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Bidirectional Forwarding Detection (BFD) in Segment Routing Networks Using MPLS Dataplane
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Abstract

Segment Routing architecture leverages the paradigm of source routing. It can be realized in the Multiprotocol Label Switching (MPLS) network without any change to the data plane. A segment is encoded as an MPLS label and an ordered list of segments is encoded as a stack of labels. Bidirectional Forwarding Detection (BFD) is expected to monitor any kind of paths between systems. This document defines how to use Label Switched Path Ping to bootstrap and control path in reverse direction of a BFD session on the Segment Routing static MPLS tunnel.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on April 27, 2018.

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1. Introduction

[RFC5880], [RFC5881], and [RFC5883] established the Bidirectional Forwarding Detection (BFD) protocol for IP networks. [RFC5884] and [RFC7726] set rules of using BFD Asynchronous mode over Multiprotocol Label Switching (MPLS) Label Switched Path (LSP). These latter standards implicitly assume that the egress BFD peer, which is the

egress Label Edge Router (LER), will use the shortest path route regardless of the path the ingress LER uses to send BFD control packets towards it.

This document defines use of LSP Ping for Segment Routing networks over MPLS dataplane [I-D.ietf-mpls-spring-lsp-ping] to bootstrap and control path of a BFD session from the egress to ingress LER using static MPLS tunnel.

1.1. Conventions used in this document

1.1.1. Terminology

BFD: Bidirectional Forwarding Detection

FEC: Forwarding Equivalence Class

MPLS: Multiprotocol Label Switching

LSP: Label Switching Path

LER: Label Edge Router

1.1.2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

2. Bootstrapping BFD session over Segment Routed tunnel

As demonstrated in [I-D.ietf-mpls-spring-lsp-ping] introduction of Segment Routing network domains with an MPLS data plane requires three new sub-TLVs that MAY be used with Target Forwarding Equivalence Class (FEC) TLV. Section 6.1 addresses use of the new sub-TLVs in Target FEC TLV in LSP ping and LSP traceroute. For the case of LSP ping the [I-D.ietf-mpls-spring-lsp-ping] states that:

Initiator MUST include FEC(s) corresponding to the destination segment.

Initiator, i.e. ingress LSR, MAY include FECs corresponding to some or all of segments imposed in the label stack by the ingress LSR to communicate the segments traversed.

It has been noted in [RFC5884] that a BFD session monitors for defects particular <MPLS LSP, FEC> tuple. [RFC7726] clarified how to establish and operate multiple BFD sessions for the same <MPLS LSP, FEC> tuple. Because only ingress edge router is aware of the SR-based explicit route the egress edge router can associate the LSP

ping with BFD Discriminator TLV with only one of the FECs it advertised for the particular segment. Thus this document clarifies that:

When LSP Ping is used to bootstrap a BFD session the FEC corresponding to the destination segment to be associated with the BFD session MUST be as the very last sub-TLV in the Target FEC TLV.

Encapsulation of a BFD Control packet in Segment Routing network with MPLS dataplane MUST follow Section 7 [RFC5884] when IP/UDP header used and MUST follow Section 3.4 [RFC6428] without IP/UDP header being used.

3. Use BFD Reverse Path TLV over SDN-provisioned Segment Routed MPLS Tunnel

For BFD over MPLS LSP case, per [RFC5884], egress LER MAY send BFD control packet to the ingress LER either over IP network or an MPLS LSP. Similarly, for the case of BFD over p2p segment tunnel with MPLS data plane, the ingress LER MAY route BFD control packet over IP network, as described in [RFC5883], or transmit over a segment tunnel, as described in Section 7 [RFC5884]. In some cases there may be a need to direct egress BFD peer to use specific path for the reverse direction of the BFD session by using the BFD Reverse Path TLV [I-D.ietf-mpls-bfd-directed]. For the case of MPLS dataplane, Segment Routing Architecture [I-D.ietf-spring-segment-routing] explains that "a segment is encoded as an MPLS label. An ordered list of segments is encoded as a stack of labels." YANG Data Model

for MPLS Static LSPs [I-D.ietf-mpls-static-yang] models outgoing MPLS labels to be imposed as leaf-list [RFC6020], i.e., as array of rt-types:mpls-label [I-D.ietf-rtgwg-routing-types] Following on that, this document defines Segment Routing Static MPLS Tunnel sub-TLV that MAY be used with the BFD Reverse Path TLV [I-D.ietf-mpls-bfd-directed]. The format of the sub-TLV is presented in Figure 1. BFD Reverse TLV MAY include zero or one SR Static MPLS Tunnel sub-TLV.

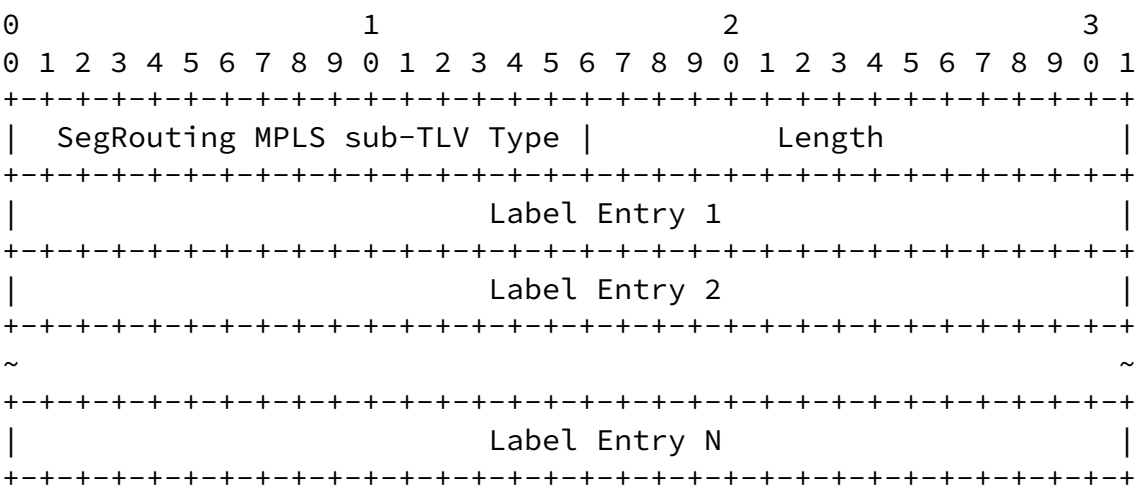

Figure 1: Segment Routing Static MPLS Tunnel sub-TLV

The Segment Routing Tunnel sub-TLV Type is two octets in length, and has a value of TBD (to be assigned by IANA as requested in Section 5).

The egress LSR MUST use the Value field as label stack for BFD

control packets for the BFD session identified by the source IP address of the MPLS LSP Ping packet and the value in the BFD Discriminator TLV. Label Entries MUST be in network order.

As in [I-D.ietf-mpls-bfd-directed], empty BFD Reverse TLV requires the egress BFD peer switch the reverse path of the BFD session, specified by BFD Discriminator TLV, to the path selected based on locally defined policy. If more than one SR Static MPLS Tunnel sub-TLV is present, then the egress BFD peer MUST send Echo Reply with Return Code field set to "Too Many TLVs Detected" Table 2.

The Segment Routing Tunnel sub-TLV MAY be used in Reply Path TLV defined in [RFC7110]

4. BFD Reverse Path TLV over Segment Routed MPLS Tunnel with Dynamic Control Plane

When Segment Routed domain with MPLS data plane uses distributed tunnel computation BFD Reverse Path TLV MAY use Target FEC sub-TLVs defined in [I-D.ietf-mpls-spring-lsp-ping].

5. IANA Considerations

5.1. Segment Routing Static MPLS Tunnel sub-TLV

The IANA is requested to assign new sub-TLV type from "Multiprotocol Label Switching Architecture (MPLS) Label Switched Paths (LSPs) Ping Parameters - TLVs" registry, "Sub-TLVs for TLV Types 1, 16, and 21" sub-registry.

Value	Description	Reference
X (TBD1)	Segment Routing Static MPLS Tunnel sub-TLV	This document

Table 1: New Segment Routing Tunnel sub-TLV

5.2. Return Code

The IANA is requested to assign a new Return Code value from the "Multi-Protocol Label Switching (MPLS) Label Switched Paths (LSPs) Ping Parameters" registry, "Return Codes" sub-registry, as follows using a Standards Action value.

Value	Description	Reference
X (TBD2)	Too Many TLVs Detected.	This document

Table 2: New Return Code

6. Security Considerations

Security considerations discussed in [RFC5880], [RFC5884], [RFC7726], and [RFC8029] apply to this document.

7. Acknowledgements

TBD

8. References

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