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LSP Attributes Related Routing Backus-Naur Form

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Abstract

Multiprotocol Label Switching (MPLS) Label Switched Paths (LSPs) established using the Resource Reservation Protocol Traffic Engineering (RSVP-TE) extensions may be signaled with a set of LSP specific attributes. These attributes may be carried in both Path and Resv messages. This document specifies how LSP attribute are to be carried in RSVP Path and Resv messages using the Routing Backus-Naur Form, and clarifies related Resv message formats. This document updates [RFC 4875](#) and [RFC 5420](#).

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[1. Introduction](#)

Signaling in support of Multiprotocol Label Switching (MPLS) and Generalized MPLS (GMPLS) point-to-point Label Switched Paths (LSPs) is defined in [[RFC3209](#)] and [[RFC3473](#)]. [[RFC4875](#)] defines signaling support for point-to-multipoint (P2MP) TE LSPs.

Two LSP Attributes related objects are defined in [[RFC5420](#)]. These objects may be used to provide additional information related to how an LSP should be setup when carried in a Path message and, when carried in a Resv message, how an LSP has been established. The definition of the objects includes a narrative description of related message formats, see [Section 9 of \[RFC5420\]](#). This definition does not provide the related Routing Backus-Naur Form (BNF), [[RFC5511](#)],

that is typically used to define how messages are to be constructed using RSVP objects. The current message format description has led to an issue in how the LSP Attributes related objects are to be processed in Resv messages of P2MP LSPs.

This document provides the BNF for Path and Resv messages carrying the LSP Attributes related object. The definition clarifies how the objects are to be carried for all LSP types. Both Path and Resv message BNF is provided for completeness.

This document presents the RSVP message related formats as modified by [[RFC5420](#)]. This document modifies formats defined in [[RFC3209](#)], [[RFC3473](#)] and [[RFC4875](#)]. See [[RFC5511](#)] for the syntax used by RSVP. Unmodified formats are not listed. An example of a case where the modified formats are applicable is described in [[NO-PHP-00B](#)].

[1.1. Conventions Used In This Document](#)

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 [[RFC2119](#)].

[2. Path Messages](#)

This section updates [[RFC4875](#)]. Path message formatting is unmodified from the narrative description provided in [Section 9 of \[\[RFC5420\]\(#\)\]](#). As stated in [[RFC5420](#)]:

The LSP_ATTRIBUTES object and the LSP_REQUIRED_ATTRIBUTES object MAY be carried in a Path message.

The order of objects in RSVP-TE messages is recommended, but implementations must be capable of receiving the objects in any meaningful order.

On a Path message, the LSP_ATTRIBUTES object and LSP_REQUIRED_ATTRIBUTES objects are RECOMMENDED to be placed immediately after the SESSION_ATTRIBUTE object if it is present, or otherwise immediately after the LABEL_REQUEST object.

If both the LSP_ATTRIBUTES object and the LSP_REQUIRED_ATTRIBUTES object are present, the LSP_REQUIRED_ATTRIBUTES object is RECOMMENDED to be placed first.

LSRs MUST be prepared to receive these objects in any order in any position within a Path message. Subsequent instances of these

objects within a Path message SHOULD be ignored and MUST be forwarded unchanged.

2.1. Path Message Format

This section presents the Path message format as modified by [\[RFC5420\]](#). Unmodified formats are not listed.

```

<Path Message> ::=
    <Common Header> [ <INTEGRITY> ]
    [ [<MESSAGE_ID_ACK> | <MESSAGE_ID_NACK>] ...]
    [ <MESSAGE_ID> ]
    <SESSION> <RSVP_HOP>
    <TIME_VALUES>
    [ <EXPLICIT_ROUTE> ]
    <LABEL_REQUEST>
    [ <PROTECTION> ]
    [ <LABEL_SET> ... ]
    [ <SESSION_ATTRIBUTE> ]
    [ <LSP_REQUIRED_ATTRIBUTES> ... ]
    [ <LSP_ATTRIBUTES> ... ]
    [ <NOTIFY_REQUEST> ]
    [ <ADMIN_STATUS> ]
    [ <POLICY_DATA> ... ]
    <sender descriptor>
    [<S2L sub-LSP descriptor list>]

```

Note that PathErr and PathTear messages are not impacted by the introduction of the LSP attributed related objects.

3. Resv Messages

This section updates [\[RFC4875\]](#) and [\[RFC5420\]](#). [Section 9 of \[RFC5420\]](#) contains the following Resv message related text:

The LSP_ATTRIBUTES object MAY be carried in a Resv message.

The order of objects in RSVP-TE messages is recommended, but implementations must be capable of receiving the objects in any meaningful order.

On a Resv message, the LSP_ATTRIBUTES object is placed in the flow descriptor and is associated with the FILTER_SPEC object that precedes it. It is RECOMMENDED that the LSP_ATTRIBUTES object be placed immediately after the LABEL object.

LSRs MUST be prepared to receive this object in any order in any position within a Resv message, subject to the previous note. Only one instance of the LSP_ATTRIBUTES object is meaningful within the context of a FILTER_SPEC object. Subsequent instances of the object SHOULD be ignored and MUST be forwarded unchanged.

This means that LSP attributes may be present per sender (LSP) and allows for LSP attributes object to be modified using make-before-

break, see [RFC3209](https://datatracker.ietf.org/doc/rfc3209). This definition is sufficient for point-to-point ([[RFC3209](https://datatracker.ietf.org/doc/rfc3209)] and [[RFC3473](https://datatracker.ietf.org/doc/rfc3473)]) LSPs, and the special case where all point-to-multipoint source-to-leaf (S2L) sub-LSPs ([[RFC4875](https://datatracker.ietf.org/doc/rfc4875)]) report the same operational status (as used in [[RFC5420](https://datatracker.ietf.org/doc/rfc5420)]). But, this definition does not allow for different egress LSRs to report different operational status. In order to allow such reporting, this document adds the following definition:

An LSR that wishes to report operational status of a (point-to-multipoint) S2L sub-LSP, it may include the LSP_ATTRIBUTES object in a Resv message, or update the object that is already carried in a Resv message. LSP_ATTRIBUTES objects representing S2L sub-LSP status MUST follow a S2L_SUB_LSP object. Only the first instance of the LSP_ATTRIBUTES object is meaningful within the context of a S2L_SUB_LSP object. Subsequent instances of the object SHOULD be ignored and MUST be forwarded unchanged.

When an LSP_ATTRIBUTES object is present before the first S2L_SUB_LSP object, the LSP_ATTRIBUTES object represents the operational status of all S2L sub-LSPs identified in the message. Subsequent instances of the object (e.g, in the filter spec or the S2L sub-LSP flow descriptor) SHOULD be ignored and MUST be forwarded unchanged. When a branch node is combining Resv state from multiple receivers into a single Resv message and an LSP_ATTRIBUTES object is present before the first S2L_SUB_LSP object in a received Resv message, the received LSP_ATTRIBUTES object SHOULD be moved to follow the first received S2L_SUB_LSP object, and then SHOULD be duplicated for, and placed after, each subsequent S2L_SUB_LSP object.

3.1. Resv Message Format -- Per LSP Operational Status

This section presents the Resv message format for LSPs as modified by [[RFC5420](https://datatracker.ietf.org/doc/rfc5420)], and can be used to report operational status per LSP. Unmodified formats are not listed. This following is based on [[RFC4875](https://datatracker.ietf.org/doc/rfc4875)].

```
<FF flow descriptor list> ::= <FF flow descriptor>
                               [ <FF flow descriptor list> ]

<FF flow descriptor>         ::= [ <FLOWSPEC> ] <FILTER_SPEC> <LABEL>
                               [ <LSP_ATTRIBUTES> ... ]
                               [ <RECORD_ROUTE> ]
                               [ <S2L sub-LSP flow descriptor list> ]

<SE flow descriptor>         ::= <FLOWSPEC> <SE filter spec list>

<SE filter spec list>        ::= <SE filter spec>
```

[<SE filter spec list>]

```

<SE filter spec> ::= <FILTER_SPEC> <LABEL>
                    [ <LSP_ATTRIBUTES> ... ]
                    [ <RECORD_ROUTE> ]
                    [ <S2L sub-LSP flow descriptor list> ]

```

3.2. Resv Message Format -- Per S2L Operational Status

This section presents the Resv message format for LSPs as modified by this document and [\[RFC5420\]](#), and can be used to report operational status per S2L sub-LSP. Unmodified formats are not listed. This following is based on [\[RFC4875\]](#).

```

<FF flow descriptor> ::= [ <FLOWSPEC> ] <FILTER_SPEC> <LABEL>
                        [ <RECORD_ROUTE> ]
                        [ <S2L sub-LSP flow descriptor list> ]

<SE filter spec>      ::= <FILTER_SPEC> <LABEL> [ <RECORD_ROUTE> ]
                        [ <S2L sub-LSP flow descriptor list> ]

<S2L sub-LSP flow descriptor list> ::=
                                <S2L sub-LSP flow descriptor>
                                [ <S2L sub-LSP flow descriptor list> ]

<S2L sub-LSP flow descriptor> ::= <S2L_SUB_LSP>
                                [ <LSP_ATTRIBUTES> ... ]
                                [ <P2MP_SECONDARY_RECORD_ROUTE> ]

```

3.2.1. Compatibility

A node that does not support the LSP Attribute object formatting as defined in this section will interpret the first present LSP Attribute object as representing LSP operational status even when it is intended to represent S2L sub-LSP status. It is unclear if this is a significant issue as the LSP Attribute object is currently considered to be an unsuitable mechanism for reporting operational status of P2MP LSPs, for example see Section 2.1 of [\[NO-PHP-00B\]](#). The intent of this document is to correct this limitation and it is expected that networks that wish to make use of such operational reporting will deploy this extension.

4. Security Considerations

This document clarifies usage of objects defined in [[RFC5420](#)]. No new information is conveyed and therefore neither are there any additional security considerations. For a general discussion on MPLS and GMPLS related security issues, see the MPLS/GMPLS security framework [[RFC5920](#)].

5. IANA Considerations

There are no new IANA considerations introduced by this document.

6. Acknowledgments

The authors would like to acknowledge the contributions of Adrian Farrel.

7. References

7.1. Normative References

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7.2. Informative References

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