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Unaffiliated BFD Echo Function
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Abstract

Bidirectional Forwarding Detection (BFD) is a fault detection protocol that can quickly determine a communication failure between two forwarding engines. This document proposes a use of the BFD Echo function where the local system supports BFD but the neighboring system does not support BFD.

Status of This Memo

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

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Table of Contents

1. Introduction 2
1.1. Conventions Used in This Document 3
2. Updates to RFC 5880 3
3. Unaffiliated BFD Echo Procedures 6
4. Unaffiliated BFD Echo Applicability 8
5. Security Considerations 8
6. IANA Considerations 8
7. Acknowledgements 8
8. Contributors 9
9. References 9
9.1. Normative References 9
9.2. Informative References 9
Authors' Addresses 10

1. Introduction

To minimize the impact of device/link faults on services and improve network availability, a network device must be able to quickly detect faults in communication with adjacent devices. Measures can then be taken to promptly rectify the faults to ensure service continuity.

BFD [RFC5880] is a low-overhead, short-duration method to detect faults on the communication path between adjacent forwarding engines. The faults can be on interfaces, data link(s), and even the forwarding engines. It is a single, unified mechanism to monitor any media and protocol layers in real time.

BFD defines an Asynchronous mode to satisfy various deployment scenarios. It also supports an Echo function to reduce the device requirement for BFD. When the Echo function is activated, the local system sends BFD Echo packets and the remote system loops back the received Echo packets through the forwarding path. If several consecutive BFD Echo packets are not received by the local system, then the BFD session is declared to be Down.

When using BFD Echo function, there are two typical scenarios as below:

- Full BFD protocol capability with affiliated Echo function: This scenario requires both the local device and the neighboring device to support the full BFD protocol.

- BFD Echo-Only function without full BFD protocol capability: This scenario requires only the local device to support sending and demultiplexing BFD Control packets.

The latter scenario is referred to as Unaffiliated BFD Echo function in this document.

Section 6.2.2 of [BBF-TR-146] describes one use case of the Unaffiliated BFD Echo function, and at least one more use case is known to be deployed.

This document describes the use of the Unaffiliated BFD Echo function over IPv4 and IPv6 for single IP hop.

1.1. Conventions Used in This Document

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. Updates to RFC 5880

The Unaffiliated BFD Echo function described in this document reuses the BFD Echo function as described in [RFC5880] and [RFC5881], but does not require BFD Asynchronous mode. When using the Unaffiliated BFD Echo function, only the local system has the BFD protocol enabled; the remote system just loops back the received BFD Echo packets as regular data packets.

This document updates [RFC5880] with respect to its descriptions on the BFD Echo function as follows.

- The 4th paragraph of Section 3.2 of [RFC5880] is updated as below:

  OLD TEXT

  An adjunct to both modes is the Echo function.

  NEW TEXT

  An adjunct or complement to both modes is the Echo function.

OLD TEXT

Since the Echo function is handling the task of detection, the rate of periodic transmission of Control packets may be reduced (in the case of Asynchronous mode) or eliminated completely (in the case of Demand mode).

NEW TEXT

Since the Echo function is handling the task of detection, the rate of periodic transmission of Control packets may be reduced (in the case of Asynchronous mode) or eliminated completely (in the case of Demand mode). The Echo function may also be used independently, with neither Asynchronous nor Demand mode.

- The 3rd and 9th paragraphs of Section 6.1 of [RFC5880] are updated as below:

OLD TEXT

Once the BFD session is Up, a system can choose to start the Echo function if it desires and the other system signals that it will allow it.

NEW TEXT

When a system is running with Asynchronous mode, once the BFD session is Up, it can choose to start the Echo function if it desires and the other system signals that it will allow it.

OLD TEXT

If the session goes Down, the transmission of Echo packets (if any) ceases, and the transmission of Control packets goes back to the slow rate.

NEW TEXT

In Asynchronous mode, if the session goes Down, the transmission of Echo packets (if any) ceases, and the transmission of Control packets goes back to the slow rate.

- The 2nd paragraph of Section 6.4 of [RFC5880] is updated as below:

OLD TEXT

When a system is using the Echo function, it is advantageous to choose a sedate reception rate for Control packets, since liveness detection is being handled by the Echo packets.

NEW TEXT

When a system is using the Echo function with Asynchronous mode, it is advantageous to choose a sedate reception rate for Control packets, since liveness detection is being handled by the Echo packets.

- The 2nd paragraph of Section 6.8 of [RFC5880] is updated as below:

OLD TEXT

When a system is said to have "the Echo function active" it means that the system is sending BFD Echo packets, implying that the session is Up and the other system has signaled its willingness to loop back Echo packets.

NEW TEXT

When a system in Asynchronous or Demand mode is said to have "the Echo function active" it means that the system is sending BFD Echo packets, implying that the session is Up and the other system has signaled its willingness to loop back Echo packets.

- The 7th paragraph of Section 6.8.3 of [RFC5880] is updated as below:

OLD TEXT

When the Echo function is active, a system SHOULD set bfd.RequiredMinRxInterval to a value of not less than one second (1,000,000 microseconds).

NEW TEXT

When the Echo function is active with Asynchronous mode, a system SHOULD set bfd.RequiredMinRxInterval to a value of not less than one second (1,000,000 microseconds).

- The 1st and 2nd paragraphs of Section 6.8.9 of [RFC5880] are updated as below:

OLD TEXT

BFD Echo packets MUST NOT be transmitted when bfd.SessionState is not Up. BFD Echo packets MUST NOT be transmitted unless the last BFD Control packet received from the remote system contains a nonzero value in Required Min Echo RX Interval.

NEW TEXT

When a system is using the Echo function with either Asynchronous or Demand mode, BFD Echo packets MUST NOT be transmitted when bfd.SessionState is not Up, and BFD Echo packets MUST NOT be transmitted unless the last BFD Control packet received from the remote system contains a nonzero value in Required Min Echo RX Interval.

OLD TEXT

BFD Echo packets MAY be transmitted when bfd.SessionState is Up. The interval between transmitted BFD Echo packets MUST NOT be less than the value advertised by the remote system in Required Min Echo RX Interval...

NEW TEXT

When a system is using the Echo function with either Asynchronous or Demand mode, BFD Echo packets MAY be transmitted when bfd.SessionState is Up, and the interval between transmitted BFD Echo packets MUST NOT be less than the value advertised by the remote system in Required Min Echo RX Interval...

3. Unaffiliated BFD Echo Procedures

As shown in Figure 1, device A supports BFD, whereas device B does not support BFD. Device A would send BFD Echo packets, and after receiving the BFD Echo packets sent from device A, the one-hop-away BFD peer device B immediately loops them back by normal IP forwarding, this allows device A to rapidly detect a connectivity loss to device B. Note that device B would not intercept any received BFD Echo packet or parse any BFD protocol field within the BFD Echo packet.

To rapidly detect any IP forwarding faults between device A and device B, a BFD Echo session MUST be created at device A, and the BFD Echo session is RECOMMENDED to follow the BFD state machine defined in Section 6.2 of [RFC5880], except that the received state is not sent but echoed from the remote system, and AdminDown state is ruled out because AdminDown effectively means removal of BFD Echo session. In this case, although BFD Echo packets are transmitted with destination UDP port 3785 as defined in [RFC5881], the BFD Echo

packets sent by device A are BFD Control packets too, the looped BFD Echo packets back from device B would drive BFD state change at device A, substituting the BFD Control packets sent from the BFD peer. Also note that when device A receives looped BFD Control packets, the validation procedures of [RFC5880] are used.

Once a BFD Echo session is created at device A, it starts sending BFD Echo packets, which SHOULD include a BFD Echo session demultiplexing field, such as BFD "Your Discriminator" defined in [RFC5880] (BFD "My Discriminator" can be set to 0 to avoid confusion), except that device A can use IP source address or UDP source port to demultiplex BFD Echo session, or there is only one BFD Echo session running at device A. Device A would send BFD Echo packets with IP destination address destined for itself, such as the IP address of interface 1 of device A. All BFD Echo packets for the session MUST be sent with a Time to Live (TTL) or Hop Limit value of 255.

"Desired Min TX Interval" and "Required Min RX Interval" defined in [RFC5880] may be populated with one second within the BFD Echo packet, which however has no real application and would be ignored by the receiver.

Considering the BFD peer wouldn't advertise "Required Min Echo RX Interval" as defined in [RFC5880], the transmission interval for sending BFD Echo packets MUST be provisioned at device A, how to make sure the BFD peer is willing and able to loop back BFD Echo packets sent with the provisioned transmission interval is outside the scope of this document. Similar to what's specified in [RFC5880], the BFD Echo session begins with the periodic, slow transmission of BFD Echo packets, the slow transmission rate SHOULD be no less then one second per packet, until the session is Up, after that the provisioned transmission interval is applied, and reverting back to the slow rate once the session goes Down. Considering the BFD peer wouldn't advertise "Detect Mult" as defined in [RFC5880], the "Detect Mult" for calculating the Detection Time MUST be provisioned at device A, the Detection Time in device A is equal to the provisioned "Detect Mult" multiplied by the provisioned transmission interval.

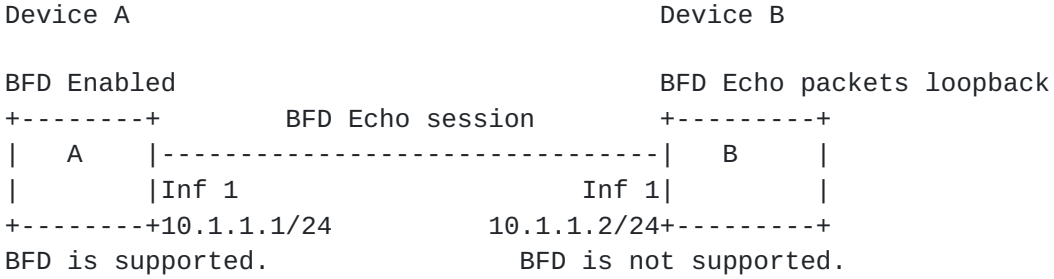

Figure 1: Unaffiliated BFD Echo diagram

4. Unaffiliated BFD Echo Applicability

Some devices that would benefit from the use of BFD may be unable to support the full BFD protocol. Examples of such devices include servers running virtual machines, or Internet of Things (IoT) devices. The Unaffiliated BFD Echo function can be used when two devices are connected and only one of them supports the BFD protocol, and the other is capable of looping BFD Echo packets.

5. Security Considerations

All Security Considerations from [RFC5880] and [RFC5881] apply.

Note that the Unaffiliated BFD Echo function prevents the use of Unicast Reverse Path Forwarding (URPF) [RFC3704] [RFC8704] in strict mode.

As specified in Section 5 of [RFC5880], since BFD Echo packets may be spoofed, some form of authentication SHOULD be included. Considering the BFD Echo packets in this document are also BFD Control packets, the "Authentication Section" as defined in [RFC5880] for BFD Control packet is RECOMMENDED to be included within the BFD Echo packet.

In order to mitigate the potential reflector attack by the remote attackers, or infinite loop of the BFD Echo packets, it's RECOMMENDED to put two requirements on the device looping BFD Echo packets, the first one is that a packet SHOULD NOT be looped unless it has a TTL or Hop Limit value of 255, and the second one is that a packet being looped MUST NOT reset the TTL or Hop Limit value to 255, and MUST use a TTL or Hop Limit value of 254.

6. IANA Considerations

This document has no IANA action requested.

7. Acknowledgements

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9. References

9.1. 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>.

[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>.

[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>.

9.2. Informative References

[BBF-TR-146] Broadband Forum, "BBF Technical Report - Subscriber Sessions Issue 1", 2013, <https://www.broadband-forum.org/technical/download/TR-146.pdf>.

[RFC3704] Baker, F. and P. Savola, "Ingress Filtering for Multihomed Networks", BCP 84, RFC 3704, DOI 10.17487/RFC3704, March 2004, <https://www.rfc-editor.org/info/rfc3704>.

[RFC8704] Sriram, K., Montgomery, D., and J. Haas, "Enhanced Feasible-Path Unicast Reverse Path Forwarding", BCP 84, RFC 8704, DOI 10.17487/RFC8704, February 2020, <https://www.rfc-editor.org/info/rfc8704>.

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