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TITLE: RSVP Extensions for Optical UNI Signaling

SOURCE: **Eric Gray, Fong Liaw, John Yu**
Zaffire, Inc.
Emails: {egray, fliwa, jzyu}@zaffire.com

George Swallow, Yakov Rekhter
Cisco Systems, Inc.
Email: {swallow, yakov}@cisco.com

Bala Rajagopalan
Tellium, Inc.
Email: Bala@tellium.com

Raj Jain
Nayna Networks, Inc.
Email: raj@nayan.com

Greg Bernstein
Ciena
Email: GregB@ciena.com

Jonathan Lang, John Drake
Calient Networks
Emails: {jplang, jdrake}@calient.net

Kireeti Kompella
Juniper Networks
kireeti@juniper.com

Yangguang Xu
Lucent Technologies, Inc.
xuyg@lucent.com

Osama Aboul-Maged
Nortel Networks
osama@nortelnetworks.com

Zhensheng Zhang
Sorrento Networks
Email: zzhang@sorrento.com

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Abstract

This draft defines a signaling mechanism based on RSVP-TE ([2]) to
support an Optical User Network Interface (UNI). This effort is in part
driven by work in the OIF as well as the recent draft on signaling
requirements for the optical UNI ([3]), and is consistent with recent
work on Generalized MPLS (see [4], [5], [6], and [7]). The main
function of this draft is to identify the relevant mechanisms in RSVP-TE
(including further extensions) to satisfy functional requirements for an
Optical UNI. This draft reflects ongoing work at the Optical
Interworking Forum (OIF), however, not all of the concepts/requirements
have been approved by the OIF.

1. Introduction

There has recently been a significant effort amongst carriers, service providers, and vendors in the optical networking space to eliminate proprietary control protocols and develop a common control plane. The Optical Internetworking Forum (OIF) has initiated work on an Optical User-Network Interface (Optical UNI) as a step in this direction. Recently, a draft [3] was submitted to the IETF defining proposed requirements and abstract messages for the Optical UNI.

This document describes how a signaling mechanism based on RSVP-TE [2] may be used for an Optical UNI. In particular, we identify the mechanisms already defined for RSVP-TE that can be used to satisfy the proposed requirements of [3]. This work is also based on recent Internet Drafts defining Generalized MPLS signaling (e.g. – [4]).

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 [8].

2. Overview

This document is compatible to the general RSVP-TE baseline document, and intends to highlight the new objects/procedures in particular relevant to UNI signaling. Therefore, this document is not a self-contained document as it currently stands. Required objects/procedures for UNI signaling are included by reference, but not all listed, except the new ones. A new version of this document may be expanded to make it self-contained.

RSVP-TE is one of the candidate protocols described in [3] for Optical UNI signaling implementation. As part of this Optical UNI, the signaling protocol must have the capability to create, delete, and modify lightpaths across a network, as well as query the status of an existing lightpath. Most of these capabilities may be directly supported by re-using existing procedures, messages, and objects defined in RSVP-TE [2] and in Generalized MPLS Signaling [4].

This document further extends [2] and [4] to support Optical UNI signaling requirements as following:

- Use of DREQ and DREP message and procedure as defined in [9] for Lightpath status enquiry and response.

- Use of Message_ID and Message_Ack objects, Ack_desire flag, and Ack message as defined in [10] to support confirmation of Lightpath deletion and reliable messaging.

- PathTear and ResvTear MUST be used to delete a lightpath due to explicit deletion or RSVP state timeout.

This document does not specify procedures to support the following proposed requirements listed in [3]:

- Concept of "indirect interface" as defined in [3]. It is   envisioned that such a requirement can be better serviced via a network management station.

- Different source and destination user groups. The use and procedure of these two attributes need further clarification, see below.

   - Procedures for client registration. This shall be supported by a
      link management protocol or by manual configuration. Both are out
      of scope of a signaling specification.

   - Light path ID. This is a NNI attributes per OIF contribution
      oif2000-0611 [13].

2.1 Use of RSVP-TE and Generalized MPLS signaling for Optical UNI

2.1.1 In-band and out-of-band signaling channels

Optical UNI requires support of in-band and out-of-band signaling channels. The in-band signaling channel is supported by the use of a regular link; and the concept of out-of-band signaling channel is supported by the use of non-packet link [7] where a non-packet link is associated (by configuration or other protocols) with the control channel.

When an out-of-band signaling channel is used, the procedure of using the "non-packet link" in [7] can be applied for advertising the control channel.

2.1.2 Reliable messaging

To support reliable messaging across the UNI, the Message_ID and Message_Ack objects, Ack message, and Ack desired flag of [10] MUST be used in UNI RSVP messages. Acknowledgements apply to hop-by-hop, as opposed to end-to-end, message delivery.

2.1.2 Lightpath creation

Lightpath creation uses the procedure described in section 2.2 "Operation of LSP tunnels" of [2]. Additional objects and their use and procedure are defined in Sections 3 and 4 of [4].

2.1.3 Lightpath modification

Lightpath modification uses procedure as described in section 2.5 "Rerouting of Traffic Engineered Tunnels" of [2].

2.1.4 Lightpath deletion

Lightpath deletion can be done by either the client that originated or terminated the lightpath. The lightpath originator will use the PathTear message while the lightpath terminator will use the ResvTear message. Acknowledgement mechanisms of [10] MUST be used to provide confirmation. The network side of the originator shall use ResvTear to delete a lightpath toward the originator. The network side of the terminator shall use PathTear to delete a lightpath toward the terminator.

2.1.5 Lightpath status enquiry and response

Any client interested in the lightpath status shall send a Diagnostic Request (DREQ) message toward the termination end point of the lightpath. The DREQ message specifies the Session Object, Sender Template Object, and an ending node. Starting at the last hop of the lightpath, the DREQ message is sent along the lightpath toward the sender and start collecting information hop-by-hop in the DREQ. When the DREQ message reaches the ending node, the message type is changed to Diagnostic Reply (DREP) and forwarded to the original requestor node. The DREQ originator can select specific RSVP objects to be collected by including a DIAG_SELECT object in the DREQ message. The full procedure of DREQ and DREP messages is described in [9].

3. RSVP Message Extensions for OPTICAL UNI signaling

In addition to objects defined in [2] and [4], new objects may need to be defined to address additional requirements. Additional objects defined in this specification are OPTIONAL with respect to RSVP and RSVP-TE.

3.1 Propagation Delay

If a maximum propagation delay is desired, the lightpath originator shall include the Tspec object for Propagation_Delay_with a new c-type, and an ADSPEC object in its Path or Resv Messages for the lightpath, which may facilitate the clients understanding the actual latency the traffic would experience.

3.2 Labels

Generalized MPLS signaling [4] defines several types of labels that may be represented in a Generalized Label object. For Optical applications a label may be arbitrarily associated with all or part of a component link, or may be a superset of multiple component links. A common understanding of the meaning of a Generalized Label – in particular the meaning of the link ID portion of the Generalized Label – must exist between the user and the network across any Optical UNI. This common understanding may be dynamically derived (e.g. using LMP [5]), or it may be configured.

This specification uses the Generalized Label, Generalized Label
Request, Upstream Label, Suggested Label and Label Set objects defined
in [4].

4. RSVP objects related to OPTICAL signaling requirements

Optical UNI signaling requirements [3] specify a set of attributes to be
signaled during lightpath creation and modification. The following table
summarizes the RSVP objects that are used to signaling a particular
OPTICAL signaling attribute.


```
    OPTICAL signaling attribute            RSVP object
    ---------------------------+-----------------------------
    Light_Path ID              | Not supported
    Source termination point   | Sender Template (or Session) [2]
    Destination termination point | Session [2]
    Source Termination Point Port | Label Set/Suggest Label [4]
    Destination Termination Label | Egress Label [4]
    Contract ID                | Session Attribute/Name [2]
    Framing                    | Generalized Label Request [4]
    Bandwidth                  | Generalized Label Request [4]
    Transparency               | Generalized Label Request [4]
    Directionality             | Upstream Label [4]
    Service Level              | Session Attribute [2]
    Diversity                  | Session Attribute [2]
                               | and Generalized Label Request
                               | Object [4]
    Return code                | Error Spec
    Source user group ID       | Session Attributes/LSP_TUNNEL_RA [2]
    Destination user group ID  | Session Attributes/LSP_TUNNEL_RA [2]
    Propagation Delay          | Propagation Delay (Tspec)
    ---------------------------+-----------------------------
```


Note that

(1) There is an attribute called Light Path ID in [3]. However,
according to the light path attributes requirements in [13], light path
ID is declared as a NNI feature, which hence should not be included.

(2) The support of Transparency is defined in OIF as a requirement, yet
not captured in [4]; they should be incorporated in new version of [4].

5. RSVP messages related to OPTICAL UNI signaling

5.1 Path Message

As described in [4], RSVP-TE signaling for support of lightpath creation
allows for labels to be suggested by the upstream LSR that is sending a
Path message. In addition, the upstream node may provide a label for use
in bi-directional setup. The format for the Path message to be used for
the OPTICAL UNI is given below.

```
        <Path Message> ::=         <Common Header> [ <INTEGRITY> ]
                                   <SESSION> <RSVP_HOP>
```

```
                              [ <TIME_VALUES> ]
                              [ <EXPLICIT ROUTE> ]
                              <GENERALIZED LABEL_REQUEST>
                              [ <LABEL SET> | <SUGGESTED LABEL> ]
                              [ <UPSTREAM LABEL> ]
                              [ <SESSION_ATTRIBUTE> ]
                              [ <POLICY_DATA> ... ]
                              <sender descriptor>

      <sender descriptor> ::=  <SENDER_TEMPLATE> <SENDER TSPEC>
                              [ <ADSPEC> <PROPAGATION DELAY> ]
                              [ <RECORD_ROUTE> ]
```

Note that

(1) The EXPLICIT ROUTE object may be included to provide an egress label
([4]). Additional explicit hops included in the EXPLICT ROUTE object may
be ignored by the network in the Optical UNI. Similarly, the RECORD
ROUTE object may be ignored by the Network side of the Optical UNI.

(2) User may need to indicate bi-directional path by including a
upstream label object [4]. ERO/egress label [4] is used to indicate
termination port.

5.2 Resv Message

RSVP-TE signaling support of the lightpath creation response is via the
OPTICAL UNI Resv message. The format for the OPTICAL UNI Resv Message is
as shown below.

```
      <Resv Message> ::=        <Common Header> [ <INTEGRITY> ]
                              <SESSION>   <RSVP_HOP>
                              [ <TIME_VALUES> ]
                              [ <RESV_CONFIRM> ]  [ <SCOPE> ]
                              [ <POLICY_DATA> ... ]
                              <STYLE> <flow descriptor list>

   <flow descriptor list> ::= <FF flow descriptor list>
                              | <SE flow descriptor>

   <FF flow descriptor list> ::= <FLOWSPEC> <FF flow descriptor>
                | <FF flow descriptor list> <FF flow descriptor>

   <FF flow descriptor> ::= [ <FLOWSPEC> ]
                              <FILTER_SPEC>
                              <GENERALIZED LABEL>
                              [ <RECORD_ROUTE> ]

   <SE flow descriptor> ::= <FLOWSPEC> <SE filter spec list>
   <SE filter spec list> ::= <SE filter spec>
                      | <SE filter spec list> <SE filter spec>
   <SE filter spec> ::= <FILTER SPEC> <GENERALIZED LABEL>
                           [ <RECORD ROUTE> ]
```

Note that

(1) Filter spec is used to identify the LSP, per RSVP-TE, required to identify the LSP in Resv. The flow spec is used to convey the delay back to head-end of lightpath, similar to Tspec+ADSPEC in Path. This would require a new c-type.

(2) Network may ignore the RRO. The reason to list it here (as an option) is that some UNIs may be owned by network providers, named as private-UNIs, in which RRO may be meaningful.

3.4 PathTear Message

The lightpath origination node uses a PathTear message to explicitly delete a lightpath. The acknowledgement procedures of [10] are used to provide confirmation. Receiving of a MESSAGE_ID_ACK object of a PathTear message SHALL be interpreted to mean that the downstream node has cleared its state associated with the specified lightpath, but not to mean a confirmation of an end-to-end lightpath deletion. If a MESSAGE_ID_ACK object of a PathTear Message cannot be piggybacked in an pending RSVP message immediately, a downstream node SHALL generate a Notify message including the MESSAGE_ID_ACK object to its upstream node. This allows a faster confirmation for the PathTear message.

5.4 ResvTear Message

A lightpath termination node uses ResvTear Message to explicitly delete a lightpath. The acknowledgement procedures of [10] are used to provide confirmation. Receiving of a MESSAGE_ID_ACK object of a ResvTear message SHALL be interpreted to mean that the upstream node has cleared its state associated with the specified lightpath, but not to mean a confirmation of an end-to-end lightpath deletion. If a MESSAGE_ID_ACK object of a ResvTear Message cannot be piggybacked in a pending RSVP message immediately, an upstream node SHALL generate a Notify message including the MESSAGE_ID_ACK object to its upstream node. This allows a faster confirmation for the ResvTear message.

5.5 Notify Message

The Notify message can be generated at any time to allow expedited notification of change in the status of a lightpath. Consequently, both the user and network sides of the Optical UNI MUST be prepared to receive a Notify message. The format of the Notify message is given in [4].

5.6 Diagnostic (DREQ) Message

The DREQ Message is used to initiate Lightpath Status Enquiry required by [3]. The format of the Diagnostic Request (DREQ) message is given in [9]. Refer to [9] for full procedures on how to handle DREQ messages.

5.7 Diagnostic Reply (DREP) Message

The DREP Message is used to send the collected lightpath status to originator of the DREQ message. It has the same format as the DREQ message. Refer to [9] for procedures on how to forward a DREP message.

Motion: Adopt the method proposed in this contribution to the technical document for optical UNI signaling in the Signaling WG.

6. References

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[9] Terzis, A., etal., "RSVP Diagnostic Messages", RFC 2745, January 2000.

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