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Signalling Unnumbered Links in CR-LDP

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1. Status of this Memo

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 (see [LSP-HIER]), or the LSR uses the Forwarding Adjacency formed by this LSP as an unnumbered component link of a bundled link (see [BUNDLE]), the LSR MUST allocate an interface identifier to that Forwarding Adjacency (just like for any other unnumbered link). Moreover, the Request message used for establishing the LSP that forms the Forwarding Adjacency MUST contain an LSP_TUNNEL_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 interface identifier that the LSR allocated to the Forwarding Adjacency.

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 identifier to the reverse Forwarding Adjacency. Furthermore, the MAPPING message for the LSP MUST contain an LSP_TUNNEL_INTERFACE_ID object, with the LSR's Router ID set to the tail end's router ID, and the Interface ID set to the interface identifier allocated by the tail-end LSR.

5.1. LSP_TUNNEL_INTERFACE_ID Object

The LSP_TUNNEL_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             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                           Router ID                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Interface ID (32 bits)                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

This subobject is strict. The Type is 0x0805 (Unnumbered Interface ID) and the Length is 8.

The Interface ID is the outgoing interface identifier with respect to the LSR specified by the router ID.

6.1. Processing the Unnumbered Interface ID Subobject

First of all, the receiving LSR must validate that it received the Request message correctly. If the first subobject in the ERO is an Unnumbered Interface subobject, the check is done as follows (for other types of ERO subobjects, the rules in [CR-LDP] apply).

The IF_ID TLV ([GMPLS-SIG], [GMPLS-CRLDP]), if present in the message, MUST contain the same Router ID (IP Address) as the Router ID carried in the Unnumbered Interface ID subobject. If not, the receiving LSR MUST return a "Bad Initial ER-Hop" error. If IF_ID TLV is present, and it carries the IF_INDEX TLV, the receiving LSR SHOULD check that the value carried in this TLV is the same as carried in the Interface ID field of the Unnumbered Interface ID subobject. If the value is different, the receiving LSR MUST return a "Bad Initial ER-Hop" error.

If the above checks are passes, the LSR checks whether the tuple <Router ID, Interface ID> from the Unnumbered Interface subobject matches the tuple <Router ID, Forward Interface ID> of any of the LSPs for which the LSR is a tail-end. If a match is found, the match identifies the Forwarding Adjacency for which the LSR has to perform label allocation.

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

Otherwise, the LSR must have information about the identifiers assigned by its neighbors to the unnumbered links (i.e., incoming interface identifiers from LSR's point of view). The LSR uses this information to find a link with tuple <Router ID, incoming interface identifier> matching the tuple <Router ID, Interface ID> from the Unnumbered Interface subobject. If the matching tuple is found, and the link is not a bundled link, the match identifies the link for which the LSR has to perform label allocation. If the matching tuple is found, and the link is a bundled link, the LSR follows the procedures for label allocation as described in [LINK-BUNDLE].

6.2. Selecting the Next Hop

Once an LSR determines the link for which the LSR has to perform label allocation, the LSR removes the initial subobject in the ERO, and computes the next hop. The next hop for an Unnumbered Interface ID subobject is determined 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 LSR at the other end of the link that the Interface ID refers to. If this is the LSR itself, the subobject is removed, and the process repeated. If the next node is some other LSR, this is the next hop to which a Request message must be sent.

When sending a Request message to the next hop, if the message carries the IF_ID object, then this object MUST contain the IF_INDEX TLV, with IP Address in that TLV set to the LSR's Router ID, and Interface ID set to the Interface ID carried in the first subobject of the ERO.

7. Security Considerations

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

8. Acknowledgments

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9. References

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