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LSP Attribute in ERO
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Abstract

LSP attributes can be specified or recorded for whole path, but they cannot be targeted to a specific hop. This document proposes alternative ways to extend the semantic for RSVP ERO object to target LSP attributes to a specific hop.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

Generalized MPLS (GMPLS) Traffic Engineering (TE) Label Switched Paths (LSPs) can be route-constrained by making use of the Explicit Route (ERO) object and related sub-objects as defined in [RFC3209], [RFC3473], [RFC3477], [RFC4873], [RFC4874], [RFC5520] and [RFC5553]. This document proposes mechanisms to target LSP attributes at a specific hop. This document presents several solutions for discussion, final document will contains only one document after WG consensus.

1.1. Contributing Authors

1.2. 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].

2. Requirements

The requirement is to provide a generic mechanism to carry information related to specific nodes when signaling an LSP. This document does not restrict what that information can be used for. LSP attribute defined [RFC5420] should be expressed in ERO and SERO objects.

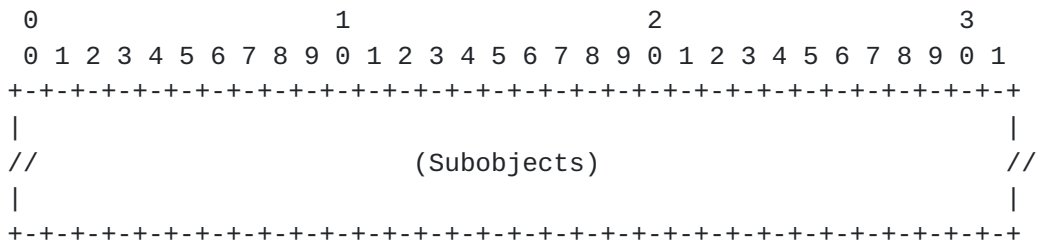
3. Solutions

3.1. Non solution

A solution using a specific ERO or SERO subobject is not used because the subobject length is limited to 8 bit, versus 16 bit for LSP ATTRIBUTES. This does not allow to put LSP ATTRIBUTE subobjects in ERO subobjects.

3.2. Extended ERO Object

The logic of the EXTENDED_EXPLICIT_ROUTE follows the one of SERO.The class of the EXTENDED_EXPLICIT_ROUTE object is xxx (of the form 11bbbbbb). The EXTENDED_EXPLICIT_ROUTE object has the following format: Class = xxx, C_Type = 1 The EXTENDED_EXPLICIT_ROUTE object may be used if some node along the explicit route support this object. The EXTENDED_EXPLICIT_ROUTE object is assigned a class value of the form 11bbbbbb, so it is forwarded by nodes not supporting it.



Subobjects The contents of an EXTENDED_EXPLICIT_ROUTE object are a series of variable- length data items called subobjects. The subobjects are defined in section Section 3.2.3 below.

3.2.1. Semantic of the Extended ERO object

Extended ERO object is carried in Path messages and carries a list of hops extended with hop-specific information. It is structured as a sequence of hop identifier subobjects (to indicate the hop who should process the subsequent attributes) and a series of hop attributes (which may be mandatory or optional) for the specified hop to process.

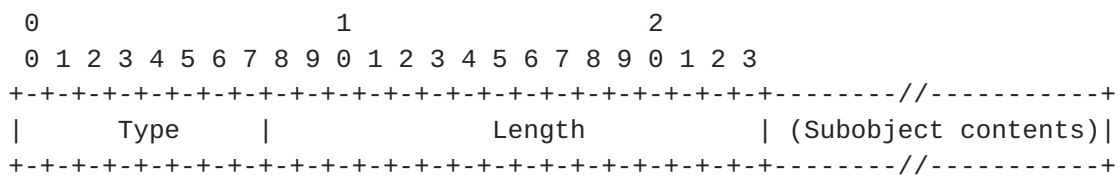
3.2.2. Procedures

If a Path message contains multiple EXTENDED_EXPLICIT_ROUTE objects, only the first object is meaningful. Subsequent EXTENDED_EXPLICIT_ROUTE objects MAY be ignored and SHOULD NOT be propagated. An EXTENDED_EXPLICIT_ROUTE SHOULD contain at least 2 subobjects. The first subobject MUST indicate a node or link that

identifies a hop that should process the next subobject(s). The address used to identify the hop SHOULD also be listed in the ERO or an SERO. This ensures that the extended attribute is for a node or link along the LSP path. The second subobject SHOULD contains an extended node or link information. In this document this SHOULD be a LSP Attribute subobject.

3.2.3. Subobjects

The content of an EXTENDED_EXPLICIT_ROUTE are a series of variable length subobjects. Each subobject has the following form



The Type indicates the type of contents of the subobject. Currently defined values are:

1 Hop identifier subobject containing an ERO subobject:

IPv4 prefix

IPv6 prefix

Unnumbered Interface ID

Autonomous system number

Path Key with 32-bit PCE ID

Path Key with 128-bit PCE ID

Per-hop attributes:

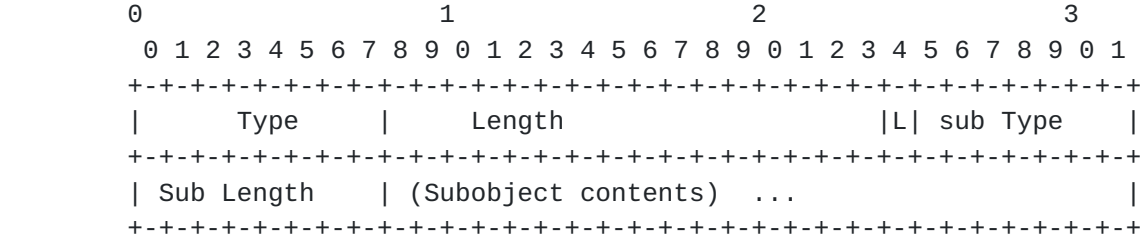
XX LSP Attribute

Length The Length contains the total length of the subobject in bytes, including the Type and Length . The Length MUST be at least 4, and MUST be a multiple of 4.

3.2.3.1. Hop identifier

The Hop identifier subobject contains exactly one ERO subobject identifying a hop. The value of the subobject is a copy of the ERO

subobject definition. The format of the subobject is as follow:



Type 0x01 Hop Identifier

Length The Length contains the total length of the subobject in bytes, including the Type and Length fields.

Sub type The ERO subobject type, the same as the ERO subobject type. the ERO type defined are :

1 IPv4 prefix

2 IPv6 prefix

3 Reserved

4 Unnumbered Interface ID

32 Autonomous system number

33 Reserved

37 Reserved

64 Path Key with 32-bit PCE ID

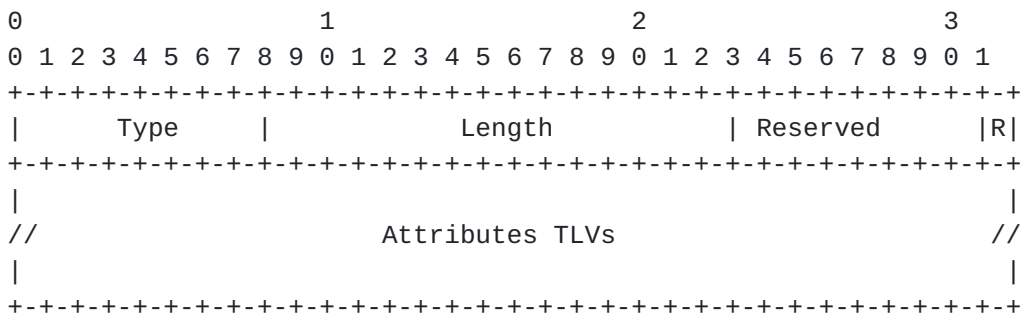
65 Path Key with 128-bit PCE ID

Sub length The ERO subobject type, the same as the ERO subobject length. It its unchanged compared to the ERO subobject definition.

Subobject contents The ERO subobject content, it its unchanged compared to the ERO subobject definition.

3.2.3.2. Hop LSP Attribute

The LSP attribute subobject contains information targeted at the hop identified by the preceding hop identifier subobject.



The attributes TLV are encoded as defined in [RFC5420] section 3.

Type x TBD by IANA.

Length The Length contains the total length of the subobject in bytes, including the Type and Length fields. The Length MUST be always divisible by 4.

Reserved Reserved, must be set to 0 when the subobject is inserted in the ERO, MUST NOT be changed when a node process the ERO and must be ignored on the node addressed by the preceding ERO subobjects

R This bit reflects the LSP_REQUIRED_ATTRIBUTE and LSP_ATTRIBUTE semantic. When set indicates required LSP attributes to be processed by the node, when cleared the LSP attributes are not required as described in Section 3.2.3.3.

3.2.3.3. Processing

Following [RFC3209] and [RFC3473] the Extended ERO is managed as a list where each hop information starts with a subobject identifying an abstract node or link. The LSP attribute subobject must be appended after the hop identifier subobject (which follows the formatting of the objects defined in [RFC3209], [RFC3473], [RFC3477], [RFC4873], [RFC4874], [RFC5520] and [RFC5553]. Several LSP attribute subobject MAY be present for each hop identification object.

When the R bit is set a node MUST examine the attribute TLV present in the subobject following the rules described in [RFC5420] section 5.2. When the R bit is not set a node MUST examine the attribute TLV present in the subobject following the rules described in [RFC5420]

section 4.2. If more than one ERO LSP attribute subobject having the R bit set is present, the first one MUST be processed and the others SHOULD be ignored. If more than one ERO LSP attribute subject having the R bit cleared is present for the same hop identification object, then the first one MUST be processed and the others SHOULD be ignored.

3.2.4. Processing

A node receiving a Path message containing an EXTENDED_EXPLICIT_ROUTE object must determine if the extended hop information is applicable for this node. The node performs the following steps:

1. The node receiving the RSVP message MUST first evaluate if the ERO object is present. If the ERO object is not present it has received the message in error and SHOULD return a pathError message.

2. Second the node MUST read the first subobject. If the node is not part of the abstract node described by the first subobject, the processing stops.

3. If there is no second subobject this indicates the end of the extended ERO. The extended ERO SHOULD be removed from the Path message. A new extended ERO MAY be added to the Path message.

4. Next the node evaluates the second subobject.

   A. If the subobject identified an abstract node and the node is also part of the abstract node, then the node deletes the first subobject and continue processing with step 3.

   B. If the subobject identified an abstract node and the node is not part of the abstract node, then the extended ERO is invalid and the node SHOULD return a PathErr with error code "Routing Error" and error value "Bad EXTENDED_EXPLICIT_ROUTE object" with the EXTENDED_EXPLICIT_ROUTE object included, truncated (on the left) to the offending unrecognized subobject

   C. If the subobject is an LSP Attribute subobject it processes it according to the rules for that subobject and removes it from the extended ERO. If the extended ERO does not contain further subject it SHOULD be removed from the Path message. A new extended ERO MAY be added to the Path message.

If a node finds a hop identification object which matches the local router handling of the subobject it will behave as described in

[RFC3209] when an unrecognized ERO subobject is encountered. This node will return a PathErr with error code "Routing Error" and error value "Bad EXTENDED_EXPLICIT_ROUTE object" with the EXTENDED_EXPLICIT_ROUTE object included, truncated (on the left) to the offending unrecognized subobject.

4. IANA Considerations

TBD once a final approach has been chosen.

5. Security Considerations

None.

6. Acknowledgments

The authors would like to thanks Lou Berger for his directions and Attila Takacs for inspiring this [I-D.kern-ccamp-rsvpte-hop-attributes]. The authors also thanks Dirk Schroetter for his contribution to the initial versions of the documents (version -00 up to -02).

7. References

7.1. Normative References

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