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RSVP-TE Recovery Extension for data plane initiated reversion,  
and protection timer signaling  
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#### Abstract

RSVP-TE recovery extensions are specified in [RFC4872] and [RFC4873]. Currently recovery signaling does not support the request for revertive protection and recovery timers values. This document extends the PROTECTION Object format allowing sub-TLVs, and defines two sub-TLVs to carry wait-to-restore and hold-off intervals.

## 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

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Table of Contents

1. Introduction . . . . .	4
2. Updated PROTECTION Object format and sub-TLVs . . . . .	6
3. Error handling . . . . .	9
4. IANA Considerations . . . . .	10
5. Security Considerations . . . . .	11
6. References . . . . .	12
Authors' Addresses . . . . .	13

## 1. Introduction

Generalized MPLS (GMPLS) extends MPLS to include support for different switching technologies [RFC3471]. These switching technologies provide several protection schemes [RFC4426][RFC4427] (e.g. 1+1, 1:N, M:N). Many characteristics of those protection schemes are common regardless of the switching technology (e.g. TDM, LSC, etc). GMPLS RSVP-TE signaling has been extended to support the various protection schemes and establish Label Switched Paths (LSPs) configuring its specific protection characteristics [RFC4426][RFC4872].

Currently RSVP-TE extensions do not address the configuration of protection switching timers. It also does not provide information on the protection switching operation mode (i.e., revertive or non-revertive).

The Hold-off time (HOFF) is defined as the time between the reporting of signal fail or degrade, and the initialization of the recovery switching operation [RFC4427]. This timer is useful to limit the number of switch actions when multiple layers of recovery are being used, or in case of 1+1 unidirectional protection scheme [G.808.1] to prevent too early switching due to the differential delay between the short and long path.

The Wait-to-Restore time (WTR) is defined as a period of time that must elapse after a recovered fault before an LSP can be used again to transport the normal traffic and/or to select the normal traffic from the LSP [RFC4427]. The WTR time is fundamental in revertive mode of operation, to prevent frequent operation of the protection switch due to an intermittent defect [G.808.1].

Reversion refers to the process of moving normal traffic back to the original working LSP after the failure is cleared and the path is repaired [RFC4426][RFC4427][RFC4872]. In transport networks reversion is desirable since the protection path may not be optimal from a routing and resource consumption point of view, additionally, moving traffic back to the working LSP allows the protection resources to be used to protect other LSPs.

WTR and HOFF timers must be accurately configured at both ends of the LSP. Operators may need to tune WTR and HOFF timers on a per LSP basis to ensure best protection switching performance (e.g., account for differential delays between

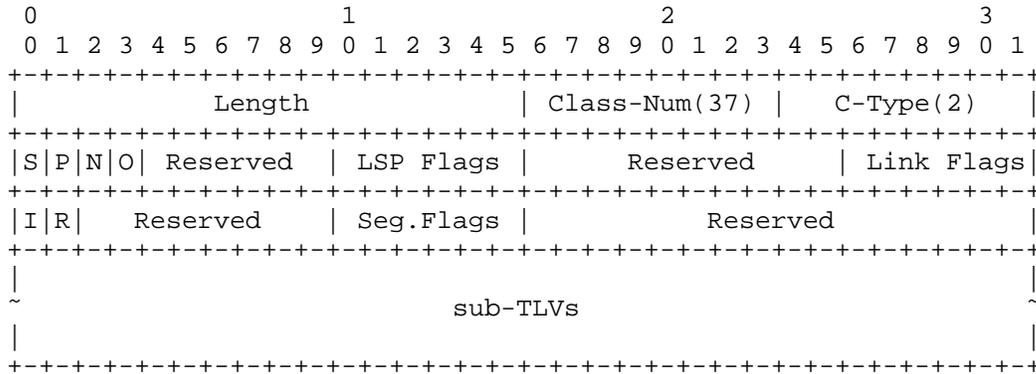
worker and protection paths). Currently these values are either pre-configured to a default value (and so may be suboptimal for some of the LSPs) or need to be manually set/tuned after the connections have been established. Since these parameters are important for recovery in transport networks, it is desirable that GMPLS RSVP-TE protection signaling carries the necessary information.

This document extends the PROTECTION Object format allowing sub-TLVs, and defines three sub-TLVs to carry WTR and HOFF timer values.

2. Updated PROTECTION Object format and sub-TLVs

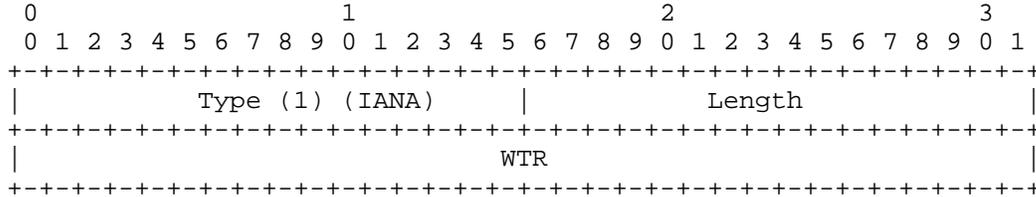
In [RFC4872] and [RFC4873] the PROTECTION object is specified to support end-to-end and segment recovery. In order to ease addition of protection attributes the PROTECTION Object is extended to carry sub-TLVs. The new format updates the PROTECTION Object format of C-Type 2. The updated format is depicted below. IANA is requested to maintain the TLV space for the PROTECTION Object.

We retained C-Type to ensure that nodes not capable of interpreting the new format (sub-TLVs) will still be able to process the object without being required to generate an error; while nodes recognising the new format will process the TLVs accordingly. The processed sub-TLV MUST be included in the PROTECTION Object sent in the Resv message upstream, to ensure that the sender can maintain a consistent view of the actual protection configuration of the LSP.

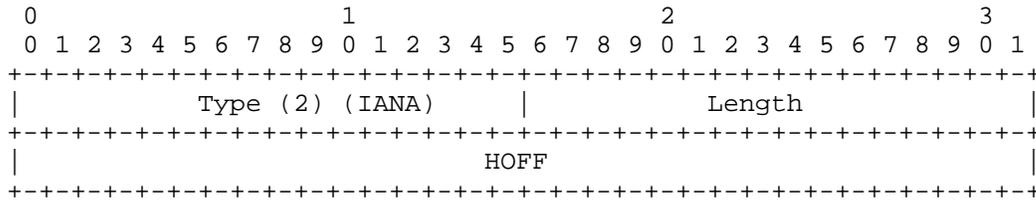


This document specifies three new sub-TLVs.

WTR - Wait-to-Restore time sub-TLV specifies the WTR time. If the WTR field is 0 the protection switching operation mode is non-revertive, otherwise revertive operation with the signalled timer (in milliseconds) is requested. The value 0xffffffff is reserved, and refers to a locally pre-configured WTR value.



HOFF - Hold-off time sub-TLV specifies the HOFF time. The values are in milliseconds. The value 0xffffffff is reserved, and refers to a locally pre-configured HOFF value.



In the case of end-to-end protection the PROTECTION Object is inserted at the top level in the Path message, the WTR and HOFF

options sub-TLVs correspond to the end-to-end protection. In the case when a segment of the LSP is to be protected and the WTR and HOFF timers for the protection segment are to be set by signaling, explicit segment recovery control has to be used, i.e., the PROTECTION Object with the desired timers set must be inserted in the appropriate Secondary Explicit Route Object (SERO).

### 3. Error handling

In the case a specific configuration of the timers is not supported the corresponding error should be generated and sent in the PathErr message: "Routing Problem/Unsupported WTR value" or "Routing Problem/Unsupported HOFF value".

4. IANA Considerations

4.1. New TLV space for the PROTECTION object

A new TLV space needs to be opened and maintained for the PROTECTION Object in the "Class Names, Class Numbers, and Class Types " Registry.

4.3. New RSVP error sub-code

For Error Code = 24 "Routing Problem" (see [RFC3209]) the following sub-codes are defined.

Sub-code -----	Value -----
Unsupported WTR value	To be assigned by IANA (suggest value: 80)
Unsupported HOFF value	To be assigned by IANA (suggest value: 81)

## 5. Security Considerations

This document introduces no new security issues. The considerations in [RFC4872] and [RFC4873] apply.

## 6. References

- [G.808.1] "Generic protection switching -- Linear trail and subnetwork protection", ITU-T Recommendation G.808.1, March 2006.
  
- [IEEE-PBBTE] "IEEE 802.1Qay Draft Standard for Provider Backbone Bridging Traffic Engineering", work in progress.
  
- [RFC3471] "Generalized Multi-Protocol Label Switching (GMPLS) Signaling Functional Description", RFC 3471, January 2003.
  
- [RFC4426] "Generalized Multi-Protocol Label Switching (GMPLS) Recovery Functional Specification", RFC 4426, March 2006.
  
- [RFC4427] "Recovery (Protection and Restoration) Terminology for Generalized Multi-Protocol Label Switching (GMPLS)", RFC 4427, March 2006.
  
- [RFC4872] "RSVP-TE Extensions in Support of End-to-End Generalized Multi-Protocol Label Switching (GMPLS) Recovery", RFC 4872, May 2007.
  
- [RFC4873] "GMPLS Segment Recovery", RFC 4873, May 2007.

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