ISIS extensions for SRv6

draft-bashandy-isis-srv6-extensions-03

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OSPFv3 Equivalent

draft-li-ospf-ospfv3-srv6-extensions-01

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Changes since V2

Node SID TLV has been replaced with an SRv6 Locator TLV.

End SIDs are now advertised as a sub-TLV of the SRv6 Locator TLV.

SRv6 related SID depth advertisements are now done using the MSD sub-TLV defined in draft-ietf-isis-segment-routing-msd

Full support for topologies and algorithms is now defined.

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Locators and SIDs

SRv6 SID is a 128 bit value

LOC:FUNCT
   LOC (the locator portion) is the L most significant bits
   FUNCT is the 128-L least significant bits.

Locators/SIDs are topology/algorithm specific

Each locator is a covering prefix for all SIDs provisioned on that node which have the matching topology/algorithm.

This allows only Locators to be installed in the forwarding plane similar to “summary addresses”.

SIDs are not installed in forwarding on transit nodes.
Locators and SIDs: Example

! MTID 0/Algorithm 0
locator 2001:DB8:0:0::0/64
  !End SID
  2001:DB8:0:0:81::0/128
  !End.X SID
  2001:DB8:0:0:82::0/128
...

!MTID 0/Algorithm 128
locator 2001:DB8:0:1::0/64
  !End SID
  2001:DB8:0:1:20::0/128
  !End.X SID
  2001:DB8:0:1:21::0/128
...

NOTES:
SIDs are “covered” by the corresponding topology/algorithm locator
Function/arguments are in the (128-L) LSBs
SRv6 Locator TLV

- Advertises SRv6 Topology/Algorithm specific locators
- Ignored by legacy nodes
- Forwarding entries are created for the advertised locators when SRv6 and topology/algorithm is supported by the receiving node
- Locators are routable and MAY also be advertised in Prefix Reachability for use by legacy nodes
- Allows SRv6 to work in the presence of legacy nodes
- Prefix Reachability entries preferred over locator advertisements in case of dual advertisements
- Shares sub-TLV space with prefix reachability TLV (135/235/236/237)
- Can be leaked between levels
SRv6 Locator

<table>
<thead>
<tr>
<th>Flags: 0 1 2 3 4 5 6 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
</tr>
</tbody>
</table>

*D bit:* When the Locator is leaked from level-2 to level-1, the D bit MUST be set.

**Algorithm:** From IGP Algorithm Registry (0 – 255)

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SRv6 End SID sub-TLV

• Sub-TLV of SRv6 Locator TLV
• Inherits Topology/Algorithm from the parent Locator
• NOT associated with a neighbor
• MUST be a subnet of the parent locator
• NOT to be installed in RIB/FIB
• Included when topo level TLV is leaked
• Following Endpoint Functions are supported:
  – End (all PSP/USP variants)
  – End.T (all PSP/USP variants)
  – End.OTP
  – End.DT6
SRv6 End SID sub-TLV

Flags: 1 octet. No flags are currently defined.

SRv6 Endpoint Function: 2 octets. As defined in [I-D.filsfils-spring-srv6-network-programming]

SID: 16 octets. This field encodes the advertised SRv6 SID.

Sub-sub-TLV-length: 1 octet. Number of octets used by sub-sub-TLVs
Optional sub-sub-TLVs
Advertising SRv6 End.X SIDs

• Associated with one (possibly multiple) neighbors
• Sub-TLVs of IS-Neighbor TLVs (22, etc.)
• Inherits Topology from the neighbor
• Algorithm MUST be specified
• MUST be a subnet of a locator with matching topology/algorithm
• NOT to be installed in RIB/FIB
• Following Endpoint Functions are supported:
  – End.X (all PSP/USP variants)
  – End.DX6
• Two sub-TLVs: P2P and LAN
SRv6 End.X SID sub-TLV

```
0                   1                   2                   3
+-------------------+-------------------+-------------------+
|   Type        |     Length    |
+-------------------+-------------------+
|   Flags       | Algorithm     |   Weight    |
+-------------------+-------------------+-------------------+
| SRv6 Endpoint Function |
+-------------------+-------------------+-------------------+
| SID (128 bits) . . . |
+-------------------+-------------------+-------------------+
| SID (cont . . .) |
+-------------------+-------------------+-------------------+
| SID (cont . . .) |
+-------------------+-------------------+-------------------+
| SID (cont . . .) |
+-------------------+-------------------+-------------------+
| SID (cont . . .) |
+-------------------+-------------------+-------------------+
| sub-tlv-len   |         Sub-TLVs (variable) . . . |
+-------------------+-------------------+-------------------+
```
SRv6 End.X SID Fields

Flags: 1 octet.

0 1 2 3 4 5 6 7
+-+-+-+-+-+-+-+-+
|B|S|P|Reserved |
+-+-+-+-+-+-+-+-+

where:

B-Flag: Backup flag. If set, the End.X SID is eligible for protection (e.g., using IPFRR) as described in [RFC8355].

S-Flag.  Set flag.  When set, the S-Flag indicates that the End.X SID refers to a set of adjacencies (and therefore MAY be assigned to other adjacencies as well).

P-Flag.  Persistent flag.  When set, the P-Flag indicates that the End.X SID is persistently allocated, i.e., the End.X SID value remains consistent across router restart and/or interface flap.

Other bits: MUST be zero when originated and ignored when received.

Algorithm: From IGP Algorithm Registry (0 – 255)

Weight: Load balancing
### SRv6 Capabilities Sub-TLV

<table>
<thead>
<tr>
<th>Type</th>
<th>Length</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional sub-sub-TLVs …</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Flags**

<table>
<thead>
<tr>
<th>O</th>
<th>Reserved</th>
</tr>
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</table>

**O-flag:** Indicates the router supports use of the 0-bit in SRH (OAM) [I-D.ali-spring-srv6-oam].

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Advertising Maximum SRv6 Depths

Based on [I-D.ietf-isis-segment-routing-msd]
This allows both per link and per node support.

- **Max-Segments Left**: Maximum Received $SL$ in the $SRH$
- **Max-End-Pop**: Maximum number of SIDs when applying $PSP$ or $USP$ flavors (0 => not supported)
- **Max-T.Insert**: Maximum number of SIDs when applying $T.insert$ (0 => not supported)
- **Max-T.Encap**: Maximum number of SIDs when applying $T.Encap$ (0=>only IPinIP support)
- **Max-End-D**: Maximum number of SIDs when applying $End.DX6$ or $End.DT6$
Comments welcome