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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 attributes are
   to be carried in RSVP Path and Resv messages using the Routing
   Backus-Naur Form, and clarifies related Resv message formats.

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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 lead
   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-OOB].

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. This definition is sufficient for point-to-point
([RFC3209] and [RFC3473]) LSPs, and the special case where all point-
to-multipoint source-to-leaf (S2L) sub-LSPs ([RFC4875]) report the
same operational status (as used in [RFC5420]). But, this definition
does not allow for different egress LSRs to report different report
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 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 the whole point-to-multipoint LSP.
   Subsequent instances of the object SHOULD be ignored and MUST be
   forwarded unchanged. Relative object positioning SHOULD be
   preserved.

3.1. Resv Message Format -- Per LSP Operational Status

   This section presents the Resv message format for LSPs as modified by
   [RFC5420], and can be used to report operational status per LSP.
   Unmodified formats are not listed. This following is based on
   [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-OOB].
   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 any additional
   security considerations. For a general discussion on MPLS and GMPLS
   related security issues, see the MPLS/GMPLS security framework [MPLS-
   SEC].

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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