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         Bidirectional Forwarding Detection (BFD) Directed Return Path
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Abstract

   Bidirectional Forwarding Detection (BFD) is expected to be able to
   monitor wide variety of encapsulations of paths between systems.
   When a BFD session monitors an explicitly routed unidirectional path
   there may be a need to direct egress BFD peer to use a specific path
   for the reverse direction of the BFD session.

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

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1. Introduction

   [RFC5880], [RFC5881], and [RFC5883] established the BFD protocol for
   IP networks. [RFC5884] and [RFC7726] set rules of using BFD
   asynchronous mode over IP/MPLS LSPs. These standards implicitly
   assume that the egress BFD peer will use the shortest path route
   regardless of route being used to send BFD control packets towards
   it.

   For the case where a LSP is explicitly routed it is likely that the
   shortest return path to the ingress BFD peer would not follow the
   same path as the LSP in the forward direction. The fact that BFD
   control packets are not guaranteed to follow the same links and nodes
   in both forward and reverse directions is a significant factor in
   producing false positive defect notifications, i.e. false alarms, if
   used by the ingress BFD peer to deduce the state of the forward
   direction.

   This document defines the BFD Reverse Path TLV as an extension to LSP
   Ping [RFC8029] and proposes that it is to be used to instruct the
   egress BFD peer to use an explicit path for its BFD control packets
   associated with a particular BFD session. The TLV will be allocated
   from the TLV and sub-TLV registry defined in [RFC8029]. As a special

case, forward and reverse directions of the BFD session can form a
bi-directional co-routed associated channel.

1.1. Conventions used in this document

1.1.1. 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. Problem Statement

When BFD is used to monitor unidirectional explicitly routed path,
e.g. MPLS-TE LSP, BFD control packets in forward direction would be
in-band using the mechanism defined in [RFC5884] and [RFC5586]. But
the reverse direction of the BFD session would follow the shortest
path route and that might lead to the problem in detecting failures
on a unidirectional explicit path as described below:

o a failure detection by ingress node on the reverse path cannot be
   interpreted as bi-directional failure unambiguously and thus
   trigger, for example, protection switchover of the forward
   direction without possibility of being a false positive.

To address this scenario the egress BFD peer would be instructed to
use a specific path for BFD control packets.

3. Control of the Reverse BFD Path

LSP ping, defined in [RFC8029], uses BFD Discriminator TLV [RFC5884]
to bootstrap a BFD session over an MPLS LSP. This document defines a
new TLV, BFD Reverse Path TLV, that MUST contain a single sub-TLV
that can be used to carry information about the reverse path for the
BFD session that is specified by value in BFD Discriminator TLV.

3.1. BFD Reverse Path TLV

The BFD Reverse Path TLV is an optional TLV within the LSP ping
[RFC8029]. However, if used, the BFD Discriminator TLV MUST be
included in an Echo Request message as well. If the BFD
Discriminator TLV is not present when the BFD Reverse Path TLV is
included, then it MUST be treated as malformed Echo Request, as
described in [RFC8029].

The BFD Reverse Path TLV carries information about the path onto
which the egress BFD peer of the BFD session referenced by the BFD
Discriminator TLV MUST transmit BFD control packets. The format of
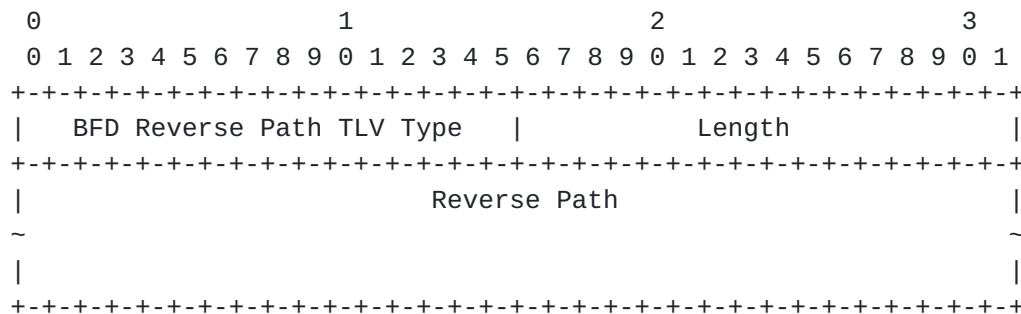the BFD Reverse Path TLV is as presented in Figure 1.

```
  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
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |   BFD Reverse Path TLV Type    |             Length            |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                         Reverse Path                          |
 ~                                                               ~
 |                                                               |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

                    Figure 1: BFD Reverse Path TLV

BFD Reverse Path TLV Type is 2 octets in length and has a value of
TBD1 (to be assigned by IANA as requested in Section 5).

Length field is 2 octets long and defines the length in octets of the
Reverse Path field.

Reverse Path field contains a sub-TLV. Any non-multicast Target FEC
Stack sub-TLV (already defined, or to be defined in the future) for
TLV Types 1, 16, and 21 of MPLS LSP Ping Parameters registry MAY be
used in this field. Multicast Target FEC Stack sub-TLVs, i.e. p2mp
and mp2mp, SHOULD NOT be included into Reverse Path field. If the
egress LSR finds multicast Target Stack sub-TLV it MUST send echo
reply with the received Reverse Path TLV, BFD Discriminator TLV and
set the Return Code to "Inappropriate Target FEC Stack sub-TLV
present" Section 3.3. None, one or more sub-TLVs MAY be included in
the BFD Reverse Path TLV. If none sub-TLVs found in the BFD Reverse
Path TLV, the egress BFD peer MUST revert to using the local policy
based decision as described in Section 7 [RFC5884], i.e., routed over
IP network.

If the egress LSR cannot find the path specified in the Reverse Path
TLV it MUST send Echo Reply with the received BFD Discriminator TLV,
Reverse Path TLV and set the Return Code to "Failed to establish the
BFD session. The specified reverse path was not found" Section 3.3.
The egress BFD peer MAY establish the BFD session over IP network as
defined in [RFC5884].

3.2. Static and RSVP-TE sub-TLVs

   When an explicit path on an MPLS data plane is set either as Static
   or RSVP-TE LSP respective sub-TLVs defined in [RFC7110] MAY be used
   to identify the explicit reverse path for the BFD session.

3.3. Return Codes

   This document defines the following Return Codes for MPLS LSP Echo
   Reply:

   o "Inappropriate Target FEC Stack sub-TLV present", (TBD3). When
      multicast Target FEC Stack sub-TLV found in the received Echo
      Request by the egress BFD peer, an Echo Reply with the return code
      set to "Inappropriate Target FEC Stack sub-TLV present" MUST be
      sent to the ingress BFD peer Section 3.1.

   o "Failed to establish the BFD session. The specified reverse path
      was not found", (TBD4). When a specified reverse path is not
      available at the egress BFD peer, an Echo Reply with the return
      code set to "Failed to establish the BFD session. The specified
      reverse path was not found" MUST be sent back to the ingress BFD
      peer Section 3.1.

4. Use Case Scenario

   In the network presented in Figure 2 node A monitors two tunnels to
   node H: A-B-C-D-G-H and A-B-E-F-G-H. To bootstrap a BFD session to
   monitor the first tunnel, node A MUST include a BFD Discriminator TLV
   with Discriminator value (e.g. foobar-1) and MAY include a BFD
   Reverse Path TLV that references H-G-D-C-B-A tunnel. To bootstrap a
   BFD session to monitor the second tunnel, node A MUST include a BFD
   Discriminator TLV with a different Discriminator value (e.g. foobar-
   2) [RFC7726] and MAY include a BFD Reverse Path TLV that references
   H-G-F-E-B-A tunnel.

```
         C---------D
         |         |
   A-------B         G-----H
         |         |
         E---------F
```
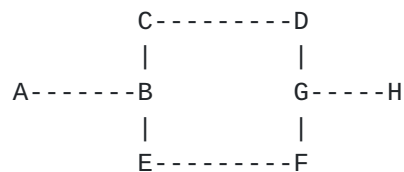
                Figure 2: Use Case for BFD Reverse Path TLV

   If an operator needs node H to monitor a path to node A, e.g.
   H-G-D-C-B-A tunnel, then by looking up list of known Reverse Paths it
   MAY find and use the existing BFD session.

5. IANA Considerations

5.1. BFD Reverse Path TLV

The IANA is requested to assign a new value for BFD Reverse Path TLV
from the "Multiprotocol Label Switching Architecture (MPLS) Label
Switched Paths (LSPs) Ping Parameters - TLVs" registry, "TLVs and
sub-TLVs" sub-registry.

Value	Description	Reference
(TBD1)	BFD Reverse Path TLV	This document

Table 1: New BFD Reverse Type 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
(TBD3)	Inappropriate Target FEC Stack sub-TLV present.	This document
(TBD4)	Failed to establish the BFD session. The specified reverse path was not found.	This document

Table 2: New Return Code

6. Security Considerations

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

7. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
           Requirement Levels", BCP 14, RFC 2119,
           DOI 10.17487/RFC2119, March 1997,
           <https://www.rfc-editor.org/info/rfc2119>.

   [RFC5586] Bocci, M., Ed., Vigoureux, M., Ed., and S. Bryant, Ed.,
              "MPLS Generic Associated Channel", RFC 5586,
              DOI 10.17487/RFC5586, June 2009,
              <https://www.rfc-editor.org/info/rfc5586>.

   [RFC5880] Katz, D. and D. Ward, "Bidirectional Forwarding Detection
              (BFD)", RFC 5880, DOI 10.17487/RFC5880, June 2010,
              <https://www.rfc-editor.org/info/rfc5880>.

   [RFC5881] Katz, D. and D. Ward, "Bidirectional Forwarding Detection
              (BFD) for IPv4 and IPv6 (Single Hop)", RFC 5881,
              DOI 10.17487/RFC5881, June 2010,
              <https://www.rfc-editor.org/info/rfc5881>.

   [RFC5883] Katz, D. and D. Ward, "Bidirectional Forwarding Detection
              (BFD) for Multihop Paths", RFC 5883, DOI 10.17487/RFC5883,
              June 2010, <https://www.rfc-editor.org/info/rfc5883>.

   [RFC5884] Aggarwal, R., Kompella, K., Nadeau, T., and G. Swallow,
              "Bidirectional Forwarding Detection (BFD) for MPLS Label
              Switched Paths (LSPs)", RFC 5884, DOI 10.17487/RFC5884,
              June 2010, <https://www.rfc-editor.org/info/rfc5884>.

   [RFC7110] Chen, M., Cao, W., Ning, S., Jounay, F., and S. Delord,
              "Return Path Specified Label Switched Path (LSP) Ping",
              RFC 7110, DOI 10.17487/RFC7110, January 2014,
              <https://www.rfc-editor.org/info/rfc7110>.

   [RFC7726] Govindan, V., Rajaraman, K., Mirsky, G., Akiya, N., and S.
              Aldrin, "Clarifying Procedures for Establishing BFD
              Sessions for MPLS Label Switched Paths (LSPs)", RFC 7726,
              DOI 10.17487/RFC7726, January 2016,
              <https://www.rfc-editor.org/info/rfc7726>.

   [RFC8029] Kompella, K., Swallow, G., Pignataro, C., Ed., Kumar, N.,
              Aldrin, S., and M. Chen, "Detecting Multiprotocol Label
              Switched (MPLS) Data-Plane Failures", RFC 8029,
              DOI 10.17487/RFC8029, March 2017,
              <https://www.rfc-editor.org/info/rfc8029>.

   [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC
              2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174,
              May 2017, <https://www.rfc-editor.org/info/rfc8174>.

Appendix A. Acknowledgments

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