CCAMP Working Group
Internet-Draft
Intended status: Informational
Expires: July 19, 2014

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January 15, 2014

RSVP-TE Signaling For GMPLS Restoration LSP
draft-gandhi-ccamp-gmpls-restoration-lsp-02

Abstract

In transport networks, there are requirements where Generalized Multi-Protocol Label Switching (GMPLS) end-to-end recovery scheme needs to employ restoration LSP while keeping resources for the working and/or protecting LSPs reserved in the network after the failure. This draft describes Resource reSerVation Protocol - Traffic Engineering (RSVP-TE) signaling for GMPLS end-to-end recovery when using restoration LSP.

Status of this Memo

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1. Introduction

Generalized Multi-Protocol Label Switching (GMPLS) extends MPLS to include support for different switching technologies [RFC3471] [RFC3473]. These switching technologies provide several protection schemes [RFC4426][RFC4427] (e.g., 1+1, 1:N and M:N). GMPLS RSVP-TE signaling has been extended to support various recovery schemes to establish Label Switched Paths (LSPs) [RFC4872][RFC4873], typically working LSP and protecting LSP. [RFC4427] Section 7 specifies various schemes for GMPLS restoration.

In GMPLS recovery schemes generally considered, restoration LSP is signaled after the failure has been detected and notified on the working LSP. In non-revertive recovery mode, working LSP is assumed to be removed from the network before restoration LSP is signaled. For revertive recovery mode, a restoration LSP is signaled while working LSP and/or protecting LSP are not torn down in control plane due to a failure. In transport networks, as working LSPs are typically signaled over a nominal path, service providers would like to keep resources associated with the working LSPs reserved. This is to make sure that the service (working LSP) can use the nominal path when the failure is repaired. Consequently, revertive recovery mode is usually preferred by recovery schemes used in transport networks.

As defined in [RFC4872] and being considered in this draft, "fully dynamic rerouting switches normal traffic to an alternate LSP that is not even partially established only after the working LSP failure occurs. The new alternate route is selected at the LSP head-end node, it may reuse resources of the failed LSP at intermediate nodes and may include additional intermediate nodes and/or links."

One example of the recovery scheme considered in this draft is 1+R recovery. The 1+R recovery is exemplified in Figure 1. In this example, working LSP on path A-B-C-Z is pre-established. Typically after a failure detection and notification on the working LSP, a second LSP on path A-H-I-J-Z is established as a restoration LSP. Unlike protection LSP, restoration LSP is signaled per need basis.

```
A --- B --- C --- Z
 \               /
   H --- I --- J
```

Figure 1: An example of 1+R recovery scheme

During failure switchover with 1+R recovery scheme, in general, working LSP resources are not released and working and restoration LSPs coexist in the network. Nonetheless, working and restoration LSPs can share network resources. Typically when failure is recovered on the working LSP, restoration LSP is no longer required and torn down (e.g., revertive mode).

Another example of the recovery scheme considered in this draft is 1+1+R. In 1+1+R, a restoration LSP is signaled for the working LSP and/or the protecting LSP after the failure has been detected and notified on the working LSP or the protecting LSP. The 1+1+R recovery is exemplified in Figure 2. In this example, working LSP on path A-B-C-Z and protecting LSP on path A-D-E-F-Z are pre-established. After a failure detection and notification on a working LSP or protecting LSP, a third LSP on path A-H-I-J-Z is established as a restoration LSP. The restoration LSP in this case provides protection against a second order failure. Restoration LSP is torn down when the failure on the working or protecting LSP is repaired.

```
   D --- E --- F
 /               \
A --- B --- C --- Z
 \               /
   H --- I --- J
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Figure 2: An example of 1+1+R recovery scheme

[RFC4872] Section 14 defines PROTECTION object for GMPLS recovery signaling. The PROTECTION object is used to identify primary and secondary LSPs using S bit and protecting and working LSPs using P bit. [RFC4872] and [RFC6689] define the usage of ASSOCIATION object for further associating GMPLS working and protecting LSPs. However, these existing methods do not specify how to identify restoration LSP when working/protecting LSPs are not torn down.

This draft describes procedures for identifying the restoration LSP for GMPLS end-to-end recovery where working and protecting LSP resources are kept reserved after the failure.

2. 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].

3. Restoration LSP Signaling

3.1. Signaling Procedure

Where GMPLS recovery scheme needs to employ restoration LSP while keeping resources for the working and/or protecting LSPs reserved in the network, restoration LSP is signaled with ASSOCIATION object with the association ID set to the LSP ID of the LSP it is restoring. For example, when a restoration LSP is signaled for a working LSP, the ASSOCIATION object in the restoration LSP contains the association ID set to the LSP ID of the working LSP. Similarly, when a restoration LSP is signaled for a protecting LSP, the ASSOCIATION object in the restoration LSP contains the association ID set to the LSP ID of the protecting LSP.

The procedure for signaling the PROTECTION object is specified in [RFC4872] and is changed by this document. Restoration LSP being used as a working LSP is signaled with P bit cleared and as a protecting LSP is signaled with P bit set.

When using a GMPLS recovery mode, where the restoration LSP is promoted to be the new working LSP, restoration LSP RSVP Path message MUST be refreshed by using the ASSOCIATION_OBJECT.LSP_ID to contain the LSP ID of the protecting LSP if known or LSP ID of itself if protecting LSP is not known as defined in [RFC6689].

When using a GMPLS recovery mode, where the restoration LSP is promoted to be the new protecting LSP, restoration LSP RSVP Path message MUST be refreshed by using the ASSOCIATIN_OBJECT.LSP_ID to contain the LSP ID of the working LSP if known or LSP ID of itself if working LSP is not known as defined in [RFC6689].

4. IANA Considerations

This document makes no request for IANA action.

5. Security Considerations

This document introduces no additional security considerations. For a general discussion on MPLS and GMPLS related security issues, see the MPLS/GMPLS security framework [RFC5920]. In addition, the considerations specified in [RFC4872] will apply.

6. Acknowledgement

The authors would like to thank George Swallow for the discussion on the GMPLS restoration.

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