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A. Mishra
Ciena Corporation
S. Pallagatti
Juniper Networks
M. Jethanandani
Ciena Corporation
M. Chen
Huawei
A. Saxena
Ciena Corporation

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BFD Stability
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Abstract

This document describes extensions to the Bidirectional Forwarding Detection (BFD) protocol to measure BFD stability. Specifically, it describes a mechanism for detection of BFD frame loss, of delays in frame transmitter and receiver engines, and of inter-frame delays that might explain issues with a BFD session.

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 <xref target="RFC2119">RFC 2119</xref>.

Status of This Memo

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1. Introduction

The Bidirectional Forwarding Detection (BFD) protocol operates by transmitting and receiving control frames, generally at high frequency, over the datapath being monitored. In order to prevent significant data loss due to a datapath failure, the tolerance for lost or delayed frames (the Detection Time as described in RFC 5880) is set to the smallest feasible value. In certain cases, this Detection Time is comparable to the inter-frame delays caused by random network events such as frame drops or frame processing (transmitter or receiver) delays.

This document proposes a mechanism to measure such transient effects to detect instability in in the receive direction of the data path from the session peer in addition to the datapath fault detection mechanisms of BFD. Such a mechanism presents significant value with the ability to measure the stability of BFD sessions and provides data to the operators.

In addition to stability measurement, the information exchanged between BFD peers can be used for rudimentary, but low-overhead, authentication.

2. BFD Null-Authentication TLV

The functionality proposed for BFD stability measurement is achieved by appending the Null-Authentication TLV to the BFD control frame.

The Null-Authentication TLV (called 0-Auth in this document) extends the existing BFD Authentication TLV structure by adding a new Auth-Type of <IANA Assigned>. This TLV carries the Sequence Number for frame loss measurement, and Sender Timestamps for delay measurements.

```
  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
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |   Auth Type   |   Auth Len    |  Auth Key ID  |   Reserved    |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                        Sequence Number                        |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                       Sender Timestamp 1 (IFG only)           |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |                       Sender Timestamp 2 (IFG+TD only)        |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

where:

Auth Type: The Authentication Type, which in this case is <IANA assigned> (Null Authentication).

Auth Len: The length of the Authentication Section, in bytes. For Loss Measurement only, the length is set to 4. For Loss and Inter-Frame Gap measurements, the length is set to 8. For Loss, Inter-Frame Gap and Transmission Delay on sender node, the length is set to 12.

Auth Key ID: The Authentication Key ID in use for this packet. This MUST be set to zero on transmit, and ignored on receipt.

Reserved: This byte MUST be set to zero on transmit, and ignored on receipt.

Sequence Number: This indicates the sequence number for this packet and MUST be present in every 0-Auth TLV. This value is incremented by 1 for every frame transmitted while the session state is UP. A value of 0 indicates a request by sender to reset the sequence number correlation logic at the receiver. The first frame transmitted by the sender MAY set this field to 0.

Inter-Frame Gap (IFG) Mode:

Sender Timestamp 1 (IFG-ST): This is the Inter-Frame Gap Sender Timestamp (IFG-ST) and is added at the last possible instance on the sender (preferably on the PHY). The difference between two such timestamps on consecutive frames is the Inter-Frame gap.

Inter-Frame Gap and Transmission Delay (IFG & TD) Mode:

Sender Timestamp 1 (TD-ST): This is the Transmission Delay Sender Timestamp (TD-ST) and is added at the first possible instance on the sender in the frame transmission engine. The difference between TD-ST and the IFG-ST that follows the TD-ST is the Sender Transmission Delay.

Sender Timestamp 2 (IFG-ST): This is the Inter-Frame Gap Sender Timestamp (IFG-ST) and is added at the last possible instance on the sender (preferably on the PHY). The difference between two such timestamps on consecutive frames is the Inter-Frame gap.

3. Theory of Operations

This mechanism allows operator to read three measures of stability of BFD: Frame Loss, Inter-Frame Gap and Transmission Delay. The Receiver Delay (interval between receipt of a frame on the PHY and the completion of processing in the receiver engine) can be measured using timestamps similar to the Sender Timestamps on the receiver node.

```
+---------+                                        +---------+
| Sender  |===================...=================| Receiver|
+---------+                                        +---------+
    |     |                                        |    |
  TD-ST   |                                        |  RD-RT
        IFG-ST                                  IFG-RT
```

3.1. Frame Loss

This measurement counts the number of BFD control frames missed at the receiver due to a transient change in the network such as congestion. Frame-loss is detected by comparing the Sequence Number field in the 0-Auth TLV in successive BFD CC frames. The Sequence Number in each successive control frame generated on a BFD session by the transmitter is incremented by one.

The first BFD Loss-Delay TLV processed by the receiver that has a non-zero sequence number is used for bootstrapping the logic. Each successive frame after this is expected to have a Sequence Number that is one greater than the Sequence Number in the previous frame.

3.2. Inter-Frame Gap

This measurement is the difference between the IFG-ST on any two consecutive BFD CC frames that carry the 0-Auth TLV (IFG or IFG&TD mode only) for a session. This is a key metric to determine transient changes in stability of BFD transmission engine or to determine the systems capability of handling the existing load. A significant deviation of IFG from the negotiated transmission interval on the local node indicates potential instabilities in the BFD transmission engine. Based on the IFG measurements, the operator MAY take action to configure the system to maintain normal operation of the node.

Similar IFG measurements on the receiver can be made using timestamps (IFG-RT). In conjunction with IFG-ST measurements, these can indicate delays caused by data-path. While a constant delay may not be indicator of instability, large transient delays can decrease the BFD session stability significantly.

3.3. Frame Transmission Delay

This measurement (TD) is the interval between the timestamp (TD-ST) when the frame transmission timer expires, triggering the BFD control frame generation, and the timestamp (IFG-TD) when the frame reaches the last level in the frame processing logic on the transmitter where the frame can be manipulated. Large variations in the TD measurements over time are indicative of non-deterministic transmission behavior of the BFD engine and can be a pre-cursor to BFD engine instability.

Similar measurements for Receiver Delay (RD) can be made using IFG-RT and RD-RT timestamps, and indicate similar instabilities on the BFD receiver engine.

4. IANA Requirements

IANA is requested to assign new Auth-Type for the Null-Authentication TLV for BFD Stability Measurement. The following number is suggested.

Value Meaning

6 Null-Authentication TLV

5. Security Consideration

Since this method uses an authentication TLV to achive the functionality, usage of this TLV will prevent the use of other authentication TLVs.

6. Acknowledgements

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7. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

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

Authors’ Addresses

Ashesh Mishra
Ciena Corporation
3939 North 1st Street
San Jose, CA 95134
USA

Email: mishra.ashesh@gmail.com

Santosh Pallagatti
Juniper Networks
Juniper Networks, Exora Business Park
Bangalore, Karnataka 560103
India

Phone: +
Email: santoshpk@juniper.net

Mahesh Jethanandani
Ciena Corporation
3939 North 1st Street
San Jose, CA 95134
USA

Email: mjethanandani@gmail.com
URI: www.ciena.com

Mach Chen
Huawei

Email: mach.chen@huawei.com

Ankur Saxena
Ciena Corporation
3939 North 1st Street
San Jose, CA 95134
USA

Email: ankurpsaxena@gmail.com