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                  Signalling Unnumbered Links in CR-LDP

                     draft-ietf-mpls-crldp-unnum-00.txt

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2. Abstract

   Current signalling used by MPLS TE doesn't provide support for
   unnumbered links. This document defines procedures and extensions to
   CR-LDP, one of the MPLS TE signalling protocols, that are needed in
   order to support unnumbered links.

3. Overview

Supporting MPLS TE over unnumbered links (i.e., links that do not have IP addresses) involves two components: (a) the ability to carry (TE) information about unnumbered links in IGP TE extensions (ISIS or OSPF), and (b) the ability to specify unnumbered links in MPLS TE signalling. The former is covered in [ISIS-TE, OSPF-TE]. The focus of this document is on the latter.

Current signalling used by MPLS TE doesn't provide support for unnumbered links because the current signalling doesn't provide a way to indicate an unnumbered link in its Explicit Route Objects. This document proposes simple procedures and extensions that allow CR-LDP signalling [CR-LDP] to be used with unnumbered links.

4. Interface Identifiers

Since unnumbered links are not identified by an IP address, then for the purpose of MPLS TE they need some other identifier. We assume that each unnumbered link on a Label Switched Router (LSR) is given a unique 32-bit identifier. The scope of this identifier is the LSR to which the link belongs; moreover, the IS-IS and/or OSPF and CR-LDP modules on an LSR must agree on interface identifiers.

Note that links are directed, i.e., a link l is from some LSR A to some other LSR B. LSR A chooses the interface identifier for link l. To be completely clear, we call this the "outgoing interface identifier from LSR A's point of view". If there is a reverse link from LSR B to LSR A (for example, a point-to-point SONET interface connecting LSRs A and B would be represented as two links, one from A to B, and another from B to A), B chooses the outgoing interface identifier for the reverse link; we call this the link's "incoming interface identifier from A's point of view". There is no a priori relationship between the two interface identifiers.
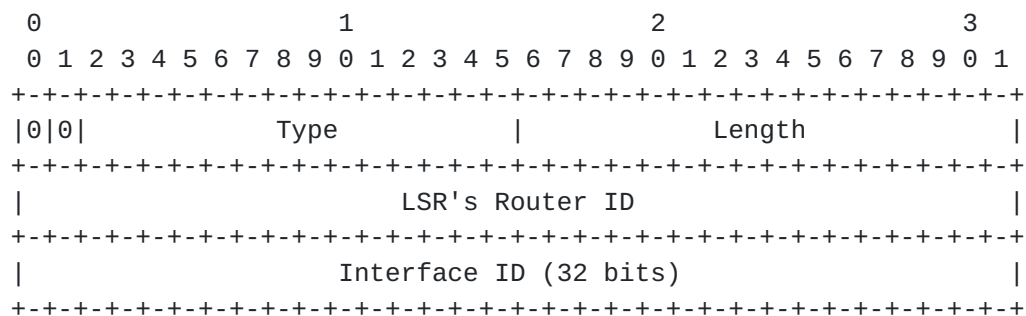
5. Unnumbered Forwarding Adjacencies

   If an LSR that originates an LSP advertises this LSP as an unnumbered
   Forwarding Adjacency in IS-IS or OSPF [LSP-HIER], the LSR MUST
   allocate an interface ID to that Forwarding Adjacency. Moreover, the
   REQUEST message for the LSP MUST contain an INTERFACE ID object
   (described below), with the LSR's Router ID set to the head end's
   router ID, and the Interface ID set to the LSP's interface ID.

   If the LSP is bidirectional, and the tail-end LSR (of the forward
   LSP) advertises the reverse LSP as an unnumbered Forwarding
   Adjacency, the tail-end LSR MUST allocate an interface ID to the
   reverse Forwarding Adjacency. Furthermore, the MAPPING message for
   the LSP MUST contain an INTERFACE ID object, with the LSR's Router ID
   set to the tail end's router ID, and the Interface ID set to the
   reverse LSP's interface ID.

5.1. INTERFACE ID Object

   The INTERFACE ID object has Type to be determined by IETF consensus
   and length 8. The format is given below.

   Figure 1: Interface ID TLV

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0|0|         Type          |             Length                |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     LSR's Router ID                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   Interface ID (32 bits)                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```


   This object can optionally appear in either a REQUEST message or a
   MAPPING message. In the former case, we call it the "Forward
   Interface ID" for that LSP; in the latter case, we call it the
   "Reverse Interface ID" for the LSP.

6. Signalling Unnumbered Links in EROs

A new subobject of the Explicit Route Object (ERO) is used to specify unnumbered links. This subobject has the following format:

Figure 2: Unnumbered Interface ID Subobject

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0|0|           Type            |              Length           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Interface ID (32 bits)                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

This subobject is strict. The Type is 0x0805 (Unnumbered Interface ID) and the Length is 4.

An LSR sending a Request message that includes an Unnumbered Interface ID subobject as the first subobject in the ERO MUST also include a PHOP TLV, specifying the Router ID of the sending LSR. This TLV is depicted in Figure 3.

Figure 3: PHOP TLV

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0|0|           Type            |              Length           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       LSR's Router ID                         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

The Type (PHOP TLV) is to be determined by IETF consensus and the Length is 4.

6.1. Interpreting the Unnumbered Interface ID Subobject

The Interface ID is the outgoing interface identifier with respect to the previous node in the path (i.e., the PHOP). If the Request message contains an Unnumbered Interface ID subobject as the first subobject in the ERO, then the PHOP object in the message must contain the router ID of the previous node.

6.2. Processing the Unnumbered Interface ID Subobject

   A node that receives a Request message with an Unnumbered Interface
   ID as the first subobject in the ERO carried by the message MUST
   check whether the tuple <PHOP, Interface ID> matches the tuple <LSR's
   Router ID, Forward Interface ID> of any of the LSPs for which the
   node is a tail-end. If a match is found, the match identifies the
   Forwarding Adjacency for which the node has to perform label
   allocation.

   Otherwise, the node MUST check whether the tuple <PHOP, Interface ID>
   matches the tuple <LSR's Router ID, Reverse Interface ID> of any of
   the bidirectional LSPs for which the node is the head-end. If a
   match is found, the match identifies the Forwarding Adjacency for
   which the node has to perform label allocation, namely, the reverse
   Forwarding Adjacency for the LSP identified by the match.

   Otherwise, if the node maintains information about Interface IDs
   assigned by its neighbors for the unnumbered links between the node
   and the neighbors (i.e., incoming interface identifiers from the
   node's point of view), the node SHOULD check whether the tuple <PHOP,
   Interface ID> matches <neighbor's Router ID, Incoming Interface ID>
   for any link. If a match is found, the match identifies the link for
   which the node has to perform label allocation.

   Otherwise, it is assumed that the node has to perform label
   allocation for the link over which the Request message was received.
   In this case the receiving node MAY validate that it received the
   Request Message correctly. To do so, the node must maintain a
   database of Traffic Engineering information distributed by IS-IS
   and/or OSPF.

   To validate that it received the Request message correctly, the node
   looks up in its Traffic Engineering database for the node
   corresponding to the router ID of the sender of the Request message.
   It then checks that there is a link from the previous node to itself
   that carries the same Interface ID as the one in the ERO subobject.
   If this is not the case, the receiving node has received the message
   in error and SHOULD return a "Bad Initial ER-Hop" error. Otherwise,
   the receiving node removes the first subobject, and continues
   processing the ERO.

6.3. Selecting the Next Hop

If, after processing and removing all initial subobjects in the ERO
that refer to itself, the receiving node finds a subobject of type
Unnumbered Interface ID, it determines the next hop as follows. The
Interface ID MUST refer to an outgoing interface identifier that this
node allocated; if not, the node SHOULD return a "Bad Strict Node"
error. The next hop is the node at the other end of the link that
the Interface ID refers to.

Furthermore, when sending a Request message to the next hop, the ERO
to be used is the current ERO (starting with the Unnumbered Interface
ID subobject).

7. Security Considerations

This document raises no new security concerns for CR-LDP.

8. Acknowledgments

Thanks to Rahul Aggarwal for his comments on the text.

9. References

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