Label Switched Path (LSP) Ping
Extended Bidirectional Forwarding Detection (BFD) Discriminator TLV
draft-vgovindan-mpls-extended-bfd-disc-tlv-00

Abstract

   This document defines an extended Bidirectional Forwarding Detection
   (BFD) discriminator TLV for the Multiprotocol Label Switching (MPLS)
   Label Switched Path (LSP) Ping mechanism, to allow bootstrapping of
   multiple BFD sessions for a given FEC.

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. Background

Bidirectional Forwarding Detection (BFD) [RFC5880] for Multiprotocol
Label Switching (MPLS) Label Switched Paths (LSPs), [RFC5884],
describes a mechanism to use BFD to monitor the connectivity in-band
on the LSPs. The BFD session on the LSP egress is bootstrapped using
the LSP Ping mechanism, defined in [RFC4379], carrying the BFD
Discriminator TLV that describes the BFD discriminator of the BFD
session on the LSP ingress.

The BFD Discriminator TLV and defined procedures around this TLV only
allow one BFD session to be bootstrapped per <MPLS Forwarding
Equivalent Class (FEC), LSP> There are scenarios where an LSP ingress
may desire to run multiple BFD sessions to monitor the connectivity
on an LSP. To achieve the bootstrapping of multiple BFD sessions per
FEC, a new TLV and procedures are required. Two scenarios where this
is useful are described below:

o Entropy labels help achieve load balancing of traffic belonging to
   the same <MPLS FEC, LSP>. It may be beneficial to track the

      individual paths of the multi-path network using separate BFD
      sessions for each non-congruent path.

   o It may be useful to establish multiple BFD sessions for the same
      <MPLS FEC, LSP> to achieve BFD session redundancy, i.e. protection
      against false positives due to equipment or soft failures inside
      boxes.

2. Overview

   An LSR ingress wanting to bootstrap one or more BFD sessions on an
   LSP is to include the Extended BFD Discriminator TLV, described in
   Section 4, in the MPLS echo request message for the FEC. The
   Extended BFD Discriminator TLV is capable of carrying multiple BFD
   discriminators, and each BFD discriminator is accompanied with an an
   instance identifier. The LSR egress, upon reception of this MPLS
   echo request, is to create requested number of BFD sessions for the
   specified FEC. Each BFD session object created on the LSR ingress
   and the LSR egress MUST be annotated with corresponding instance
   identifier. BFD session procedures are to follow those described in
   [RFC5884].

3. Procedures for BFD session establishment and removal using the Extended BFD TLV

3.1. Procedures for establishing BFD sessions

   There are at least two options possible here:

   1. BFD session establishment MUST follow the procedure specified in
       [RFC5884].

   2. The base procedure for BFD session establishment MUST be the same
       as that of [RFC5884]. This procedure can be enhanced by
       specifying additional Operation type field and Operation status
       field in the proposed Extended BFD Discriminator TLV. See
       Appendix A for a description of Operation types and Operation
       status codes.

3.2. Procedures for removing BFD sessions

   [RFC5884] does not specify an explicit procedure for deleting BFD
   sessions. A few options are possible here:

   1. Specify an explicit delete procedure for the BFD session using
       Operation types field and Operation status field through the
       Extended BFD TLV. See Appendix A for a description of Operation
       types and Operation status codes.

   2. Specify a timer based deletion procedure: A new purge timer field
       can be introduced within the proposed Extended BFD Discriminator
       TLV. The ingress specifies the value for the purge timer field.
       Once the BFD session transitions from up to down state, the
       egress is to delete the session after the value specified in the
       purge timer field. Ed Note: This approach is an open topic for
       discussion.

   3. No new procedure to delete a BFD session is introduced.
       Assumption by the egress is that BFD sessions can be deleted if
       corresponding FEC is deleted from the system or sometime after
       BFD sessions go down.

   Regardless of the option chosen to proceed, all BFD sessions
   established with the FEC MUST be removed automatically if the FEC is
   removed.

[4](#). Extended BFD Discriminator TLV

   The Extended BFD Discriminator object is a new TLV that MAY be
   included in the MPLS echo request message. An MPLS echo request MUST
   NOT include more than one Extended BFD Discriminator object. The
   Extended BFD Discriminator object describes one or more BFD
   discriminators along with each having an instance identifier. An
   MPLS echo reply MAY include the Extended BFD Discriminator object,
   but MUST NOT include more than one Extended BFD Discriminator object.

   Extended BFD Discriminator TLV Type is TBD1. Length is 8 or
   multiples of 8. Length of (8 x N) implies that there are N entries
   in the Value field of the Extended BFD Discriminator TLV. Each entry
   in the Value field of the Extended BFD Discriminator TLV has
   following format:

```
    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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |           Reserved            |       Instance Identifier     |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                       BFD Discriminator                       |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

               Figure 1: Extended BFD Discriminator TLV

   Reserved - This field MUST be set to zero on transmit, and ignored
   on receipt.

   Instance Identifier - An instance identifier of the BFD session.
   The instance identifier is a value allocated by the LSP ingress

   for corresponding BFD Discriminator, and MUST be unique within the
   FEC on the LSP ingress node. The instance identifier MUST NOT
   change for the lifetime of the BFD session.

   BFD Discriminator - The BFD discriminator allocated for this BFD
   session by the LSP ingress.

See Appendix A for a discussion on an alternate format for the TLV.

5. Mutually Exclusive: BFD TLVs

   The BFD Discriminator TLV and the Extended BFD Discriminator TLV are
   mutually exclusive. An MPLS echo request/reply message MUST NOT
   include both the BFD Discriminator TLV and the Extended BFD
   Discriminator TLV. Reception of an MPLS echo request with both the
   BFD Discriminator TLV and the Extended BFD Discriminator TLV is to
   result in the Return Code being set to Malformed echo request
   received (1).

6. Backwards Compatibility

   If an LSP ingress wishes to bootstrap multiple BFD sessions with the
   Extended BFD Discriminator TLV when an LSP already has a BFD session
   bootstrapped with the BFD Discriminator TLV, following procedures are
   RECOMMENDED.

   The LSP ingress is to send an MPLS echo request carrying the Extended
   BFD Discriminator TLV with the same BFD discriminator of the existing
   BFD session (one bootstrapped previously with the BFD Discriminator
   TLV), giving it an instance identifier. Once the transition of the
   existing BFD session is completed, then the LSP ingress can generate
   further MPLS echo request messages with the Extended BFD
   Discriminator TLV to bootstrap more BFD sessions.

7. Encapsulation

   The encapsulation of BFD packets are the same as specified by
   [RFC5884]

8. Security Considerations

   This document defines a mechanism to bootstrap multiple BFD sessions
   per FEC. BFD sessions, naturally, use system and network resources.
   More BFD sessions means more resources will be used. It is highly
   important to ensure only minimum number of BFD sessions are
   provisioned per FEC, and bootstrapped BFD sessions are properly
   deleted when no longer required. Additionally security measures
   described in [RFC4379] and [RFC5884] are to be followed.

9. IANA Considerations

9.1. Extended BFD Discriminator TLV

The IANA is requested to assign new value TBD1 for Extended BFD
Discriminator TLV from the "Multiprotocol Label Switching
Architecture (MPLS) Label Switched Paths (LSPs) Ping Parameters -
TLVs" registry.

```
     Value   Meaning                                  Reference
     -----   -------                                  ---------
     TBD1    Extended BFD Discriminator TLV           this document
```

10. Acknowledgements

TBD

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12. 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.

[RFC5880] Katz, D. and D. Ward, "Bidirectional Forwarding Detection
           (BFD)", RFC 5880, June 2010.

[RFC5884] Aggarwal, R., Kompella, K., Nadeau, T., and G. Swallow,
           "Bidirectional Forwarding Detection (BFD) for MPLS Label
           Switched Paths (LSPs)", RFC 5884, June 2010.

Appendix A. Alternate format for the BFD Extended TLV

The BFD Extended TLV can be used to carry the Operation Type and the
Operation Status (Op Status) bits that are defined 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Operation Type|  Op Status    |       Instance Identifier     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        BFD Discriminator                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

                 Figure 2: Alternate format of the Extended
                          BFD Discriminator TLV

   Ed Note: The definitions of Operation Type and Operation Status
   fields are subject to discussion. Additional codes can be defined
   if this approach is pursued.

   Operation Type - Operation to be performed on the corresponding
   BFD Discriminator. Valid values are:

      1 - Create: This value MAY be used in the MPLS echo request,
      but MUST NOT be used in the MPLS echo reply. The operation
      type 1 indicates that receiver (i.e. LSP egress) is to ensure
      that BFD session for this FEC, with corresponding BFD
      Discriminator in "your discriminator" field, exists or is
      created.

      2 - Delete: This value MAY be used in the MPLS echo request,
      but MUST NOT be used in the MPLS echo reply. The operation
      type 2 indicates that receiver (i.e. LSP egress) is to ensure
      that BFD session for this FEC, with corresponding BFD
      Discriminator in "your discriminator" field, does not exist or
      is deleted.

      3 - CreateAck: This value MUST NOT be used in the MPLS echo
      request, but MAY be used in the MPLS echo reply. The operation
      type 3 indicates that receiver (i.e. LSP egress) is
      acknowledging received Create(1) request.

      4 - DeleteAck: This value MUST NOT be used in the MPLS echo
      request, but MAY be used in the MPLS echo reply. The operation
      type 4 indicates that receiver (i.e. LSP egress) is
      acknowledging received Delete(2) request.

   Op Status

      0 - The operation succeeded.

      1 - Not enough Resources.

      BFD Discriminator - When the Extended BFD Discriminator TLV is
      carried in the MPLS echo request, this field describes the BFD
      discriminator allocated for this BFD session by the LSP ingress.
      When the Extended BFD Discriminator TLV is carried in the MPLS
      echo reply, this field describes the BFD discriminator allocated
      for this BFD session by the LSP egress.

   The Extended BFD Discriminator TLV in an MPLS echo request MUST have
   either Create(1) or Delete(2) operation type. The Extended BFD
   Discriminator TLV in an MPLS echo reply MUST have either CreateAck(3)
   or DeleteACK(4) operation type.

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