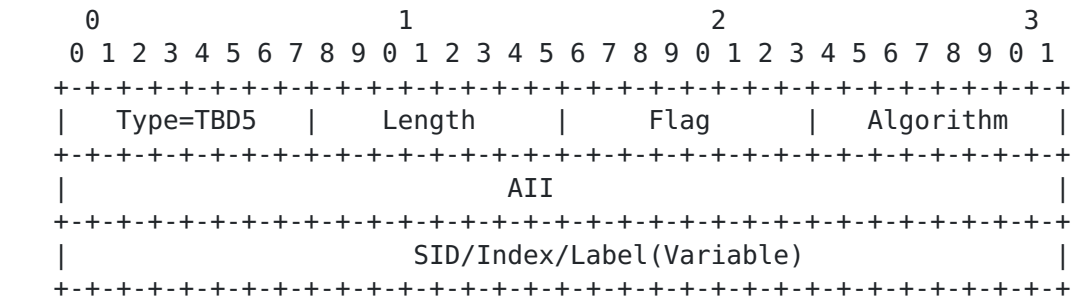

Figure 4

where:

Type:TBD5(Suggested value to be assigned by IANA)

Length: Variable. Depending on the size of the SID.

The "Flags" and "SID/Index/Label" fields are the same as the Adjacency-SID sub-TLV [RFC8667].

AII: Identifies the TN-slice (AII) information corresponding to the Adjacency-SID.

This sub-TLV MAY be present in any of the following TLVs:

TLV-22 (Extended IS reachability) [RFC5305].

TLV-222 (Multitopology IS)[RFC5120].

TLV-23 (IS Neighbor Attribute)[RFC5311].

TLV-223 (Multitopology IS Neighbor Attribute)[RFC5311].

TLV-141 (inter-AS reachability information)[RFC5316].

Multiple Adj-SID sub-TLVs MAY be associated with a single IS-neighbor. This sub-TLV MAY appear multiple times in each TLV.

8. Advertising Adjacency-SID per TN-slice Identifier in LANs

In LAN subnetworks,[RFC8667] defines the LAN-Adj-SID sub-TLV for a router to advertise the Adj-SID of each of its neighbors.

To distinguish forwarding behavior of different virtual networks, Adjacency-SID need to be allocated per TN-slice Identifier and advertised in the IGP domain. This document defines a new extension of the existing Adjacency-SID sub-TLV.

The LAN-Adj-SID for TN-slice Identifier sub-TLV has the following format:

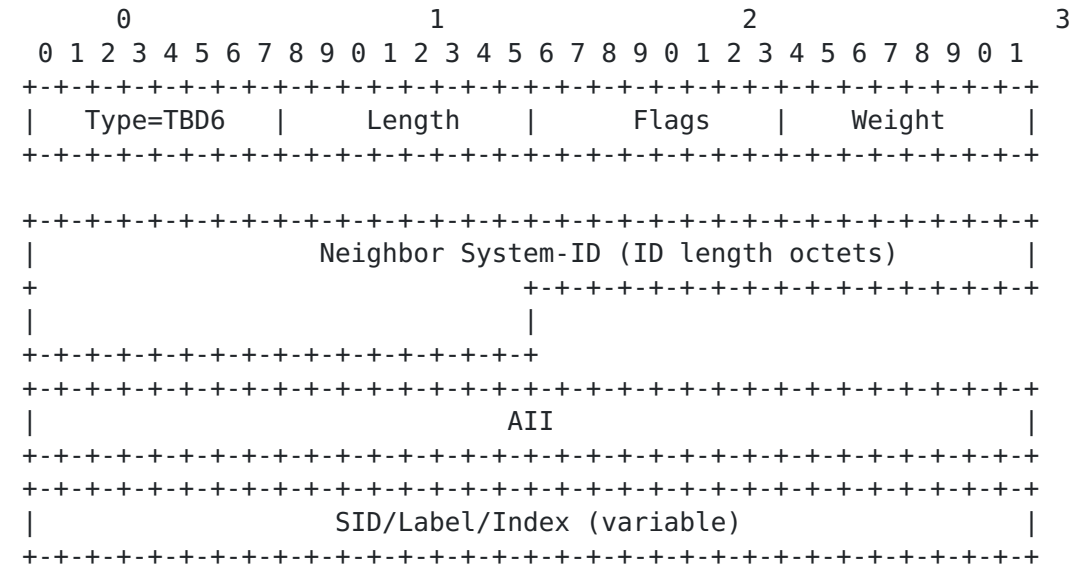

Figure 5

where:

Type:TBD6 (Suggested value to be assigned by IANA)

Length: Variable. Depending on the size of the SID.

The "Flags" and "SID/Index/Label" fields are the same as the Adjacency-SID sub-TLV [RFC8667].

AII: Identifies the TN-slice (AII) information corresponding to the Adjacency-SID.

This sub-TLV MAY be present in any of the following TLVs:

TLV-22 (Extended IS reachability) [RFC5305].

TLV-222 (Multitopology IS)[RFC5120].

TLV-23 (IS Neighbor Attribute)[RFC5311].

TLV-223 (Multitopology IS Neighbor Attribute)[RFC5311].

Multiple Adj-SID sub-TLVs MAY be associated with a single IS-neighbor. This sub-TLV MAY appear multiple times in each TLV.

9. IANA Considerations

This document requests allocation for the following Sub-TLVs.

9.1. Router Capabilities for TN-slice Identifier

This document requests IANA to assign a new code point in the "sub-TLV for TLV 242" registry.

Type: TBD1

9.2. TN-slice Identifier list sub-TLV

This TLV shares sub-TLV space with existing "Sub-TLVs for TLVs 22, 222, 23,223 and 141 registry".

Type:TBD2(to be assigned by IANA).

9.3. L2 Bundle Member TN-slice Identifier sub-TLV

This TLV shares sub-TLV space with existing "Sub-TLVs for TLVs 22, 222, 23, 25, 223 and 141 registry.

Type:TBD3(to be assigned by IANA).

This sub-TLV is allowed in the following TLVs:

22	23	25	141	222	223
n	n	y	n	n	n

9.4. Prefix-SID for TN-slice Identifier sub-TLV

This TLV shares sub-TLV space with existing "Sub-TLVs for TLVs 135,235,226 and 237 registry".

Type:TBD4(to be assigned by IANA).

9.5. Adjacency-SID for TN-slice Identifier sub-TLV

This TLV shares sub-TLV space with existing "Sub-TLVs for TLVs 22, 222, 23,223 and 141 registry".

Type:TBD5(to be assigned by IANA).

9.6. LAN-Adj-SID for TN-slice Identifier sub-TLV

This TLV shares sub-TLV space with existing "Sub-TLVs for TLVs 22, 222, 23, and 223registry".

Type:TBD6(to be assigned by IANA).

10. Security Considerations

TBD.

11. Acknowledgements

TBD.

12. References

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