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**LSP Attribute in ERO**  
**draft-margaria-ccamp-lsp-attribute-ero-01**

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.

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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 present 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. ERO LSP Attribute Subobject

The ERO LSP Attributes subobject may be carried in the ERO or SERO object if they are present. The subobject uses the standard format of an ERO subobject.

##### 3.1.1. ERO LSP\_ATTRIBUTE subobject

The length is variable and content MUST be the same as for the LSP\_ATTRIBUTE object with Attributes TLVs.

The ERO LSP attribute subobject is defined as follows:

```

      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
      +--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
      |L|  Type  |      Length      |      Reserved      |R|
      +--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
      |
      //              Attributes TLVs              //
      |
      +--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
  
```

See [\[RFC3209\]](#) for a description of L parameters. 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 3.1.2](#).





Attributes TLVs as defined in [\[RFC5420\] section 3](#).

### **3.1.2. Procedures**

As described in [\[RFC3209\]](#) and [\[RFC3473\]](#) the 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 existing subobjects defined in [\[RFC3209\]](#), [\[RFC3473\]](#), [\[RFC3477\]](#), [\[RFC4873\]](#), [\[RFC4874\]](#), [\[RFC5520\]](#) and [\[RFC5553\]](#). Several LSP attribute subobject MAY be present.

If a node is processing an LSP attribute subobject and does not support 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 EXPLICIT\_ROUTE object" with the EXPLICIT\_ROUTE object included, truncated (on the left) to the offending unrecognized subobject.

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, the first one MUST be processed and the others SHOULD be ignored. [[anchor8: This need to be revised due to object length Pb --Ed.]]

### **3.1.3. Pros and Cons**

This solution minimize the changes to the ERO object and so implementations can access all per-hop information when processing the ERO.

However, per hop ERO sub-objects are limited to 255 bytes in length which may limit its extensibility. Subsequent uses of this mechanism may wish to carry large amounts of contiguous information targeted at a single hop, which would need to split across multiple sub-objects.

It also requires the sub-object to be duplicated multiple times in the ERO if the same information needs to be targeted at multiple nodes.



Each hop on an LSP may have at most two ERO Hop Info Index subobjects associated with it. One for optional attributes, and one for



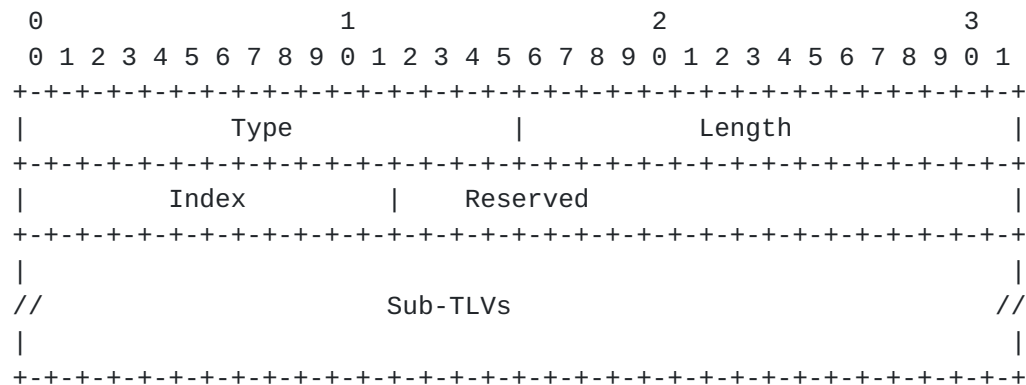
### 3.2.3. RR0 Hop Info Index Subobject

The RR0 Hop info index subobject is defined as follows:

Each hop on an LSP may have at most one RRO Hop Info Index subobjects associated with it.

The LSP Attribute Hop Info TLV is defined as follows:





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.

Index A value referred to by the Index field in the ERO Hop Info Index Subobject.

Reserved Reserved, must be set to 0 when the subobject is inserted in the LSP Attributes, MUST NOT be changed when a node process the LSP Attributes and must be ignored on the node processing the Hop Info TLV.

Sub-TLVs The information that is targeted at the specific hop or hops identified by the Index field.

This document defines 1 sub-TLV type as below.

#### **3.2.4.1. Per Hop Attribute sub-TLV**

The Per Hop Attribute sub-TLV is defined to be identical to the Attributes TLV in [RFC5420]. Thus using this sub-TLV means any Attribute TLV can now be targeted at specific nodes using the LSP Attribute Hop Info TLV.

Note that this means the number space for the Type value of Attributes for the whole LSP and those that can only ever be targeted at specific hops is shared.

#### **3.2.5. Procedures**

As described in [RFC3209] and [RFC3473] the ERO is managed as a list where each hop information starts with a subobject identifying an abstract node or link. The Hop Info Index subobject must be appended





after the existing subobjects defined in [\[RFC3209\]](#), [\[RFC3473\]](#), [\[RFC3477\]](#), [\[RFC4873\]](#), [\[RFC4874\]](#), [\[RFC5520\]](#) and [\[RFC5553\]](#). Only one Hop Info Index subobject may be added per node or link entry.

If a node is processing an ERO Hop Info Index subobject and does not support 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 EXPLICIT\_ROUTE object" with the EXPLICIT\_ROUTE object included, truncated (on the left) to the offending unrecognized subobject.

If the node does supports the Hop Info Index subobject it will look for a corresponding (Both having the same Index field value) LSP Attribute Hop Info TLV in the LSP Attribute object. If one is not present it will return a PathErr with error code "Routing Error" and error value "Bad EXPLICIT\_ROUTE object".

A node processing the LSP Attribute Hop Info TLV should not alter it. It is valid for multiple ERO entries to refer to the same Hop Info TLV, thus targeting the same information at multiple nodes.

The RRO Hop Info Index subobject should be processed according to the rules of [section 7.3.1 of \[RFC5420\]](#). A node inserting an RRO Hop Info Index subobject should not also insert an RRO Attributes subobject.

### **[3.2.6](#). Pros and Cons**

This solution is more complex in term of processing, but addresses some of the restrictions in the first solution. LSP Attribute TLVs allow a length of up to 65535 bytes and the indexing system allows multiple nodes to target the same information. The LSP Attribute Hop Info TLV may be extended by further sub-TLV types

Other objects may be candidate to contain the Indexed ERO attribute, for instance the ERO object with a new C-Type.



#### **4. IANA Considerations**

TBD once a final approach has been chosen.

## **5. Security Considerations**

None.

## **6. Acknowledgments**

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