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     Rbridges: Bidirectional Forwarding Detection (BFD) support for TRILL
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Abstract

   This document specifies use of the BFD (Bidirectional Forwarding
   Detection) protocol in RBridge campuses based on the OAM (Operations,
   Administration, and Maintenance) Channel extension to the TRILL
   (TRansparent Interconnection of Lots of Links) protocol.

   BFD is a widely deployed OAM mechanism in IP and MPLS networks.
   However, in the present form a BFD packet cannot be sent over a TRILL
   network as it is either IP/ UDP encapsulated or encapsulated directly
   over MPLS or using ACH encapsulation. This document also defines BFD
   encapsulation over TRILL to address this shortcoming.

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].

   This Internet-Draft will expire on September 14, 2011.

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[1](). **Introduction**

   Faster convergence is a very critical feature of TRILL networks. The
   TRILL IS-IS Hellos used between RBridges provide a basic neighbor and
   continuity check for TRILL links. However, failure detection by non-
   receipt of such Hellos is based on the holding time parameter which
   is commonly set to a value of tens of seconds and, in any case, has a
   minimum expressible value of one second.

   Some applications, including voice over IP, may wish, with high
   probability, to detect interruptions in continuity within a much
   shorter time period. In some cases physical layer failures can be
   detected very rapidly but this is not always possible, such as when
   there is a failure between two bridges that are in turn between two
   RBridges. There are also many subtle failures possible at higher
   levels. For example, some forms of failure could affect unicast
   frames while still letting multicast frames through; since all TRILL
   IS-IS Hellos are multicast such a failure cannot be detected with
   Hellos. Thus, a low overhead method for frequently testing
   continuity for the TRILL Data between neighbor RBridges is necessary
   for some applications. BFD protocol provides a low-overhead, short-
   duration detection of failures in the path between forwarding
   engines.

   This document describes a TRILL encapsulation for BFD packets for
   networks that do not use IP addressing or for ones where it is not
   desireable.

[2](). **Terminology**

   BFD: Bi-directional Forwarding Detection

   OAM: Operations, Administration, and Maintenance

   MPLS: Multi Protocol Label Switching

   IS-IS: Intermediate-System to Intermediate-System

   TTL: Time To Live

[3](). **BFD over TRILL**

   TRILL supports neighbor BFD Echo and one-hop and multi-hop BFD
   Control, as specified below, over the TRILL OAM Channel facility.
   Multi-destination BFD is beyond the scope of this document. The OAM
   Channel facility is specified in [TRILLoam].

BFD over TRILL support is similar to BFD over IP support except where
it is explicitly so mentioned. When running BFD over TRILL both
Single Hop as well as in Multi Hop sessions are supported.

Asynchronous mode is supported, however the demand mode is not
supported for TRILL. BFD over TRILL supports the Echo function,
however this can be used for only Single hop sessions.

The TRILL Header Hop count in the BFD packets sent out with a value
of 63. To prevent spoofing attacks, the TRILL Hop count of a
received session is checked. For a single Hop session if the Hop
count is less than 63 the packet is discarded if the GTSM mode
[RFC5082] is set. For Multi Hop sessions the Hop count check can be
disabled or the bfdTrillAcceptedHopCount value can be configured. If
a packet is received with a hop count of less than
bfdTrillAcceptedHopCount, the packet is discarded.

The format of the echo packet is not defined.

A new BFD TRILL header is defined.

Authentication mechanisms as supported in BFD are also supported for
BFD running over TRILL.

4. Sessions and Initialization

Within an RBridge campus, there will be only a single TRILL BFD
Control session between two RBridges over a given interface visible
to TRILL. This BFD session must be bound to this interface. As
such, both sides of a session MUST take the "Active" role (sending
initial BFD Control packets with a zero value of Your Discriminator),
and any BFD packet from the remote machine with a zero value of Your
Discriminator MUST be associated with the session bound to the remote
system and interface.

Note that TRILL BFD provides OAM facilities for the TRILL Data plane.
This is above whatever protocol is in use on a particular link, such
as a PPP [TrillPPP] link or an Ethernet link. Link technology
specific OAM protocols may be used on a link between neighbor
RBridges, for example Continuity Fault Management [802.1ag] if the
link is Ethernet. But such link layer OAM and coordination between
it and TRILL data plaen layer OAM, such as TRILL BFD, is beyond the
scope of this document.

If lower level mechanisms, such as link aggregation [802.1AX], are in
use that present a single logical interface to TRILL IS-IS, only a
single TRILL BFD session can be established to any other RBridge over

   this logical interface. However, lower layer OAM could be aware of
   and/or run separately on each of the components of an aggregation.

5. Relationship to MPLS OAM

   TRILL BFD uses the TRILL OAM Channel [TRILLoam] is the same way that
   MPLS OAM protocols use the MPLS Generic Associated Channel [RFC5586].
   However, the RBridges that implement TRILL are IS-IS based routers,
   not label switched routers; thus TRILL BFD is closer to IPv4/IPv6 BFD
   than to MPLS BFD.

   TRILL BFD optionally includes support of BFD Echo which is not
   specified for MPLS BFD.

6. TRILL BFD Control Protocol

   TRILL BFD Control frames are unicast TRILL OAM Message Channel frames
   [TRILLoam]. The TRILL OAM Protocol value is given in Section 4.

   The protocol specific data associated with the TRILL BFD Control
   protocol is as shown below. See [RFC5880] for further information on
   these fields.

    TRILL BFD Control Protocol Data:
      +-+
      |Vers | Diag |Sta|P|F|C|A|D|M| Detect Mult | Length |
      +-+
      | My Discriminator |
      +-+
      | Your Discriminator |
      +-+
      | Desired Min TX Interval |
      +-+
      | Required Min RX Interval |
      +-+
      | Required Min Echo RX Interval |
      +-+
    Optional Authentication Section:
      +-+
      | Auth Type | Auth Len | Authentication Data... |
      +-+

7. One-Hop TRILL BFD Control

   One-hop TRILL BFD Control is typically used to rapidly detect link
   and RBridge failures. TRILL BFD frames over one hop for such
   purposes SHOULD be sent with priority 7.

   For neighbor RBridges RB1 and RB2, each RBridge sends one-hop TRILL
   BFD Control frames to the other only if TRILL IS-IS has detected bi-
   directional connectivity and both RBridges indicate support of TRILL
   BFD is enabled. The BFD Enabled TLV is used to indicate this as
   specified in [RFCbfdtlv]. The indication of TRILL BFD support with
   the BFD Enabled TLV overrides any indication of lack of support
   through failure to indicate support of the OAM-Channel TRILL Header
   extended flag.

8. BFD Control Frame Processing

   The following tests SHOULD be performed on received TRILL BFD Control
   frames before generic BFD processing.

   Is the M bit in the TRILL Header non-zero? If so, discard the frame.
   TRILL support of multi-destination BFD Control is beyond the scope of
   this document.

   If the OAM Header MH flag is zero, indicating one-hop, test that the
   TRILL Header hop count received was 0x3F (i.e., is 0x3E if it has
   already been decremented) and if it is any other value discard the
   frame. If the MH OAM flag is one, indicating multi-hop, test that
   the TRILL Header hop count received was not less than a configurable
   value that defaults to 0x30. If it is less, discard the frame.

9. TRILL BFD Echo Protocol

   A TRILL BFD Echo frame is a unicast TRILL OAM Message Channel frame,
   as specified in [TRILLoam], which should be bounced back by an
   immediate neighbor because both the ingress and egress nicknames are
   set to a nickname of the originating RBridge. Normal TRILL Data
   frame forwarding will cause the frame to be returned. The TRILL OAM
   protocol number for BFD Echo is given in Section 4.

   TRILL BFD Echo frames SHOULD only be sent on a link if

   A TRILL BFD Control session has been established,

   TRILL BFD Echo support is indicated by the potentially echo
   responding RBridge, and

The TRILL BFD Echo originating RBridge wishes to make use of this
optional feature.

Since the originating RBridge is the RBridge that will be processing
a returned Echo frame, the entire TRILL BFD Echo protocol specific
data area is considered opaque and left to the discretion of the
originating RBridge. Nevertheless, it is RECOMMENDED that this data
include information by which the originating RBridge can authenticate
the returned BFD Echo frame and confirm the neighbor that echoed the
frame back. For example, it could include its own SystemID, the
neighbor's SystemID, a session identifier and a sequence count as
well as a Message Authentication Code.

9.1. BFD Echo Frame Processing

The following tests SHOULD be performed on returned TRILL BFD Echo
frames before other processing. (In some implementations, the TRILL
Header may not be available to the TRILL BFD Echo module in which
case these check are not possible.)

Is the M bit in the TRILL Header non-zero? If so, discard the frame.
TRILL support of multi-destination BFD Echo is beyond the scope of
this document.

The TRILL BFD Echo frame should have gone exactly two hops so test
that the TRILL Header hop count as received was 0x3E (i.e., 0x3D if
it has already been decremented) and if it is any other value discard
the frame. The TRILL OAM Header in the frame should have the MH bit
equal to one and if it is zero, the frame is discarded.

10. Management and Operations Considerations

The TRILL BFD parameters at an RBridge are configurable... The
default values are ... TBD.

It is required that the operator of an RBridge campus configure the
rates at which TRILL BFD frames are transmitted on a link to avoid
congestion (e.g., link, I/O, CPU) and false failure detection.

11. Security Considerations

This draft raises no new security considerations than those already
mentioned in the BFD [RFC5880]. By keeping a seperate flag for
Single Hop and Multihop sessions it allows the TTL check to be
performed thus preventing spoofing of packets.

   However the same is possible even without the changes mentioned in
   this document. A device should rate limit the LSP ping packets
   redirected to the CPU so that the CPU is not overwhelmed.

12. IANA Considerations

   IANA is request to allocate two TRILL OAM Protocol numbers from the
   range allocated by Standards Actions, as follows:

      Protocol   Number
      --------   ------
      BFD Control TBD (2 suggested)
      BFD Echo   TBD (3 suggested)

13. Acknowledgements

   The authors would like to thank a lot of folks. Names will be
   disclosed soon.

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