Advertising L2 Bundle Member Link Attributes in IS-IS
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Abstract

   There are deployments where the Layer 3 interface on which IS-IS
   operates is a Layer 2 interface bundle. Existing IS-IS
   advertisements only support advertising link attributes of the Layer
   3 interface. If entities external to IS-IS wish to control traffic
   flows on the individual physical links which comprise the Layer 2
   interface bundle link attribute information about the bundle members
   is required.

   This document introduces the ability for IS-IS to advertise the link
   attributes of layer 2 (L2) bundle members.

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 IS-IS
   adjacency is established is a Layer 2 interface bundle, for instance
   a Link Aggregation Group (LAG) [IEEE802.1AX]. This reduces the
   number of adjacencies which 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 (PCE) [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 - but currently IS-IS only supports advertising link
   attributes for the Layer 3 interfaces on which it operates.

This document introduces a new TLV to advertise link attribute information for each of the L2 bundle members which comprise the Layer 3 interface on which IS-IS operates.

[SR] introduces a new link attribute - adjacency segment identifier (Adj-SID) - which can be used as an instruction to forwarding to send traffic over a specific link. This document introduces additional sub-TLVs to advertise Adj-SIDs for L2 Bundle members.

Note that the new advertisements defined in this document are intended to be provided to external entities.

2. L2 Bundle Member Attributes TLV

A new TLV is introduced to advertise L2 Bundle member attributes. Although much of the information is identical to and uses the same sub-TLVs included in Extended IS-Neighbor advertisements (TLVs 22 and 222), a new TLV is used so that changes to the advertisement of the L2 Bundle member link attributes does not trigger unnecessary action by the [ISO10589] Decision process.

This new TLV utilizes the sub-TLV space defined for TLVs 22, 23, 141, 222, and 223.

The following new TLV is introduced:

          L2 Bundle Member Attributes
          Type: 25 (suggested - to be assigned by IANA)
          Length: Number of octets to follow

          Parent L3 Neighbor Descriptor
           L3 Neighbor System ID + pseudonode ID (7 octets)
           Flags: 1 octet field of following flags:

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

             where:

             P-flag: When set to 1 one of the sub-TLVs described
             in Section 2.1 immediately follows the flags field.
             If the P-flag is set to 0, then none of the sub-TLVs
             described in Section 2.1 are present.

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

         One or more of the following:
          L2 Bundle Attribute Descriptors
            Length of L2 Bundle Attribute Descriptor (1 octet)
              NOTE: This includes all fields described below.

            Number of L2 Bundle Member Descriptors (1 octet)
            L2 Bundle Member Link Local Identifiers
              (4 * Number of L2 Bundle Member Descriptors octets)

              NOTE: An L2 Bundle Member Descriptor is a Link Local
              Identifier as defined in [RFC5307].

            sub-TLV(s)

            A 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. Use of these
            two classes of sub-TLVs is described in the following
            sections.

      NOTE: Only one Parent L3 Neighbor Descriptor is present in a given
      TLV. Multiple L2 Bundle Attribute Descriptors may be present in a
      single TLV.

2.1. Parallel L3 Adjacencies

   When there exist multiple L3 adjacencies to the same neighbor
   additional information is required to uniquely identify the L3
   Neighbor. One and only one of the following three sub-TLVs is used
   to uniquely identify the L3 adjacency:

   o IPv4 Interface Address (sub-TLV 6 defined in [RFC5305])

   o IPv6 Interface Address (sub-TLV 12 defined in [RFC6119])

   o Link Local/Remote Identifiers (sub-TLV 4 defined in [RFC5307])

   When the P-bit is set in the flags field in the Parent L3 Neighbor
   Descriptor one and only one of the above sub-TLVs MUST be present.
   The chosen sub-TLV MUST immediately follow the flags field described
   in Section 2.

   These sub-TLVs MAY be omitted if no parallel adjacencies to the
   neighbor exist.

2.2. Shared Attribute sub-TLVs

   These sub-TLVs advertise a single copy of an attribute (e.g. link
   bandwidth). The attribute applies to all of the L2 Bundle Members in
   the set advertised under the preceding L2 Bundle Member Attribute
   Descriptor. No more than one copy of a given sub-TLV in this
   category may appear in the set of sub-TLVs under the preceding L2
   Bundle Member Attribute Descriptor. If multiple copies of a given
   sub-TLV are present both MUST be ignored.

   The set of L2 Bundle Member Descriptors which may be advertised under
   a single L2 Bundle Member Attribute Descriptor is therefore limited
   to bundle members which share the set of attributes advertised in the
   shared attribute sub-TLVs.

   All existing sub-TLVs defined in the IANA Sub-TLVs for TLVs 22, 23,
   141, 222, and 223 registry are in the category of shared attribute
   sub-TLVs unless otherwise specified in this document.

3. Advertising L2 Bundle Member Adj-SIDs

   [SR] defines sub-TLVs to advertise Adj-SIDs for L3 adjacencies.
   However these sub-TLVs only support a advertisement of a single Adj-
   SID. As it is expected that each L2 Bundle member will have unique
   Adj-SIDs in many deployments it is desirable to define a new sub-TLV
   which allows more efficient encoding of a set of Adj-SIDs in a single
   sub-TLV. Two new sub-TLVs are therefore introduced to support

advertising Adj-SIDs for L2 Bundle members. The format of the new
sub-TLVs is similar to that used for L3 adjacencies, but is optimized
to allow advertisement of a set of Adj-SIDs (one per L2 Bundle
Member) in a single sub-TLV.

The two new sub-TLVs defined in the following sections do not fall
into the category of shared attribute sub-TLVs.

3.1. L2 Bundle Member Adjacency Segment Identifier sub-TLV

This sub-TLV is used to advertise Adj-SIDs for L2 Bundle Members
associated with a parent L3 adjacency which is Point-to-Point. The
following format is defined for this sub-TLV:

   Type: 41 (suggested value to be assigned by IANA) (1 octet)
   Length: variable (1 octet)

   Flags: 1 octet field of following flags:

```
     0 1 2 3 4 5 6 7
    +-+-+-+-+-+-+-+-+
    |F|*|V|L|S|     |
    +-+-+-+-+-+-+-+-+
```

      where:

      * - Is a flag used in the L3 Adj-SID sub-TLV but which is NOT
        used in this sub-TLV. These bits SHOULD be sent as 0 and MUST
        be ignored on receipt

      F-Flag: Address-Family flag. If unset, then the Adj-SID refers
      to an L2 Bundle Member with outgoing IPv4 encapsulation. If set
      then the Adj-SID refers to an L2 Bundle Member with outgoing
      IPv6 encapsulation.

      V-Flag: Value flag. If set, then the Adj-SID carries a value.
      By default the flag is SET.

      L-Flag: Local Flag. If set, then the value/index carried by
      the Adj-SID has local significance. By default the flag is
      SET.

      S-Flag. Set Flag. When set, the S-Flag indicates that the
      Adj-SID refers to a set of L2 Bundle Members (and therefore
      MAY be assigned to other L2 Bundle Members as well).

      Other bits: MUST be zero when originated and ignored when

received.

Weight: 1 octet. The value represents the weight of the Adj-SID
    for the purpose of load balancing. The use of the weight is
    defined in [SR-ARCH].

NOTE: Flags and weight are shared by all L2 Bundle Members
listed in the L2 Bundle Attribute Descriptor.

L2 Bundle Member Adj-SID Descriptors. There MUST be one descriptor
 for each of the L2 Bundle Members advertised under the preceding
 L2 Bundle Member Attribute Descriptor. Each descriptor consists
 of one of the following fields:

  SID/Index/Label: according to the V and L flags, it contains
    either:

    * A 3 octet local label where the 20 rightmost bits are used
       for encoding the label value. In this case the V and L
       flags MUST be set.

    * A 4 octet index defining the offset in the SID/Label space
       advertised by this router. See [SR].
       In this case V and L flags MUST be unset.

    * A 16 octet IPv6 address. In this case the V flag MUST be
       set. The L flag MUST be unset if the IPv6 address is
       globally unique.

3.2. L2 Bundle Member LAN Adjacency Segment Identifier sub-TLV

   This sub-TLV is used to advertise Adj-SIDs for L2 Bundle Members
   associated with a parent L3 adjacency which is a LAN adjacency. In
   LAN subnetworks, the Designated Intermediate System (DIS) is elected
   and originates the Pseudonode-LSP (PN-LSP) including all neighbors of
   the DIS. When Segment Routing is used, each router in the LAN MAY
   advertise the Adj-SID of each of its neighbors on the LAN.
   Similarly, for each L2 Bundle Member a router MAY advertise an Adj-
   SID to each neighbor on the LAN.

   The following format is defined for this sub-TLV:

     Type: 42 (suggested value to be assigned by IANA) (1 octet)
     Length: variable (1 octet)
     Neighbor System ID: 6 octets

Flags: 1 octet field of following flags:

```
 0 1 2 3 4 5 6 7
+-+-+-+-+-+-+-+-+
|F|*|V|L|S|     |
+-+-+-+-+-+-+-+-+
```

where:

* - Is a flag used in the L3 Adj-SID sub-TLV but which is NOT used in this sub-TLV. These bits SHOULD be sent as 0 and MUST be ignored on receipt

F-Flag: Address-Family flag. If unset, then the Adj-SID refers to an L2 Bundle Member with outgoing IPv4 encapsulation. If set then the Adj-SID refers to an L2 Bundle Member with outgoing IPv6 encapsulation.

V-Flag: Value flag. If set, then the Adj-SID carries a value. By default the flag is SET.

L-Flag: Local Flag. If set, then the value/index carried by the Adj-SID has local significance. By default the flag is SET.

S-Flag. Set Flag. When set, the S-Flag indicates that the Adj-SID refers to a set of L2 Bundle Members (and therefore MAY be assigned to other L2 Bundle Members as well).

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

Weight: 1 octet. The value represents the weight of the Adj-SID for the purpose of load balancing. The use of the weight is defined in [SR-ARCH].

NOTE: Flags and weight are shared by all L2 Bundle Members listed in the L2 Bundle Attribute Descriptor.

L2 Bundle Member LAN Adj-SID Descriptors. There MUST be one descriptor for each of the L2 Bundle Members advertised under the preceding L2 Bundle Member Attribute Descriptor. Each descriptor consists of one of the following fields:

SID/Index/Label: according to the V and L flags, it contains either:

* A 3 octet local label where the 20 rightmost bits are used

for encoding the label value. In this case the V and L
flags MUST be set.

   * A 4 octet index defining the offset in the SID/Label space
      advertised by this router. See [SR].
      In this case V and L flags MUST be unset.

   * A 16 octet IPv6 address. In this case the V flag MUST be
      set. The L flag MUST be unset if the IPv6 address is
      globally unique.

4. IANA Considerations

   This document adds the following new TLV to the IS-IS TLV Codepoints
   registry.

   Value: 25 (suggested - to be assigned by IANA)

   Name: L2 Bundle Member Attributes

   The name of the Sub-TLVs for TLVs 22, 23, 141, 222, and 223 registry
   needs to be changed to Sub-TLVs for TLVs 22, 23, 25, 141, 222, and
   223 registry. An additional column needs to be added to the registry
   to indicate which sub-TLVs may appear in the new L2 Bundle Member
   Attributes TLV. The following table indicates the appropriate
   settings for all currently defined sub-TLVs as regards their use in
   the new L2 Bundle Member Attributes TLV.

        3 Administrative group (color) y
        4 Link Local/Remote Identifiers y
        6 IPv4 interface address y
        8 IPv4 neighbor address y
        9 Maximum link bandwidth y
        10 Maximum reservable link bandwidth y
        11 Unreserved bandwidth y
        12 IPv6 Interface Address y
        13 IPv6 Neighbor Address y
        14 Extended Administrative Group y
        18 TE Default metric y
        19 Link-attributes y
        20 Link Protection Type y
        21 Interface Switching Capability Descriptor y
        22 Bandwidth Constraints y
        23 Unconstrained TE LSP Count y
        24 Remote AS number n
        25 IPv4 remote ASBR Identifier n
        26 IPv6 remote ASBR Identifier n
        27 Interface Adjustment Capability Descriptor (IACD) y
        28 MTU n
        29 SPB-Metric y
        30 SPB-A-OALG y

   This document adds the following new sub-TLVs to the sub-TLVs for
   TLVs 22, 23, 25, 141, 222, and 223 registry.

   Value: 41 (suggested - to be assigned by IANA)

   Name: L2 Bundle Member Adj-SID

   This sub-TLV is allowed in the following TLVs:

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

   Value: 42 (suggested to be assigned by IANA)

   Name: L2 Bundle Member LAN Adj-SID

   This sub-TLV is allowed in the following TLVs:

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

5. Security Considerations

    None.

6. Acknowledgements

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7. References

7.1. Normative References

    [IEEE802.1AX]
              Institute of Electrical and Electronics Engineers, "IEEE
              Standard for Local and Metropolitan Area Networks - Link
              Aggregation.", ISO/IEC 10589:2002, Second Edition, Nov
              2008.

    [ISO10589]
              International Organization for Standardization,
              "Intermediate system to Intermediate system intra-domain
              routeing information exchange protocol for use in
              conjunction with the protocol for providing the
              connectionless-mode Network Service (ISO 8473)", ISO/
              IEC 10589:2002, Second Edition, Nov 2002.

    [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119,
              DOI 10.17487/RFC2119, March 1997,
              <http://www.rfc-editor.org/info/rfc2119>.

    [RFC5305] Li, T. and H. Smit, "IS-IS Extensions for Traffic
              Engineering", RFC 5305, DOI 10.17487/RFC5305, October
              2008, <http://www.rfc-editor.org/info/rfc5305>.

    [RFC5307] Kompella, K., Ed. and Y. Rekhter, Ed., "IS-IS Extensions
              in Support of Generalized Multi-Protocol Label Switching
              (GMPLS)", RFC 5307, DOI 10.17487/RFC5307, October 2008,
              <http://www.rfc-editor.org/info/rfc5307>.

    [RFC6119] Harrison, J., Berger, J., and M. Bartlett, "IPv6 Traffic
              Engineering in IS-IS", RFC 6119, DOI 10.17487/RFC6119,
              February 2011, <http://www.rfc-editor.org/info/rfc6119>.

7.2. Informational References

   [RFC4655] Farrel, A., Vasseur, J., and J. Ash, "A Path Computation
              Element (PCE)-Based Architecture", RFC 4655,
              DOI 10.17487/RFC4655, August 2006,
              <http://www.rfc-editor.org/info/rfc4655>.

   [SR]   "IS-IS Extensions for Segment Routing, draft-ietf-isis-
              segment-routing-extensions-06(work in progress)", December
              2015.

   [SR-ARCH] "Segment Routing Architecture, draft-ietf-spring-segment-
              routing-07(work in progress)", December 2015.

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