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J. Dong
M. Chen
Huawei Technologies
Z. Li
China Mobile
D. Ceccarelli
Ericsson
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**GMPLS RSVP-TE Extensions for Lock Instruct and Loopback
draft-ietf-ccamp-rsvp-te-li-lb-02**

Abstract

This document specifies extensions to Resource Reservation Protocol - Traffic Engineering (RSVP-TE) to support Lock Instruct (LI) and Loopback (LB) mechanism for Label Switched Paths (LSPs). The mechanisms are applicable to technologies which use Generalized Multi-Protocol Label Switching (GMPLS) as control plane.

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 [RFC 2119](#) [[RFC2119](#)].

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[1.](#) Introduction

The requirements for Lock Instruct (LI) and Loopback (LB) in Multiprotocol Label Switching Transport Profile (MPLS-TP) are specified in [[RFC5860](#)], and the framework of LI and LB is specified in [[RFC6371](#)].

In general the LI and LB are useful Operations, Administration and Maintenance (OAM) functions for technologies which use Generalized Multi-Protocol Label Switching (GMPLS) as control plane, e.g. time-division multiplexing, wavelength-division multiplexing, and packet switching. It is natural to use and extend the GMPLS control plane protocol to provide a unified approach for LI and LB provisioning in all these technologies.

This document specifies extensions to Resource Reservation Protocol - Traffic Engineering (RSVP-TE) to support lock instruct and loopback mechanism for Label Switched Paths (LSPs). The mechanisms are applicable to technologies which use GMPLS as control plane. For MPLS-TP network, the mechanisms defined in this document are complementary to [[RFC6435](#)].

2. Extensions to RSVP-TE

The A (Administratively down) bit in ADMIN_STATUS object [[RFC3471](#)] [[RFC3473](#)] is used to indicate the lock/unlock of the LSP. Format of ADMIN_STATUS Object is as below:

```

0                               1                               2                               3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               | Class-Num(196)| C-Type (1) |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|R|                               Reserved                |H|L|I|C|T|A|D|
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

```

Reflect (R): 1 bit - see [[RFC3471](#)]

Handover (H): 1 bit - see [[RFC5852](#)]

Lockout (L): 1 bit - see [[RFC4872](#)]

Inhibit Alarm Indication (I): 1 bit - see [[RFC4783](#)]

Call Control (C): 1 bit - see [[RFC4974](#)]

Testing (T): 1 bit - see [[RFC3471](#)]

Administratively down (A): 1 bit - see [[RFC3471](#)], reused for Lock

Deletion in progress (D): 1 bit - see [[RFC3471](#)]

A new bit is defined in Attribute Flags TLV [[RFC5420](#)] to indicate the loopback mode. The bit number is TBA.

Bit Number	Name and Usage
TBA	Loopback mode desired. This flag indicates a particular node on the LSP is required to enter loopback mode. This MAY also be used for specifying the loopback state of the node.

3. Operations

3.1. Lock Instruct

When an ingress LSR wants to put an LSP into lock mode, it MUST send a Path message with the Administratively down (A) bit and the Reflect (R) bit in ADMIN_STATUS Object set. The intermediate nodes SHOULD forward the message with the A bit unchanged to the downstream .

On receipt of this Path message, the egress LSR SHOULD try to take the LSP out of service. If the egress Label Switching Router (LSR) locks the LSP successfully, it SHOULD send a Resv message with the A

bit in ADMIN_STATUS object set. Otherwise, it SHOULD send a PathErr message with the Error Code "OAM Problem"

[[I-D.ietf-ccamp-oam-configuration-fwk](#)] and the new Error Value "Lock Failure", and the following Resv messages SHOULD be sent with the A bit cleared. With this procedure, the intermediate nodes would also be aware of whether the LSP is in Lock mode or not.

When an LSP is put in lock mode, the subsequent Path and Resv messages SHOULD keep the A bit in ADMIN_STATUS Object set.

When the ingress LSR wants to take the LSP out of the lock mode, it MUST send a Path message with the A bit in ADMIN_STATUS Object cleared. The intermediate nodes SHOULD forward this message with the A bit unchanged to the downstream.

On receipt of this Path message, the egress LSR SHOULD try to bring the LSP back to service. If the egress LSR unlocks the LSP successfully, it SHOULD send a Resv message with the A bit in ADMIN_STATUS Object cleared. Otherwise, it SHOULD send a PathErr message with the Error Code "OAM Problem" [[I-D.ietf-ccamp-oam-configuration-fwk](#)] and the new Error Value "Unlock Failure", and the following Resv messages SHOULD be sent with the A bit set.

When an LSP is taken out of lock mode, the subsequent Path and Resv messages SHOULD keep the A bit in ADMIN_STATUS Object cleared.

3.2. Loopback

The loopback request can be sent either to the egress LSR or to a particular intermediate node. The mechanism defined in [[I-D.ietf-ccamp-lsp-attribute-ro](#)] is used for addressing the loopback request to a particular node on the LSP. The loopback request is acceptable only when the LSP is in lock mode.

When a ingress LSR wants to put a particular LSR on the LSP into loopback mode, it MUST send a Path message with the Loopback bit in the Attribute Flags TLV set. The mechanism defined in [[I-D.ietf-ccamp-lsp-attribute-ro](#)] is used to address the loopback request to the particular LSR. The Administratively down (A) bit in ADMIN_STATUS object SHOULD be set to keep the LSP in lock mode.

On receipt of this Path message, the target LSR of the loopback request SHOULD try to put the LSP into loopback mode. If the node puts the LSP into loopback mode successfully, it SHOULD set the Loopback (B) bit in the Record Route Object (RRO) Attribute subobject [[RFC5420](#)] and push this subobject onto the RRO object in the corresponding Resv message. The Administratively down (A) bit in

ADMIN_STATUS object SHOULD also be set in the Resv message. If the node cannot put the LSP into loopback mode, it SHOULD send a PathErr message with the Error Code "OAM Problem"

[[I-D.ietf-ccamp-oam-configuration-fwk](#)] and the new Error Value "Loopback Failure".

When the ingress LSR wants to take the LSP out of loopback mode, it MUST send a Path message with the Loopback (B) bit in the Attribute Flags TLV cleared. The mechanism defined in

[[I-D.ietf-ccamp-lsp-attribute-ro](#)] is used to indicate that the particular LSR SHOULD exit loopback mode for this LSP. The Administratively down (A) bit in ADMIN_STATUS object SHOULD be set.

On receipt of this Path message, the target LSR SHOULD try to take the LSP out of loopback mode. If the node takes the LSP out of loopback mode successfully, it SHOULD clear the Loopback (B) Bit in the RRO Attribute subobject and push this subobject onto the RRO object in the corresponding Resv message. The Administratively down (A) Bit in ADMIN_STATUS Object SHOULD be set. Otherwise, the node SHOULD send a PathErr message with the Error Code "OAM Problem" [[I-D.ietf-ccamp-oam-configuration-fwk](#)] and the new Error Value "Exit Loopback Failure".

4. IANA Considerations

One bit number "Loopback" needs to be assigned in the Attribute Flags registry.

Four new Error Values need to be allocated for "OAM Problem" Error Code:

Value	Error
TBA	Lock Failure
TBA	Unlock Failure
TBA	Loopback Failure
TBA	Exit Loopback Failure

5. Security Considerations

This document does not introduce any new security issues above those identified in [[RFC3209](#)] and [[RFC3473](#)].

6. Acknowledgements

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Authors' Addresses

Jie Dong
Huawei Technologies
Huawei Building, No.156 Beiqing Rd.
Beijing 100095
China

Email: jie.dong@huawei.com

Mach(Guoyi) Chen
Huawei Technologies
Huawei Building, No.156 Beiqing Rd.
Beijing 100095
China

Email: mach.chen@huawei.com

Zhenqiang Li
China Mobile
Unit2, Dacheng Plaza, No. 28 Xuanwumenxi Ave.
Beijing 100053
China

Email: lizhenqiang@chinamobile.com

Daniele Ceccarelli
Ericsson
Via A. Negrone 1/A
Genova - Sestri Ponente
Italy

Email: daniele.ceccarelli@ericsson.com