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Advertisement of Remote Interface Identifiers for Layer 2 Bundle Members
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Abstract

In networks where Layer 2 (L2) interface bundles (such as a Link Aggregation Group (LAG) [IEEE802.1AX]) are deployed, a controller may need to collect the connectivity relationships between bundle members for traffic engineering (TE) purposes. For example, when performing topology management and bidirectional path computation for TE, it is essential to know the connectivity relationships among bundle members.

This document describes how OSPF and IS-IS would advertise the remote interface identifiers for Layer 2 bundle members. The corresponding extension of BGP-LS is also specified.

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1. Introduction

BGP-LS [RFC9552] is widely used for collecting topology information from IGPs. In networks where Layer 2 (L2) interface bundles (such as a Link Aggregation Group (LAG) [IEEE802.1AX]) are deployed, a controller may need to collect the connectivity relationships between bundle members for traffic engineering (TE) purposes. For example, when performing topology management and bidirectional path computation for TE, it is essential to know the connectivity relationships among bundle members.

When advertising L2 bundles in OSPF [RFC9356] and IS-IS [RFC8668], a member link is described by its local interface identifier, also referred to as a link local identifier. If the remote interface identifier could be advertised for each member link, the pairing

relationships between the local and remote interfaces would be clear.

This document describes the mechanism for advertising the remote interface identifier for Layer 2 bundle members in OSPF and IS-IS. The BGP-LS extension for advertising L2 bundle member interface remote identifier is also specified in this document.

1.1. 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 BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

2. Use Case

Figure 1 shows a network, in which an L2 bundle is deployed between R1 and R2. The controller collects the topology information from R3 via BGP-LS.

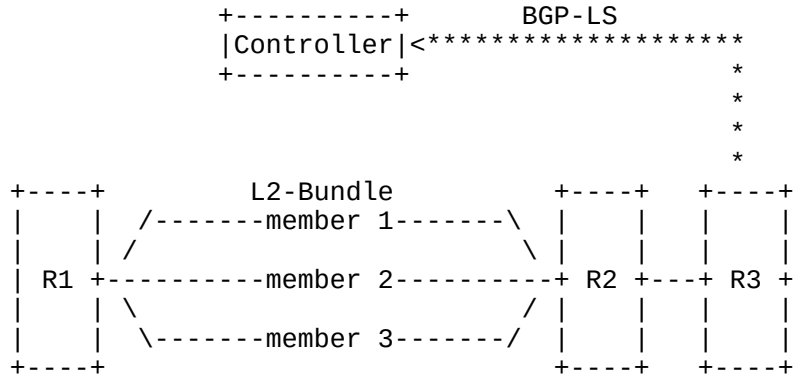


Figure 1

The network operator may want to control bidirectional traffic flows on the individual member links of the underlying Layer 2 bundle for TE purposes. The real-time bandwidth, delay, and link loss might be measured for each bundle member at both ends. Labels or SIDs might be allocated for each bundle member at both ends. So, there would be requirements for the controller to figure out the connectivity relationships between bundle members.

This document defines a mechanism for IGP routers to advertise the remote interface identifiers for each L2 bundle member, along with

the corresponding mechanism for the controller to collect such information via BGP-LS.

3. Advertising L2 Bundle Member Remote Interface Identifier

In OSPF, the remote interface identifiers of L2 bundle members are advertised as follows.

```
OSPFv2 Extended Link TLV, or OSPFv3 Router-Link TLV, for L3 Link:
  L2 Bundle Member Attributes TLV:
    L2 Bundle Member Descriptor of Member #1
    L2 Bundle Member Interface Remote Identifier Sub-TLV (Optional -
      as defined in Section 4)
  L2 Bundle Member Attributes TLV:
    L2 Bundle Member Descriptor of Member #2
    L2 Bundle Member Interface Remote Identifier Sub-TLV (Optional -
      as defined in Section 4)
  ...
  L2 Bundle Member Attributes TLV:
    L2 Bundle Member Descriptor of Member #n
    L2 Bundle Member Interface Remote Identifier Sub-TLV (Optional -
      as defined in Section 4)
```

In IS-IS, the remote interface identifiers of L2 bundle members are advertised as follows. Note that IS-IS can advertise a set of members in a single L2 Bundle Member Attribute Descriptor, so the L2 Bundle Member Interface Remote Identifier Sub-TLV MUST carry multiple remote interface identifiers, one for each of the bundle members advertised in the associated L2 Bundle Member Descriptor.

```
L2 Bundle Member Attributes TLV:
  Parent L3 Neighbor Descriptor
  Length of L2 Bundle Attribute Descriptor
  Number of L2 Bundle Member Descriptors
  L2 Bundle Member Link Local Identifiers of Member #1,#2,...,#n
  Sub-TLV(s)
  L2 Bundle Member Interface Remote Identifier Sub-TLV (Optional -
    as defined in Section 5) for Member #1,#2,...,#n
```

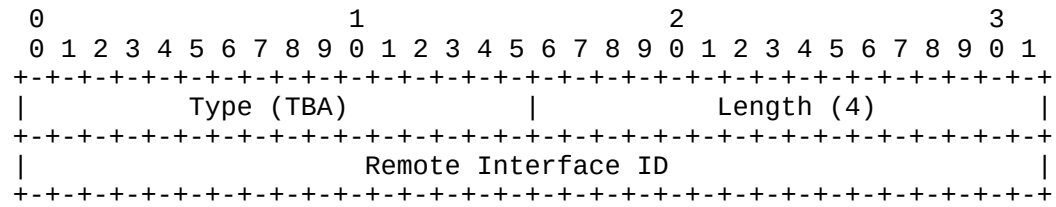
In BGP-LS, the remote interface identifiers of L2 bundle members are advertised as follows.

```
BGP-LS Link NLRI: Peer Adj Link for R1->R2(as described in Section
    5.2 of [RFC9086])
Link Attributes:
  L2 Bundle Member Attributes TLV:
    L2 Bundle Member Descriptor of Member #1
    L2 Bundle Member Interface Remote Identifier Sub-TLV (Optional -
      as defined in Section 6)
  L2 Bundle Member Attributes TLV:
    L2 Bundle Member Descriptor of Member #2
    L2 Bundle Member Interface Remote Identifier Sub-TLV (Optional -
      as defined in Section 6)
  ...
  L2 Bundle Member Attributes TLV:
    L2 Bundle Member Descriptor of Member #n
    L2 Bundle Member Interface Remote Identifier Sub-TLV (Optional -
      as defined in Section 6)
```

4. OSPF Extension

This document defines a new L2 Bundle Member Interface Remote Identifier Sub-TLV in both OSPFv2 and OSPFv3. This Sub-TLV is used to advertise the remote interface identifier for a L2 bundle member.

It can be carried as a sub-TLV of the OSPF L2 Bundle Member Attributes TLV [RFC9356]. It has the following format:



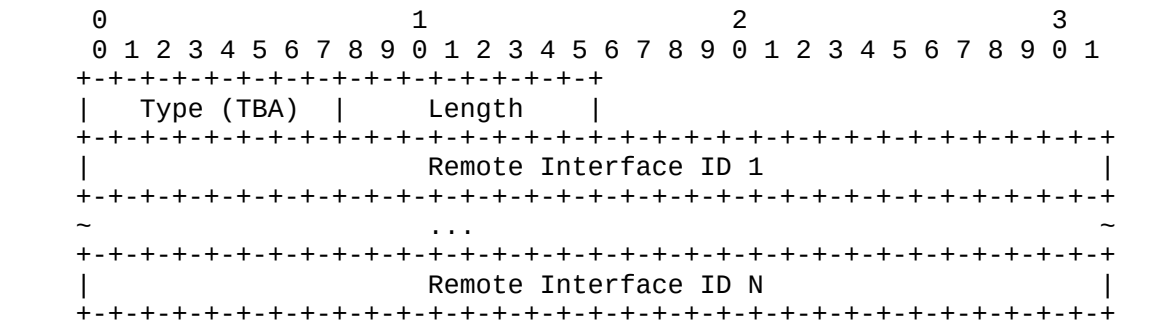
- Type: TBA.
- Length: 4.
- Remote Interface ID: Remote identifier of interface, 4 octets.

A remote interface ID with value of zero is not valid and MUST be ignored and handled as if the sub-TLV was not present.

5. IS-IS Extension

This document defines a new L2 Bundle Member Interface Remote Identifier Sub-TLV in IS-IS. This Sub-TLV is used to advertise the remote interface identifiers for L2 bundle members.

It can be carried as a sub-TLV of the IS-IS L2 Bundle Member Attributes TLV [RFC8668]. It has the following format:



o Type: TBA.

o Length: 4 * Number of L2 Bundle Member Descriptors.

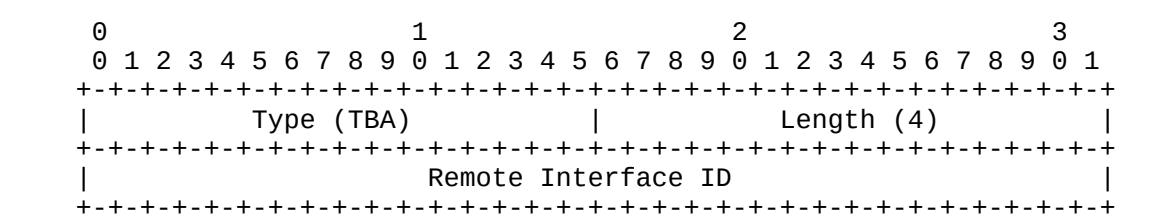
o Remote Interface ID: Remote identifier of interface, 4 octets.

There MUST be one Remote Interface ID for each of the L2 Bundle Members advertised under the associated L2 Bundle Member Attribute Descriptor. A remote interface ID with value of zero MUST be ignored and handled as if the value was unknown.

6. BGP-LS Extension

This document defines a new L2 Bundle Member Interface Remote Identifier Sub-TLV in BGP-LS. This Sub-TLV is derived from the Remote Interface Identifier Sub-TLV of OSPF (Section 3) and IS-IS (Section 4).

It can be carried as a sub-TLV of the BGP-LS L2 Bundle Member Attributes TLV [RFC9085]. It has the following format:



o Type: TBA.

o Length: 4.

o Remote Interface ID: Remote identifier of interface, 4 octets.

A remote interface ID with value of zero is not valid and MUST be ignored and handled as if the sub-TLV was not present.

7. Acquirement of Remote Interface Identifier

IGPs have no direct way to exchange L2 bundle member link identifiers since the Layer 3 protocol is not operating directly on the bundle members. Some L2 protocols may be used to get the remote interface identifiers for bundle members. This may be discovered via [IEEE802.1AX] when used to form the LAG bundle. A router may also run LLDP [802.1AB] on the bundle members to exchange local interface identifiers with its neighbor, by using the Port ID TLV.

How the remote interface identifier is obtained is out of the scope of this document.

8. Security Considerations

This document describes how OSPF, IS-IS and BGP-LS would advertise the remote interface identifiers for Layer 2 bundle members. There are no new security issues introduced by the extensions in this document. The security considerations of [RFC8668], [RFC9356] , [RFC9552],[RFC9085] and [RFC9086] are are applicable to this document.

As always, if the IS-IS protocol is used in an environment where unauthorized access to the physical links on which IS-IS Protocol Data Units (PDUs) are sent occurs, then attacks are possible. The use of authentication as defined in [RFC5304] and [RFC5310] is recommended to prevent such attacks.

As always, if the OSPF protocol is used in an environment where unauthorized access to the physical links on which OSPF packets are sent occurs, then attacks are possible. The use of authentication as defined in [RFC5709], [RFC7474], [RFC4552], and [RFC7166] is recommended for preventing such attacks.

The isolation of BGP-LS peering sessions is recommended to ensure that BGP-LS topology information (including the newly added remote interface identifiers information) is not advertised to an external BGP peering session outside the trusted domain [RFC8402].

9. IANA Considerations

This document adds the following new sub-TLV to the "OSPFv2 Extended Link TLV Sub-TLVs" registry.

Type	Designation	L2BM
TBA	L2 Bundle Member Interface Remote Identifier	Y

This document adds the following new sub-TLV to the "OSPFv3 Extended-LSA Sub-TLVs" registry.

Type	Description	L2BM
TBA	L2 Bundle Member Interface Remote Identifier	Y

This document adds the following new sub-TLV to the "IS-IS Sub-TLVs for TLVs Advertising Neighbor Information" registry.

Type	Description	22	23	25	141	222	223
TBA	L2 Bundle Member Interface Remote Identifier	n	n	y	n	n	n

This document adds the following new sub-TLV to the "BGP-LS NLRI and Attribute TLVs" registry.

Type	Description
TBA	L2 Bundle Member Interface Remote Identifier

10. References

10.1. Normative References

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10.2. Informational References

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