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Unsolicited BFD for Sessionless Applications

Abstract

For operational simplification of "sessionless" applications using Bidirectional Forwarding Detection (BFD), in this document we present procedures for "unsolicited BFD" that allow a BFD session to be initiated by only one side, and established without explicit per-session configuration or registration by the other side (subject to certain per-interface or global policies).

We also introduce a new YANG module to configure and manage "unsolicited BFD". The YANG module in this document is based on YANG 1.1 as defined in RFC 7950 and conforms to the Network Management Datastore Architecture (NMDA) as described in RFC 8342. This document updates RFC 9314.

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 BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

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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This Internet-Draft will expire on 13 September 2023.

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1. Introduction

The current implementation and deployment practice for BFD ([RFC5880] and [RFC5881]) usually requires BFD sessions be explicitly configured or registered on both sides. This requirement is not an issue when an application like BGP [RFC4271] has the concept of a "session" that involves both sides for its establishment. However, this requirement can be operationally challenging when the prerequisite "session" does not naturally exist between two endpoints in an application. Simultaneous configuration and coordination may be required on both sides for BFD to take effect. For example:

* When BFD is used to keep track of the "liveness" of the nexthop of static routes. Although only one side may need the BFD

functionality, currently both sides need to be involved in specific configuration and coordination and in some cases static routes are created unnecessarily just for BFD.

*When BFD is used to keep track of the "liveness" of the third-pary nexthop of BGP routes received from the Route Server [RFC7947] at an Internet Exchange Point (IXP). As the third-party nexthop is different from the peering address of the Route Server, for BFD to work, currently two routers peering with the Route Server need to have routes and nexthops from each other (although indirectly via the Route Server).

Clearly it is beneficial and desirable to reduce or eliminate unnecessary configurations and coordination in these "sessionless" applications using BFD.

In this document we present procedures for "unsolicited BFD" that allow a BFD session to be initiated by only one side, and established without explicit per-session configuration or registration by the other side (subject to certain per-interface or global policies).

Unsolicited BFD impacts only the initiation of BFD sessions. There is no change to all the other procedures specified in [RFC5880] such as, but not limited to, the Echo function and Demand mode.

With "unsolicited BFD" there is potential risk for excessive resource usage by BFD from "unexpected" remote systems. To mitigate such risks, several mechanisms are recommended in the Security Considerations section.

The procedure described in this document could be applied to BFD for Multihop paths [RFC5883]. However, because of security risks, this document applies only to BFD for single IP hops [RFC5881].

Compared to the "Seamless BFD" [RFC7880], this proposal involves only minor procedural enhancements to the widely deployed BFD itself. Thus we believe that this proposal is inherently simpler in the protocol itself and deployment. As an example, it does not require the exchange of BFD discriminators over an out-of-band channel before BFD session bring-up.

When BGP Add-Path [RFC7911] is deployed at an IXP using a Route Server, multiple BGP paths (when they exist) can be made available to the clients of the Route Server as described in [RFC7947]. The "unsolicited BFD" can be used in BGP route selection by these clients to eliminate paths with "inaccessible nexthops".

2. Procedures for Unsolicited BFD

With "unsolicited BFD", one side takes the "Active role" and the other side takes only the "Passive role" as described in [RFC5880], section 6.1.

Passive unsolicited BFD support MUST be disabled by default, and MUST require explicit configuration to be enabled. On the passive side, the following BFD parameters, from [RFC5880] section 6.8.1 SHOULD be configurable:

- *bfd.DesiredMinTxInterval
- *bfd.RequiredMinRxInterval
- *bfd.DetectMult

The passive side MAY also choose to use the values of the parameters above that the active side uses in its BFD Control packets. However, the bfd.LocalDiscr value MUST be selected by the passive side to allow multiple unsolicited BFD sessions.

The active side starts sending the BFD Control packets as specified in [RFC5880]. The passive side does not send BFD Control packets initially, it sends BFD Control packets only after it has received BFD Control packets from the active side.

When the passive side receives a BFD Control packet from the active side with 0 as "Your Discriminator" and does not find an existing BFD session, the passive side MAY create a matching BFD session toward the active side, if permitted by local configuration and policy.

When the passive side receives an incoming BFD Control packet on a numbered interfaces, the source address of that packet MUST belong to the subnet of the interface on which the BFD packet is received. The source address of the BFD Control packet MUST be compared against expected routing protocol peer addresses on that interface. If the source address does not match any expected address, the BFD control packet MUST NOT be processed. The mechanism to obtain the expected addresses is outsde the scope of this document: e.g., they may be configured or dynamically learnt.

The passive side MUST then start sending BFD Control packets and perform the necessary procedure for bringing up, maintaining and tearing down the BFD session. If the BFD session fails to get established within a certain amount of time (which is implementation specific but has to be at least equal to the local failure detection time), or if an established BFD session goes down, the passive side MUST stop sending BFD Control packets and SHOULD delete the BFD session created until BFD Control packets are initiated by the active side again.

When an Unsolicited BFD session goes down, an implementation MAY retain the session state for a period of time. Retaining this state can be useful for operational purposes.

3. State Variables

This document defines a new state variable called Role.

bfd.Role

The role of the local system during BFD session initialization, as per [RFC5880], section 6.1. Possible values are Active or Passive.

4. YANG Data Model

This section extends the YANG data model for BFD [RFC9314] to cover unsolicited BFD. The new module imports [RFC8349] since the "bfd" container in [RFC9314] is under "control-plane-protocol". The YANG module in this document conforms to the Network Management Datastore Architecture (NMDA) [RFC8342].

4.1. Unsolicited BFD Hierarchy

Configuration for unsolicited BFD parameters for IP single-hop sessions can be done at 2 levels:

* Globally, i.e. for all interfaces. This requires support for the "unsolicited-params-global" feature.
* For specific interfaces. This requires support for the "unsolicited-params-per-interface" feature.

If configuration exists at both levels, per-interface configuration takes precedence over global configuration.

For operational data, a new "unsolicited" container has been added for BFD IP single-hop sessions.

The tree diagram below uses the graphical representation of data models, as defined in [RFC8340].

```
module: ietf-bfd-unsolicited

  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/bfd:bfd/bfd-ip-sh:ip-sh:
    +--rw unsolicited {bfd-unsol:unsolicited-params-global}?
       +--rw enabled?                          boolean
       +--rw local-multiplier?                 multiplier
       +--rw (interval-config-type)?
          +--:(tx-rx-intervals)
          |  +--rw desired-min-tx-interval?    uint32
          |  +--rw required-min-rx-interval?   uint32
          +--:(single-interval) {single-minimum-interval}?
             +--rw min-interval?              uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/bfd:bfd/bfd-ip-sh:ip-sh
          /bfd-ip-sh:interfaces:
    +--rw unsolicited {bfd-unsol:unsolicited-params-per-interface}?
       +--rw enabled?                          boolean
       +--rw local-multiplier?                 bfd-types:multiplier
       +--rw (interval-config-type)?
          +--:(tx-rx-intervals)
          |  +--rw desired-min-tx-interval?    uint32
          |  +--rw required-min-rx-interval?   uint32
          +--:(single-interval) {bfd-types:single-minimum-interval}?
             +--rw min-interval?              uint32
  augment /rt:routing/rt:control-plane-protocols
          /rt:control-plane-protocol/bfd:bfd/bfd-ip-sh:ip-sh
          /bfd-ip-sh:sessions/bfd-ip-sh:session:
    +--ro role?   bfd-unsol:role
```

4.2. Unsolicited BFD Module

```
<CODE BEGINS> file "ietf-bfd-unsolicited@2023-03-12.yang"

module ietf-bfd-unsolicited {

  yang-version 1.1;

  namespace "urn:ietf:params:xml:ns:yang:ietf-bfd-unsolicited";

  prefix "bfd-unsol";

  // RFC Ed.: replace occurences of YYYY with actual RFC numbers
  // and remove this note

  import ietf-bfd-types {
    prefix "bfd-types";
    reference
      "RFC 9314: YANG Data Model for Bidirectional Forwarding
       Detection (BFD)";
  }

  import ietf-bfd {
    prefix "bfd";
    reference
      "RFC 9314: YANG Data Model for Bidirectional Forwarding
       Detection (BFD)";
  }

  import ietf-bfd-ip-sh {
    prefix "bfd-ip-sh";
    reference
      "RFC 9314: YANG Data Model for Bidirectional Forwarding
       Detection (BFD)";
  }

  import ietf-routing {
    prefix "rt";
    reference
      "RFC 8349: A YANG Data Model for Routing Management
       (NMDA version)";
  }

  organization "IETF BFD Working Group";

  contact
    "WG Web:   <https://datatracker.ietf.org/wg/bfd/>
     WG List:  <rtg-bfd@ietf.org>

     Editors:  Enke Chen (enchen@paloaltonetworks.com),
               Naiming Shen (naiming@zededa.com),
               Robert Raszuk (robert@raszuk.net),
```

```
              Reshad Rahman (reshad@yahoo.com)";

  description
    "This module contains the YANG definition for BFD unsolicited
     as per RFC YYYY.

     Copyright (c) 2023 IETF Trust and the persons
     identified as authors of the code.  All rights reserved.

     Redistribution and use in source and binary forms, with or
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     (http://trustee.ietf.org/license-info).

     This version of this YANG module is part of RFC YYYY; see
     the RFC itself for full legal notices.";

  reference "RFC YYYY";

  revision 2023-03-12 {
    description
      "Initial revision.";
    reference
      "RFC YYYY: Unsolicited BFD for Sessionless Applications.";
  }

  /*
   * Feature definitions
   */
  feature unsolicited-params-global {
    description
      "This feature indicates that the server supports global
       parameters for unsolicited sessions.";
    reference
      "RFC YYYY: Unsolicited BFD for Sessionless Applications.";
  }

  feature unsolicited-params-per-interface {
    description
      "This feature indicates that the server supports per-interface
       parameters for unsolicited sessions.";
    reference
      "RFC YYYY: Unsolicited BFD for Sessionless Applications.";
  }

  /*
   * Type Definitions
   */
```

```
typedef role {
  type enumeration {
    enum active {
      description "Active role";
    }
    enum passive {
      description "Passive role";
    }
  }
  description
    "Role of local system during BFD session initialization.";
  reference
    "RFC5880: Bidirectional Forwarding Detection (BFD),
     Section 6.1";
}

/*
 * Augments
 */
 augment "/rt:routing/rt:control-plane-protocols/"
       + "rt:control-plane-protocol/bfd:bfd/bfd-ip-sh:ip-sh" {
   if-feature bfd-unsol:unsolicited-params-global;
   description
     "Augmentation for BFD unsolicited parameters";
   container unsolicited {
     description
       "BFD IP single-hop unsolicited top level container";
     leaf enabled {
       type boolean;
       default false;
       description
         "BFD unsolicited enabled globally for IP single-hop.";
     }
     uses bfd-types:base-cfg-parms;
   }
 }

 augment "/rt:routing/rt:control-plane-protocols/"
       + "rt:control-plane-protocol/bfd:bfd/bfd-ip-sh:ip-sh/"
       + "bfd-ip-sh:interfaces" {
   if-feature bfd-unsol:unsolicited-params-per-interface;
   description
     "Augmentation for BFD unsolicited on IP single-hop interface";
   container unsolicited {
     description
       "BFD IP single-hop interface unsolicited top level
        container";
     leaf enabled {
       type boolean;
```

```
  default false;
  description
    "BFD unsolicited enabled on this interface.";
}
/*
 * The following is the same as bfd-types:base-cfg-parms, but
 * without default values (for inheritance)
 */
leaf local-multiplier {
  type bfd-types:multiplier;
  description
    "Multiplier transmitted by the local system. Defaults to
     ../../unsolicited/local-multiplier.";
}
must "local-multiplier or ../../unsolicited/local-multiplier" {
  error-message
    "The local-multiplier must be specified either under the inte
     or globally.";
}

choice interval-config-type {
  description
    "Two interval values or one value used for both transmit and
     receive. Defaults to ../../unsolicited/interval-config-type.
  case tx-rx-intervals {
    leaf desired-min-tx-interval {
      type uint32;
      units "microseconds";
      description
        "Desired minimum transmit interval of control packets.";
    }
    leaf required-min-rx-interval {
      type uint32;
      units "microseconds";
      description
        "Required minimum receive interval of control packets.";
    }
  }
  case single-interval {
    if-feature "bfd-types:single-minimum-interval";
    leaf min-interval {
      type uint32;
      units "microseconds";
      description
        "Desired minimum transmit interval and required
         minimum receive interval of control packets.";
    }
  }
}
```

```
      must "(min-interval or ../../unsolicited/min-interval) or
            (desired-min-tx-interval and required-min-rx-interval) or
            (../../unsolicited/desired-min-tx-interval and
             ../../unsolicited/required-min-rx-interval)" {
        error-message
          "The interval(s) must be specified either under the interface
           or globally.";
      }
    }
  }

  augment "/rt:routing/rt:control-plane-protocols/"
        + "rt:control-plane-protocol/bfd:bfd/bfd-ip-sh:ip-sh/"
        + "bfd-ip-sh:sessions/bfd-ip-sh:session" {
    description
      "Augmentation for BFD unsolicited on IP single-hop session";
      leaf role {
        type bfd-unsol:role;
        config false;
        description "Role.";
      }
  }
}

<CODE ENDS>
```

4.3. Data Model Example

This section shows an example on how to configure the passive end of unsolicited BFD:

* We have global BFD IP single-hop unsolicited configuration with a local-multiplier of 2 and min-interval at 50ms
* BFD IP single-hop unsolicited is enabled on interface eth0, with a local-multiplier of 3 and min-interval at 250 ms
* BFD IP single-hop unsolicited is enabled on interface eth1. Since there is no parameter configuration for eth1, it inherits from the global configuration.

```
<?xml version="1.0" encoding="UTF-8"?>
<config xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
<interfaces xmlns="urn:ietf:params:xml:ns:yang:ietf-interfaces">
  <interface>
    <name>eth0</name>
    <type
        xmlns:ianaift="urn:ietf:params:xml:ns:yang:iana-if-type">ianaift
  </interface>
  <interface>
    <name>eth1</name>
    <type
        xmlns:ianaift="urn:ietf:params:xml:ns:yang:iana-if-type">ianaift
  </interface>
</interfaces>
<routing xmlns="urn:ietf:params:xml:ns:yang:ietf-routing">
  <control-plane-protocols>
    <control-plane-protocol>
      <type
          xmlns:bfd-types="urn:ietf:params:xml:ns:yang:ietf-bfd-types">b
      <name>name:BFD</name>
      <bfd xmlns="urn:ietf:params:xml:ns:yang:ietf-bfd">
        <ip-sh xmlns="urn:ietf:params:xml:ns:yang:ietf-bfd-ip-sh">
          <unsolicited>
            <enabled>true</enabled>
            <local-multiplier>2</local-multiplier>
            <min-interval>50000</min-interval>
          </unsolicited>
          <interfaces>
              <interface>eth0</interface>
              <unsolicited>
                <enabled>true</enabled>
                <local-multiplier>3</local-multiplier>
                <min-interval>250000</min-interval>
              </unsolicited>
          </interfaces>
          <interfaces>
              <interface>eth1</interface>
              <unsolicited>
                <enabled>true</enabled>
              </unsolicited>
          </interfaces>
        </ip-sh>
      </bfd>
    </control-plane-protocol>
  </control-plane-protocols>
</routing>
</config>
```

5. IANA Considerations

This document registers the following namespace URI in the "IETF XML Registry" [RFC3688]:

URI: urn:ietf:params:xml:ns:yang:ietf-bfd-unsolicited

Registrant Contact: The IESG.

XML: N/A; the requested URI is an XML namespace.

This document registers the following YANG module in the "YANG Module Names" registry [RFC6020]:

Name: ietf-bfd-unsolicited

Namespace: urn:ietf:params:xml:ns:yang:ietf-bfd-unsolicited

Prefix: bfd-unsol

Reference: RFC YYYY

6. Acknowledgments

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7. Security Considerations

7.1. BFD Protocol Security Considerations

The same security considerations and protection measures as those described in [RFC5880] and [RFC5881] apply to this document. In addition, with "unsolicited BFD" there is potential risk for excessive resource usage by BFD from "unexpected" remote systems. To mitigate such risks, implementations of unsolicited BFD MUST:

* Limit the feature to specific interfaces, and to single-hop BFD with "TTL=255" [RFC5082].
* Apply "policy" to process BFD packets only from certain subnets or hosts.
* Deploy the feature only in certain "trustworthy" environment, e.g., at an IXP, or between a provider and its customers.
* Use BFD authentication, see [RFC5880]. In some environments, e.g. when using an IXP, BFD authentication can not be used because of the lack of coordination into the operation of the two endpoints of the BFD session. In other environments, e.g. when BFD is used to track the next hop of static routes, it is possible to use BFD

authentication: this comes with the extra cost of configuring matching key-chains at the two endpoints. If BFD authentication is used, the Meticulous Keyed SHA1 mechanism SHOULD be used.

7.2. YANG Module Security Considerations

The YANG module specified in this document defines a schema for data that is designed to be accessed via network management protocols such as NETCONF [RFC6241] or RESTCONF [RFC8040]. The lowest NETCONF layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) [RFC6242]. The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS [RFC8446].

The NETCONF access control model [RFC8341] provides the means to restrict access for particular NETCONF or RESTCONF users to a preconfigured subset of all available NETCONF or RESTCONF protocol operations and content.

There are a number of data nodes defined in this YANG module that are writable/creatable/deletable (i.e., config true, which is the default). These data nodes may be considered sensitive or vulnerable in some network environments. Write operations (e.g., edit-config) to these data nodes without proper protection can have a negative effect on network operations. These are the subtrees and data nodes and their sensitivity/vulnerability:

/routing/control-plane-protocols/control-plane-protocol/bfd/ip-sh / unsolicited:

- *data node "enabled" enables creation of unsolicited BFD IP single-hop sessions globally, i.e. on all interfaces. See Section 7.1.
- *data nodes local-multiplier, desired-min-tx-interval, required-min-rx-interval and min-interval all impact the parameters of the unsolicited BFD IP single-hop sessions.

/routing/control-plane-protocols/control-plane-protocol/bfd/ip-sh / interfaces/interface/unsolicited:

- *data node "enabled" enables creation of unsolicited BFD IP single-hop sessions on a specific interface. See Section 7.1.
- *data nodes local-multiplier, desired-min-tx-interval, required-min-rx-interval and min-interval all impact the parameters of the unsolicited BFD IP single-hop sessions on the interface.

Some of the readable data nodes in this YANG module may be considered sensitive or vulnerable in some network environments. It is thus important to control read access (e.g., via get, get-config,

or notification) to these data nodes. These are the subtrees and data nodes and their sensitivity/vulnerability:

/routing/control-plane-protocols/control-plane-protocol/bfd/ip-sh / sessions/session/role: access to this information discloses the role of the local system in the creation of the unsolicited BFD session.

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