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## **YANG Data Model for Bidirectional Forwarding Detection (BFD) Hardware Offloaded Session**

### **Abstract**

This document defines a extension YANG data model that can be used to manage Hardware Offloaded Bidirectional Forwarding Detection (BFD).

This document specially talks about BFD sessions that are offloaded to hardware.

The YANG modules in this document conform to the Network Management Datastore Architecture (NMDA).

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## 1. Introduction

This document defines an extension YANG data model to base model [[RFC9314](#)] that can be used to manage BFD sessions that are offloaded to hardware. BFD is a network protocol which is used for liveness detection of arbitrary paths between systems.

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

### 1.2. Tree Diagrams

This document uses the graphical representation of data models defined in [[RFC8340](#)].

## 2. Design of the Data Model

This yang model which is extension to base BFD yang mode been designed to manage BFD HW offloaded sessions. This new "bfd"

container is augmented by all the YANG modules for their respective specific information:

1. `ietf-bfd-ip-sh-ext.yang` augments `"/routing/control-plane-protocols/control-plane-protocol/bfd/ip-sh/sessions/session"` with the `"session-offloaded"` leaf for BFD sessions over IP single-hop extension.
2. `ietf-bfd-ip-mh-ext.yang` augments `"/routing/control-plane-protocols/control-plane-protocol/bfd/ip-mh/sessions-groups/session-group"` with the `"session-offloaded"` leaf for BFD sessions over IP multi-hop extension.
3. `ietf-bfd-lag-ext.yang` augments `"/routing/control-plane-protocols/control-plane-protocol/bfd/bfd-lag/sessions/session"` with the `"ession-offloaded"` leaf for BFD sessions over LAG extension.

### 3. BFD IP single-hop-ext hierarchy

An `"ip-sh-ext"` node is added under `"bfd"` node in `control-plane-protocol`. The operational state data for each BFD IP single-hop session is under this `"ip-sh-ext"` node.

```
module: ietf-bfd-ip-sh-ext
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:
+--rw ip-sh-ext
  +--ro session-running-ext
  +--ro session-offloaded?   boolean
```

### 4. BFD IP multi-hop-ext hierarchy

An `"ip-mh-ext"` node is added under `"bfd"` node in `control-plane-protocol`. The operational state data for each BFD IP multi-hop session is under this `"ip-mh-ext"` node.

```
module: ietf-bfd-ip-mh-ext
augment /rt:routing/rt:control-plane-protocols
  /rt:control-plane-protocol/bfd:bfd/bfd-ip-mh:ip-mh
  /bfd-ip-mh:session-groups/bfd-ip-mh:session-group:
  +rw session-offloaded?   boolean
```

## 5. BFD Over LAG-ext hierarchy

An "lag-ext" node is added under "bfd" node in control-plane-protocol. The operational state data for each BFD Over LAG session is under this "lag-ext" node.

```
module: ietf-bfd-lag-ext
augment /rt:routing/rt:control-plane-protocols
    /rt:control-plane-protocol/bfd:bfd/bfd-lag:lag
    /bfd-lag:sessions/bfd-lag:session:
        +rw session-offloaded?    boolean
```

## 6. BFD IP single-hop ext YANG Module

This YANG module imports "ietf-bfd-ip-sh" from RFC9314 and augments.

```
<CODE BEGINS> file "ietf-bfd-ip-sh-ext@2022-02-22.yang"
```

```
module ietf-bfd-ip-sh-ext {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-bfd-ip-sh-ext";

  prefix "bfd-ip-sh-ext";

  import ietf-bfd {
    prefix "bfd";
    reference
      "RFC 9314: A 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)";
  }

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

  organization "IETF BFD Working Group";
  contact
    "WG Web: <http://tools.ietf.org/wg/bfd>
    WG List: <rtg-bfd@ietf.org>

    Editors: Rajaguru Veluchamy (rvelucha@cisco.com)";

  description
    "This module contains the YANG definition for BFD IP single-hop
    as per RFC 5881 with some extended info.

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```

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reference

"RFC 5881: Bidirectional Forwarding Detection (BFD)  
for IPv4 and IPv6 (Single Hop)  
RFC 9314: YANG Data Model for Bidirectional Forwarding  
Detection (BFD)";

revision 2022-02-18 {

description "Initial revision.";

reference

"RFC XXXX: A YANG data model for BFD IP single-hop extension";

}

/\*

\* Augments

\*/

augment "/rt:routing/rt:control-plane-protocols/"

+ "rt:control-plane-protocol/bfd/bfd-ip-sh:ip-sh/"

+ "bfd-ip-sh:sessions/bfd-ip-sh:session" {

description "BFD augmentation for IP single-hop-ext";

leaf session-offloaded {

type boolean;

description

"Indicates whether BFD session is running in hardware";

}

}

}

<CODE ENDS>

## 7. BFD IP multi-hop ext YANG Module

This YANG module imports "ietf-bfd-ip-mh" from RFC9314 and augments.

<CODE BEGINS> file "ietf-bfd-ip-mh-ext@2022-02-22.yang"

```
module ietf-bfd-ip-mh-ext {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-bfd-ip-mh-ext";
  prefix "bfd-ip-mh-ext";

  import ietf-bfd {
    prefix "bfd";
    reference
      "RFC 9314: A 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)";
  }

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

  organization "IETF BFD Working Group";
  contact
    "WG Web: <http://tools.ietf.org/wg/bfd>
    WG List: <rtg-bfd@ietf.org>

    Editors: Rajaguru Veluchamy (rvelucha@cisco.com)";

  description
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```



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reference

"RFC 5881: Bidirectional Forwarding Detection (BFD)  
for IPv4 and IPv6 (Single Hop)  
RFC 9314: YANG Data Model for Bidirectional Forwarding  
Detection (BFD)";

revision 2022-02-18 {

description "Initial revision.";

reference

"RFC XXXX: A YANG data model for BFD IP single-hop extension";

}

/\*

\* Augments

\*/

augment "/rt:routing/rt:control-plane-protocols/"

+ "rt:control-plane-protocol/bfd:bfd/bfd-ip-mh:ip-mh/"

+ "bfd-ip-mh:session-groups/bfd-ip-mh:session-group" {

description "BFD augmentation for IP multi-hop-ext";

leaf session-offloaded {

type boolean;

description

"Indicates whether BFD session is running in hardware";

}

}

}

<CODE ENDS>

## **8. BFD Over LAG ext YANG Module**

This YANG module imports "ietf-bfd-lag" from RFC9314 and augments.

```
<CODE BEGINS> file "ietf-bfd-lag-ext@2022-02-22.yang"
```

```
module ietf-bfd-lag-ext {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-bfd-lag-ext";
  prefix "bfd-lag-ext";

  import ietf-bfd {
    prefix "bfd";
    reference
      "RFC 9314: A 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)";
  }

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

  organization "IETF BFD Working Group";
  contact
    "WG Web: <http://tools.ietf.org/wg/bfd>
    WG List: <rtg-bfd@ietf.org>

    Editors: Rajaguru Veluchamy (rvelucha@cisco.com)";

  description
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    the RFC itself for full legal notices.";
```

```

reference
  "RFC 5881: Bidirectional Forwarding Detection (BFD)
  for IPv4 and IPv6 (Single Hop)
  RFC 9314: YANG Data Model for Bidirectional Forwarding
  Detection (BFD)";

revision 2022-02-18 {
  description "Initial revision.";
  reference
    "RFC XXXX: A YANG data model for BFD IP single-hop extension";
}

/*
 * Augments
 */
augment "/rt:routing/rt:control-plane-protocols/"
  + "rt:control-plane-protocol/bfd:bfd/bfd-lag:lag/"
  + "bfd-lag:sessions/bfd-lag:session" {
  description "BFD augmentation for LAG ext";
  leaf session-offloaded {
    type boolean;
    description
      "Indicates whether BFD session is running in hardware";
  }
}
}
}

```

<CODE ENDS>

## 9. Security Considerations

Security considerations defined in [RFC9314] apply here too .

## 10. IANA Considerations

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

**URI:** urn:ietf:params:xml:ns:yang:ietf-bfd-ip-sh-ext

**Registrant Contact:** The IESG.

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

**URI:** urn:ietf:params:xml:ns:yang:ietf-bfd-ip-mh-ext

**Registrant Contact:** The IESG.

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

**URI:** urn:ietf:params:xml:ns:yang:ietf-bfd-lag-ext

**Registrant Contact:** The IESG.

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

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

**Name:** ietf-bfd-ip-sh-ext

**Namespace:** urn:ietf:params:xml:ns:yang:ietf-bfd-ip-sh-ext

**Prefix:** bfd-ip-sh

**Reference:** RFC 9314

**Name:** ietf-bfd-ip-mh-ext

**Namespace:** urn:ietf:params:xml:ns:yang:ietf-bfd-ip-mh-ext

**Prefix:** bfd-ip-mh

**Reference:** RFC 9314

**Name:** ietf-bfd-lag

**Namespace:** urn:ietf:params:xml:ns:yang:ietf-bfd-lag

**Prefix:** bfd-lag

**Reference:** RFC 9314

## 11. Acknowledgements

I would like to thank Vengada Prasad Govindan for his support and guidance on this work.

## 12. Normative References

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## Appendix A. Change log

RFC Editor: Remove this section upon publication as an RFC.

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