                    Clarifications to RFC 5884
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Abstract

   This document clarifies the procedures for establishing, maintaining
   and removing multiple, concurrent BFD sessions for a given <MPLS LSP,
   FEC> described in RFC5884.

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1. Background

   [RFC5884] defines the procedures to bootstrap and maintain BFD
   sessions for a <MPLS FEC, LSP> using LSP ping. While Section 4 of
   [RFC5884] specifies that multiple BFD sessions can be established for
   a <MPLS FEC, LSP> tuple, the procedures to bootstrap and maintain
   multiple BFD sessions concurrently over a <MPLS FEC, LSP> are not
   clearly specified. Additionally, the procedures of removing BFD
   sessions bootstrapped on the egress LSR are unclear. This document
   provides those clarifications without deviating from the principles
   outlined in [RFC5884].

   The ability for an ingress LSR to establish multiple BFD sessions for
   a <MPLS FEC, LSP> tuple is useful in scenarios such as Segment
   Routing based LSPs or LSPs having Equal-Cost Multipath (ECMP). The
   process used by the ingress LSR to determine the number of BFD
   session(s) to be bootstrapped for a <MPLS FEC, LSP> tuple and the
   mechanism of constructing those session(s) are outside the scope of
   this document.

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
   [RFC2119].

2. Theory of Operation

2.1. Procedures for establishment of multiple BFD sessions

   Section 6 of [RFC5884] specifies the procedure for bootstrapping BFD
   sessions using LSP ping. It further states that a BFD session SHOULD
   be established for each alternate path that is discovered. This
   requirement has been the source of some ambiguity as the procedures
   of establishing concurrent, multiple sessions have not been
   explicitly specified. This ambiguity can also be attributed in part
   to the text in Section 7 of [RFC5884] forbidding either end to change
   local discriminator values in BFD control packets after the session
   reaches the UP state. The following procedures are described to
   clarify the ambiguity based on the interpretation of the authors's
   reading of the referenced sections:

   At the ingress LSR:

      MPLS LSP ping can be used to bootstrap multiple BFD sessions for a
      given <MPLS FEC, LSP>. Each LSP ping MUST carry a different
      discriminator value in the BFD discriminator TLV [RFC4379].

   The egress LSR needs to perform the following:

      If the validation of the FEC in the MPLS Echo request message
      succeeds, check the discriminator specified in the BFD
      discriminator TLV of the MPLS Echo request. If there is no local
      session that corresponds to the discriminator (remote) received in
      the MPLS Echo request, a new session is bootstrapped and a local
      discriminator is allocated. The validation of a FEC is a
      necessary condition to be satisfied to create a new BFD session at
      the egress LSR. However, the policy or procedure if any, to be
      applied by the egress LSR before allowing a new BFD session to be
      created is outside the scope of this document. Such policies or
      procedures could consider availability of system resources before
      allowing a session to be created. When the egress LSR disallows
      the creation of a BFD session due to policy, it MUST drop the MPLS
      Echo request message.

      Ensure the uniqueness of the <MPLS FEC, LSP, Remote
      Discriminiator> tuple.

      The remaining procedures of session establishment are as specified
      in [RFC5884].

2.2. Procedures for maintenance of multiple BFD sessions

   Both the ingress LSR and egress LSR use the YourDiscriminator of the
   received BFD packet to demultiplex BFD sessions.

2.3. Procedures for removing BFD sessions at the egress LSR

   [RFC5884] does not specify an explicit procedure for deleting BFD
   sessions. The procedure for removing a BFD session established by an
   out-of-band discriminator exchange using the MPLS LSP ping can
   improve resource management (like memory etc.) especially in
   scenarios involving thousands or more of such sessions. A few
   options are possible here:

      The BFD session MAY be removed in the egress LSR if the BFD
      session transitions from UP to DOWN. This can be done after the
      expiry of a configurable timer started after the BFD session state
      transitions from UP to DOWN at the egress LSR.

      The BFD session on the egress LSR MAY be removed by the ingress
      LSR by using the BFD diagnostic code AdminDown(7) as specified in
      [RFC5880]. When the ingress LSR wants to remove a session without
      triggering any state change at the egress, it MAY transmit BFD
      packets indicating the State as Down(1), diagnostic code
      AdminDown(7) detectMultiplier number of times. Upon receiving
      such a packet, the egress LSR MAY remove the BFD session, without
      triggering a change of state.

      The procedures to be followed at the egress LSR when BFD
      session(s) remain in the DOWN state for a significant amount of
      time is a local matter. Such procedures are outside the scope of
      this document.

      All BFD sessions established with the FEC MUST be removed
      automatically if the FEC is removed.

2.4. Changing discriminators for a BFD session

   The discriminators of a BFD session established over an MPLS LSP
   cannot be changed when it is in UP state. The BFD session could be
   removed after a graceful transition to AdminDown state using the BFD
   diagnostic code AdminDown. A new session could be established with a
   different discriminator. The initiation of the transition from the
   Up to Down state can be done either by the ingress LSR or the egress
   LSR.

3. Backwards Compatibility

   The procedures clarified by this document are fully backward
   compatible with an existing implementation of [RFC5884]. While the

capability to bootstrap and maintain multiple BFD sessions may not be
present in current implementations, the procedures outlined by this
document can be implemented as a software upgrade without affecting
existing sessions. In particular, the egress LSR needs to support
multiple BFD sessions per <MPLS FEC, LSP> before the ingress LSR is
upgraded.

4. Encapsulation

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

5. Security Considerations

This document clarifies the mechanism to bootstrap multiple BFD
sessions per <MPLS FEC, LSP>. 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.

6. IANA Considerations

This document does not make any requests to IANA.

7. Acknowledgements

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8. Normative References

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