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RFC 9468
Unsolicited Bidirectional Forwarding Detection (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 augments RFC 9314.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at https://www.rfc-editor.org/info/rfc9468.

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1. Introduction

The current implementation and deployment practice for BFD ([RFC5880] and [RFC5881]) usually requires that 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 next hop 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-party next hop of BGP routes received from the Route Server [RFC7947] at an Internet Exchange Point (IXP). As the third-party next hop 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 next hops 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]. Unsolicited BFD can be used by BGP route selection's route resolvability condition (Section 9.1.2.1 of [RFC4271]) to exclude routes where the NEXT_HOP is not reachable using the procedures specified in 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 BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

2. Procedures for Unsolicited BFD

With "unsolicited BFD", one side takes the "Active role" and the other side takes 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 listed 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 **SHOULD** create a matching BFD session toward the active side, unless not permitted by local configuration or policy.

When the passive side receives an incoming BFD Control packet on a numbered interface, the source address of that packet **MUST** belong to the subnet of the interface on which the BFD packet is received, else the BFD Control packet **MUST NOT** be processed.

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

This is 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 the YANG modules described in [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
- 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 "role" leaf node 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?
       +--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
       +--rw enabled?                         boolean
       +--rw local-multiplier?
            bfd-types:multiplier
             {bfd-unsol:unsolicited-params-per-interface}?
       +--rw (interval-config-type)?
               {bfd-unsol:unsolicited-params-per-interface}?
          +--:(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@2023-08-31.yang"

module ietf-bfd-unsolicited {

  yang-version 1.1;

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

  prefix bfd-unsol;

  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>

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               Naiming Shen (naiming@zededa.com),
               Robert Raszuk (robert@raszuk.net),
               Reshad Rahman (reshad@yahoo.com)";

  description
    "This module contains the YANG definition for unsolicited BFD,
     as per RFC 9468.

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     This version of this YANG module is part of RFC 9468; see
     the RFC itself for full legal notices.";

  reference
    "RFC 9468: Unsolicited Bidirectional Forwarding Detection
     (BFD) for Sessionless Applications";

  revision 2023-08-31 {
    description
      "Initial revision.";
    reference
      "RFC 9468: Unsolicited Bidirectional Forwarding Detection (BFD)
       for Sessionless Applications";
  }
```

```
  /*
   * Feature definitions
   */
  feature unsolicited-params-per-interface {
    description
      "This feature indicates that the server supports per-interface
       parameters for unsolicited sessions.";
    reference
      "RFC 9468: Unsolicited Bidirectional Forwarding Detection (BFD)
       for Sessionless Applications";
  }

  /*
   * Type Definitions
   */

  identity role {
    description
      "Base identity from which all roles are derived.
       Role of local system during BFD session initialization.";
  }

  identity active {
    base bfd-unsol:role;
    description
      "Active role.";
    reference
      "RFC 5880: Bidirectional Forwarding Detection (BFD),
       Section 6.1";
  }

  identity passive {
    base bfd-unsol:role;
    description
      "Passive role.";
    reference
      "RFC 5880: 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" {
    description
      "Augmentation for unsolicited BFD parameters.";
    container unsolicited {
      description
        "BFD IP single-hop unsolicited top-level container.";
      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" {
    description
      "Augmentation for unsolicited BFD on IP single-hop
       interface.";
    container unsolicited {
      description
        "BFD IP single-hop interface unsolicited top-level
         container.";
      leaf enabled {
        type boolean;
        default "false";
        description
          "Unsolicited BFD is enabled on this interface.";
      }
      /*
       * The following is the same as bfd-types:base-cfg-parms, but
       * without default values (for inheritance)
       */
      leaf local-multiplier {
        if-feature "bfd-unsol:unsolicited-params-per-interface";
        type bfd-types:multiplier;
        description
          "Multiplier transmitted by the local system.  Defaults to
           ../../unsolicited/local-multiplier.
           A multiplier configured under an interface takes
           precedence over the multiplier configured at the global
           level.";
      }
      choice interval-config-type {
        if-feature "bfd-unsol:unsolicited-params-per-interface";
        description
          "Two interval values or one value used for both transmit
           and receive.  Defaults to
           ../../unsolicited/interval-config-type.  An interval
           configured under an interface takes precedence over any
           interval configured at the global level.";
        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.";
          }
        }
      }
    }
  }

  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 unsolicited BFD on IP single-hop session.";
    leaf role {
      type identityref {
        base 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 50 ms.
- 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:ethernetCsmacd</type>
  </interface>
  <interface>
    <name>eth1</name>
    <type
        xmlns:ianaift="urn:ietf:params:xml:ns:yang:iana-if-type">
         ianaift:ethernetCsmacd</type>
  </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">
          bfd-types:bfdv1</type>
       <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>
             <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

IANA has registered the following namespace URI in the "ns" subregistry within 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.

IANA has registered the following YANG module in the "YANG Module Names" registry [RFC6020]:

Name: ietf-bfd-unsolicited
Maintained by IANA: N
Namespace: urn:ietf:params:xml:ns:yang:ietf-bfd-unsolicited
Prefix: bfd-unsol
Reference: RFC 9468

6. Security Considerations

6.1. 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 sessions using the procedures from [RFC5082]. See Section 5 of [RFC5881] for the details of these procedures.
- Apply policy to process BFD packets only from certain subnets or hosts.
- Deploy the feature only in an environment that does not offer anonymous participation. Examples include an IXP, where the IXP operator will have a business relationship with all IXP participants, or between a provider and its customers.

6.2. BFD Protocol Authentication Considerations

Implementations of unsolicited BFD are **RECOMMENDED** to use BFD authentication; see [RFC5880]. If BFD authentication is used, the strongest BFD authentication mechanism that is supported **MUST** be used.

In some environments, such as IXPs, BFD authentication cannot be used because of the lack of coordination for the operation of the two endpoints of the BFD session.

In other environments, such as 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 between the two endpoints.

6.3. 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 Network Configuration Access Control Mode (NACM) [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 6.1.
- 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. Write operations to these nodes change the rates of BFD packet generation and detection time of the failures of a BFD session.

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

- Data node "enabled" enables the creation of unsolicited BFD IP single-hop sessions on a specific interface. See Section 6.1.
- 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.

7. References

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