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LSP Attribute in ERO
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Abstract

[RFC5420](#) extends RSVP-TE to specify or record generic attributes which apply to the whole of the path of an LSP. This document proposes an extension to the RSVP ERO and RRO objects to allow it to specify or record generic attributes which apply to a given 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 [\[RFC5553\]](#). Several documents have identified the need for attributes that can be targeted at specific hops in the path of an LSP, including [\[RFC6163\]](#), [\[I-D.ietf-ccamp-wson-signaling\]](#), [\[I-D.dong-ccamp-rsvp-te-mpls-tp-li-lb\]](#) or [\[I-D.ali-ccamp-rc-objective-function-metric-bound\]](#),. This document provides a generic mechanism for use by these other documents.

RSVP already supports generic extension of LSP attributes in [RFC5420]. In order to support current and future ERO constraint extensions this document defines a mechanism to define per-Hop attributes.

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. A mechanism similar to LSP attribute defined [RFC5420] should be expressed in ERO and SERO objects. A new ERO sub-object is defined, containing a list of generic per-Hop attributes. The mechanism defined in this document limits itself to single HOP attributes, and does not address attributes valid for a LSP section

3. Specifying Hop Attribute

The ERO 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. ERO_HOP_ATTRIBUTE subobject

The length is variable and content is a list of HOP Attributes TLVs defined in Section 3.2. The size of the ERO sub-object limits the size of the attribute TLV to 250 bytes. The typical size of currently defined and forthcoming LSP_ATTRIBUTE TLVs applicable to a specific hop (WSON_SIGNALING, OF and Metric) is not foreseen to exceed this limit.

The ERO_HOP_ATTRIBUTE subobject is defined as follows:

If a node is processing an ERO_HOP_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](#).

A node processing an ERO_HOP_ATTRIBUTE subobject with an HOP attribute TLV longer than the ERO subobject SHOULD 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 malformed subobject. The processing of the Hop attribute TLVs SHOULD be described in the documents defining them.

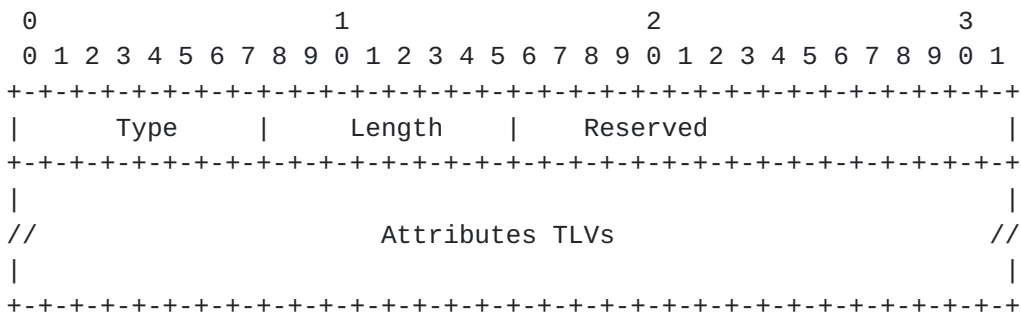
4. Recording Hop attribute

In some cases it is important to determine if an optional Hop attribute has been processed by a node.

4.1. RRO_HOP_ATTRIBUTE subobject

The RRO_HOP_ATTRIBUTE subobject may be carried in the RECORD_ROUTE object if it is present. The subobject uses the standard format of an RRO subobject.

The RRO_HOP_ATTRIBUTE subobject is defined as follows:



The Type and Length parameters are as defined in [\[RFC3209\] section 4.4.1](#). The Type for the RRO_HOP_ATTRIBUTE subobject is TBA by IANA. The attributes TLV are encoded as defined in [Section 3.2](#).

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 RRO, MUST NOT be changed when a node process the RRO and must be ignored on the node addressed by the preceding RRO subobjects.

Attributes TLVs The processed or addition HOP attributes, using the format defined in [Section 3.2](#).

4.2. Procedures

4.2.1. Subobject presence rule

The RRO rules defined in [\[RFC3209\]](#) are not changed. The RRO_HOP_ATTRIBUTE subobject MUST be pushed after the RRO attribute subobject (if present) defined in [\[RFC5420\]](#). The RRO_HOP_ATTRIBUTE subobject MAY be present between a pair of subobject identifying LSR or links. All such subobjects MUST be forwarded unmodified by transit LSRs.

4.2.2. Reporting Compliance with ERO Hop Attributes

To report that an ERO Hop attribute has been considered, or to report an additional attribute, an LSR MAY add a RRO_HOP_ATTRIBUTE subobject with the HOP Attribute TLV which describes the attribute to be reported. The requirement to report compliance MUST be specified in the document that defines the usage of an Hop attribute.

4.2.3. Compatibility with RRO Attributes subobject

The RRO_HOP_ATTRIBUTE extends the capability of the RRO Attributes subobject defined in [\[RFC5420\] section 7.2](#) by allowing the node to report the attribute value. The mechanism defined in this document is compatible with the RRO Attributes using the following procedures.

For LSP attributes signaled in the LSP_ATTRIBUTES or LSP_REQUIRED_ATTRIBUTES, a node SHOULD use the RRO Attributes to report processing of those attributes. If a node desires to include the LSP_ATTRIBUTE TLV, it SHOULD use both the RRO Attributes and RRO_HOP_ATTRIBUTE. Head end nodes not supporting the RRO_HOP_ATTRIBUTE will drop the information.

For LSP attributes signaled in the ERO Hop attribute and not in the LSP_ATTRIBUTES or LSP_REQUIRED_ATTRIBUTES, if a node desires to

include the LSP_ATTRIBUTE, it SHOULD use the RRO_HOP_ATTRIBUTE and SHOULD NOT use the RRO Attributes.

5. IANA Considerations

5.1. ERO LSP Attribute Subobject

IANA manages the "RSVP PARAMETERS" registry located at <http://www.iana.org/assignments/rsvp-parameters/rsvp-parameters.xml>. We request IANA to make an allocation in the Sub-object type 20 EXPLICIT_ROUTE - Type 1 Explicit Route registry.

This document introduces a new ERO sub-object:

Value	Description	Reference
-----	-----	-----
TBA	ERO HOP Attribute	This document

5.2. RRO LSP Attribute Subobject

IANA manages the "RSVP PARAMETERS" registry located at <http://www.iana.org/assignments/rsvp-parameters/rsvp-parameters.xml>. We request IANA to make an allocation in the Sub-object type 21 ROUTE_RECORD - Type 1 Route Record registry.

This document introduces a new RRO sub-object:

Value	Description	Reference
-----	-----	-----
TBA	RRO HOP Attribute	This document

5.3. Existing LSP Attribute TLVs

IANA manages the "RSVP-TE PARAMETERS" registry located at <http://www.iana.org/assignments/rsvp-te-parameters/rsvp-te-parameters.xml>. The "Attributes TLV Space" registry manage the following attributes, as defined in [RFC5420]:

- o TLV Type (T-field value)
- o TLV Name
- o Whether allowed on LSP_ATTRIBUTES object
- o Whether allowed on LSP_REQUIRED_ATTRIBUTES object

We request IANA to add the following information for each TLV in the RSVP TLV type identifier registry.

- o Whether allowed on LSP attribute ERO subobject

The existing registry is modified for existing TLVs as follows:

5.3.1. Attribute Flags

The new TLV type definition is as follow

- o TLV Type = 1
- o TLV Name = Attribute Flags TLV
- o Allowed on LSP_ATTRIBUTES object
- o Allowed on LSP_REQUIRED_ATTRIBUTES object
- o Allowed on LSP attribute ERO subobject
- o Defining RFC = [[RFC5420](#)]

5.3.2. Service ID TLV

The new TLV type definition is as follow

- o TLV Type = 2
- o TLV Name = Service ID TLV
- o Allowed on LSP_ATTRIBUTES object
- o Not allowed on LSP_REQUIRED_ATTRIBUTES object
- o Not allowed on LSP attribute ERO subobject
- o Defining RFC = [[RFC7260](#)]

5.3.3. OAM Configuration TLV

The new TLV type definition is as follow

- o TLV Type = 3
- o TLV Name = OAM Configuration TLV
- o Allowed on LSP_ATTRIBUTES object
- o Allowed on LSP_REQUIRED_ATTRIBUTES object

- o Not allowed on LSP attribute ERO subobject
- o Defining RFC = [[RFC6060](#)]

6. Security Considerations

This document adds new subobject in the EXPLICIT_ROUTE and the ROUTE_RECORD object carried in RSVP message used in MPLS and GMPLS signaling. It builds on mechanism defined in [[RFC3209](#)] and [[RFC5420](#)] and does not introduce any new security. The existing security considerations described in [[RFC2205](#)], [[RFC3209](#)], [[RFC3473](#)] and [[RFC5420](#)] do apply.

As any RSVP-TE signaling request, the procedures defined in this document permit the transfer and reporting of functional preferences on specific node. This may reveal information about the LSP request and status to anyone with unauthorized access. The mechanism described in this document do not contribute to this issue, which can be only resolved by encrypting the content of the whole signaling message.

In addition the reporting of attributes using the RRO may reveal details about the node that the operator wishes to remains confidential. The same strategy and policies that apply to other RRO subobjects also apply to this new mechanism. It is recommended that domain boundary policies take the releasing of RRO hop attributes into consideration.

7. 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).

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