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Label Switched Path (LSP) Ping/Traceroute Reply Mode Simplification draft-akiya-mpls-lsp-ping-reply-mode-simple-02

Abstract

The Multiprotocol Label Switching (MPLS) Label Switched Path (LSP) Ping and Traceroute use the Reply Mode field to signal the method to be used in the MPLS echo reply. This document adds one value to the Reply Mode field to indicate reverse LSP. This document also adds an optional TLV which can carry ordered list of Reply Mode values.

This document updates RFC4379.

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].

Status of This Memo

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1. Introduction

The MPLS LSP Ping, described in [RFC4379], allows an initiator to encode instructions (Reply Mode) on how a responder should send the response back to the initiator. [RFC7110] also allows the initiator to encode a TLV (Reply Path TLV) which can instruct the responder to use specific LSP to send the response back to the initiator. Both approaches are powerful as they provide the ability for the initiator to control the return path.

However, it is becoming increasingly difficult for an initiator to select a valid return path to encode in the MPLS LSP echo request

packets. If the initiator does not select a valid return path, the MPLS LSP echo reply will not get back to the initiator. This results in a false failure of MPLS LSP Ping and Traceroute operation. In an effort to minimize such false failures, different implementations have chosen different default return path encoding for different LSP types and LSP operations. The problem with implementations having different default return path encoding is that the MPLS echo reply will not work in many cases, and the default value may not be the preferred choice by the operators.

This document further describes the problem in Section 2, and proposes a solution in Section 3 to minimizes false failure scenarios while accommodating operator preferences.

2. Problem Statements

It is becoming increasingly difficult for implementations to automatically supply a workable return path encoding for all MPLS LSP Ping and Traceroute operations across all LSP types. There are several factors which are contributing to this complication.

- Some LSPs have a control-channel, and some do not. Some LSPs have a reverse LSP, and some do not. Some LSPs have IP reachability in the reverse direction, and some do not.

- LSRs on some LSPs can have different available return path(s). Available return path(s) can depend on whether the responder is a transit LSR or an egress LSR. In case of a bi-directional LSP, available return path(s) on transit LSRs can also depend on whether LSP is completely co-routed, partially co-routed or associated (i.e., LSPs in the two directions are not co-routed).

- MPLS echo request packets may incorrectly terminate on an unintended target, which can have different available return path(s) than the intended target.

- The MPLS LSP Ping operation is expected to terminate on egress LSR. However, the MPLS LSP Ping operation with specific TTL values and MPLS LSP Traceroute operation can terminate on both transit LSR(s) and the egress LSR.

Except for the case where the responder node does not have an IP route back to the initiator, it is possible to use Reply Mode of value 2 (Reply via an IPv4/IPv6 UDP packet) in all cases. However, some operators are preferring control-channel and reverse LSP as default return path if they are available, which is not always the case.

When specific return path encoding is supplied by users or applications, then there are no issues in choosing the return path encoding. When specific return path encoding is not supplied by users or applications, then implementations use extra logic to compute, and sometimes guess, the default return path encodings. If a responder node receives an MPLS echo request containing return path instructions which cannot be accommodated due to unavailability, then the responder often drops such packets. This results in the initiator not receiving the MPLS LSP echo reply packets back. This consequence may be acceptable for failure cases (e.g., broken LSPs) where the MPLS echo request terminated on unintended target. However, the initiator not receiving back MPLS echo reply packets, even when the intended target received and verified the requests, is not desirable as false failures will be conveyed to users.

Many operators prefer some return path(s) over others for specific LSP types. To accommodate this, implementations may default to operator preferred return path (or allow default return path to be configured) for a specific operation. However, if the sender of MPLS echo request knew that preferred return path will not be available at the intended target node, then it is not very beneficial to use a Reply Mode corresponding to preferred return path (i.e., the sender of the MPLS echo request will not receive the MPLS echo reply in the successful case). What would be beneficial, for a given operation, is for the sender of the MPLS echo request to determine which return path(s) can and cannot be used ahead of time.

This document adds one Reply Mode value to describe the reverse LSP, and one optional TLV to describe an ordered list of reply modes. Based on operational needs, the TLV can describe multiple Reply Mode values in a preferred order to allow the responder to use the first available Reply Mode from the list. This eliminates the need for the initiator to compute, or sometimes guess, the default return path encoding. And that will result in simplified implementations across vendors, and result in improved usability to fit operational needs.

3. Solution

This document adds one reply mode to indicate reverse LSP, to be used by the MPLS LSP Ping and Traceroute. This document also adds an optional TLV which can carry ordered list of reply modes.

3.1. Reply via reverse LSP

Some LSP types are capable of having related LSP in reverse direction, through signaling or other association mechanisms. This document uses the term "Reverse LSP" to refer to the LSP in reverse direction of such LSP types. Note that this document restricts the

scope of "Reverse LSP" applicability to those reverse LSPs which are capable and allowed to carry the IP encapsulated MPLS echo reply.

This document adds one Reply Mode to be used by MPLS LSP Ping and Traceroute operations.

Value	Meaning
TBD1	Reply via reverse LSP

MPLS echo request with TBD1 (Reply via reverse LSP) in the Reply Mode field may be used to instruct responder to use reverse LSP to send MPLS echo reply. Reverse LSP is in relation to the last FEC specified in the Target FEC Stack TLV.

When a responder is using this Reply Mode, transmitting MPLS echo reply packet MUST use IP destination address of 127/8 for IPv4 and 0:0:0:0:0:FFFF:7F00/104 for IPv6.

3.2. Reply Mode Order TLV

This document also introduces a new optional TLV to describe list of Reply Mode values. The new TLV will contain one or more Reply Mode value(s) in preferred order. The first Reply Mode value is the most preferred and the last Reply Mode value is the least preferred. Following rules apply when using Reply Mode Order TLV.

1. Reply Mode Order TLV MAY be included in MPLS echo request.

2. Reply Mode Order TLV MUST NOT be included in MPLS echo reply.

3. Reply Mode field of MPLS echo request MUST be set to a valid value when supplying Reply Mode Order TLV in transmitting MPLS echo request. The initiator SHOULD set Reply Mode field of MPLS echo request to a value that corresponds to a return path which most likely to be available, in case responder does not understand the Reply Mode Order TLV.

4. If a responder node understands the Reply Mode Order TLV and the TLV is valid, then the responder MUST consider Reply Mode values described in the TLV and MUST NOT use the value described in the Reply Mode field of received MPLS echo request.

5. If a responder node understands the Reply Mode Order TLV but the TLV is not valid (due to conditions listed below), then the responder MUST only use the value described in the Reply Mode field of received MPLS echo request.

6. Reply Mode Order TLV MUST contain at least one Reply Mode value, and SHOULD contain at least two Reply Mode values.

7. A Reply Mode value MUST NOT be repeated (i.e. MUST NOT appear multiple times) in the Reply Mode Order TLV.

8. Reply Mode value 1 (Do not reply) SHOULD NOT be used in the Reply Mode Order TLV.

The responding node is to select the first available return path in this TLV. Reply Mode value corresponding to selected return path MUST be set in Reply Mode field of MPLS echo reply to communicate back to the initiator which return path was chosen.

The format of the TLV is as follows:

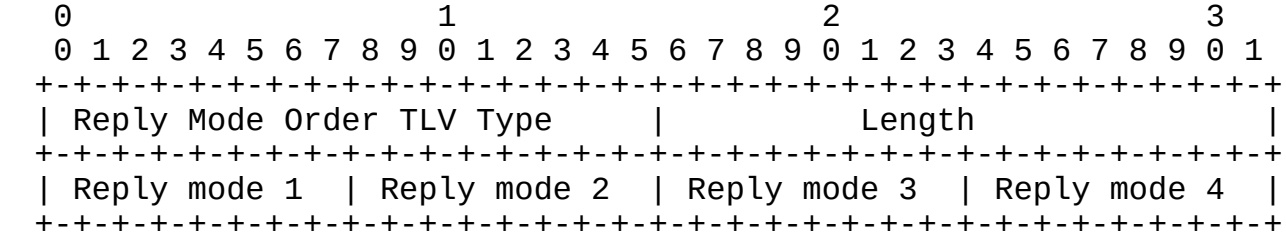

Figure 1 Reply Mode Order TLV

This is a variable length optional TLV. Each Reply Mode field is 1 octet.

4. Relations to Other LSP Ping/Trace Features

4.1. Reply Path TLV

[RFC7110] defines a new Reply Mode (5 - Reply via Specified Path). This Reply Mode specified in MPLS echo request indicates that MPLS echo reply be sent on one specific path described by the Reply Path TLV. The Flags field of the Reply Path TLV can indicate B (Bidirectional) bit to describe reverse direction of the tested bidirectional LSP. However, it is desired to have a new Reply Mode (TBD1 - Reply via reverse LSP) to indicate reverse direction of the tested bidirectional LSP without requiring to include additional TLV (i.e. Reply Path TLV). Therefore, a new Reply Mode (TBD1 - Reply via reverse LSP) has been added.

4.2. Proxy LSP Ping

The mechanism defined in this document will work with Proxy LSP Ping defined by [I-D.ietf-mpls-proxy-lsp-ping]. MPLS proxy ping request can carry a Reply Mode value and the Reply Mode Order TLV with list

of Reply Mode values. Proxy LSR MUST copy both Reply Mode value and the Reply Mode Order TLV into MPLS echo request. Proxy LSR, upon receiving MPLS echo reply, MUST copy Reply Mode value into MPLS proxy ping reply. With these procedures, Reply Mode used by the MPLS echo reply sender is propagated in the Reply Mode field to the sender of MPLS proxy ping request.

5. Security Considerations

Beyond those specified in [RFC4379], there are no further security measures required.

6. IANA Considerations

6.1. New Reply Mode

IANA is requested to assign one reply modes from the "Reply Mode" sub-registry within the "Multiprotocol Label Switching Architecture (MPLS)" registry.

Value	Meaning	Reference
TBD1	Reply via reverse LSP	this document

6.2. New Reply Mode Order TLV

IANA is requested to assign a new TLV type value from the "TLVs" sub-registry within the "Multiprotocol Label Switching Architecture (MPLS)" registry, for the "Reply Mode Order TLV".

The new TLV Type value should be assigned from the range (32768-49161) specified in [RFC4379] section 3 that allows the TLV type to be silently dropped if not recognized.

Type	Meaning	Reference
TBD2	Reply Mode Order TLV	this document

7. Acknowledgements

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9.1. Normative References

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[RFC4379] Kompella, K. and G. Swallow, "Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures", RFC 4379, February 2006.

9.2. Informative References

[I-D.ietf-mpls-proxy-lsp-ping] Swallow, G., Lim, V., and S. Aldrin, "Proxy MPLS Echo Request", draft-ietf-mpls-proxy-lsp-ping-01 (work in progress), January 2014.

[RFC7110] Chen, M., Cao, W., Ning, S., Jounay, F., and S. Delord, "Return Path Specified Label Switched Path (LSP) Ping", RFC 7110, January 2014.

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