

Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: December 6, 2014

T. Nadeau
Brocade
Z. Ali
N. Akiya
Cisco Systems
June 4, 2014

BFD Management Information Base
draft-ietf-bfd-mib-22

Abstract

This draft defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects for modeling Bidirectional Forwarding Detection (BFD) protocol.

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, RFC 2119 [RFC2119].

Status of This Memo

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

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on December 6, 2014.

Copyright Notice

Copyright (c) 2014 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1. Introduction	2
2. The Internet-Standard Management Framework	3
3. Terminology	3
4. Brief Description of MIB Objects	3
4.1. General Variables	3
4.2. Session Table (bfdSessionTable)	3
4.3. Session Performance Table (bfdSessionPerfTable)	3
4.4. BFD Session Discriminator Mapping Table (bfdSessDiscMapTable)	4
4.5. BFD Session IP Mapping Table (bfdSessIpMapTable)	4
5. BFD MIB Module Definitions	4
6. Security Considerations	34
7. IANA Considerations	36
8. Acknowledgments	37
9. References	37
9.1. Normative References	37
9.2. Informative References	38

1. Introduction

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects to configure and/or monitor Bidirectional Forwarding Detection for [RFC5880], [RFC5881], [RFC5883] and [RFC7130], BFD versions 0 and/or 1, on devices supporting this feature.

This memo does not define a compliance requirement for a system that only implements BFD version 0. This is a reflection of a considered and deliberate decision by the BFD WG, because the BFD version 0 protocol is primarily of historical interest by comparison to the widespread deployment of the BFD version 1 protocol.

2. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIV2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

As with all MIB modules, an attempt to SET or CREATE an object to a value that is not supported by the implementation will result in a failure using a return code that indicates that the value is not supported.

3. Terminology

This document adopts the definitions, acronyms and mechanisms described in [RFC5880], [RFC5881], [RFC5883] and [RFC7130]. Unless otherwise stated, the mechanisms described therein will not be re-described here.

4. Brief Description of MIB Objects

This section describes objects pertaining to BFD. The MIB objects are derived from [RFC5880], [RFC5881], [RFC5883] and [RFC7130], and also include textual conventions defined in [I-D.ietf-bfd-tc-mib].

4.1. General Variables

The General Variables are used to identify parameters that are global to the BFD process.

4.2. Session Table (bfdSessionTable)

The session table is used to identify a BFD session between a pair of nodes.

4.3. Session Performance Table (bfdSessionPerfTable)

The session performance table is used for collecting BFD performance counters on a per session basis. This table is an AUGMENT to the bfdSessionTable.

4.4. BFD Session Discriminator Mapping Table (bfdSessDiscMapTable)

The BFD Session Discriminator Mapping Table provides a mapping between a local discriminator value to the associated BFD session found in the bfdSessionTable.

4.5. BFD Session IP Mapping Table (bfdSessIpMapTable)

The BFD Session IP Mapping Table maps, given bfdSessInterface, bfdSessSrcAddrType, bfdSessSrcAddr, bfdSessDstAddrType, and bfdSessDstAddr, to an associated BFD session found in the bfdSessionTable. This table SHOULD contain those BFD sessions that are of type IP.

5. BFD MIB Module Definitions

This MIB module makes references to the following documents. [RFC2578], [RFC2579], [RFC2580], [RFC2863], [RFC3289], [RFC3413], [RFC5082] and [RFC5880].

```
BFD-STD-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    MODULE-IDENTITY, OBJECT-TYPE, NOTIFICATION-TYPE,  
        mib-2, Integer32, Unsigned32, Counter32, Counter64  
        FROM SNMPv2-SMI -- [RFC2578]
```

```
    TruthValue, RowStatus, StorageType, TimeStamp  
        FROM SNMPv2-TC -- [RFC2579]
```

```
    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP  
        FROM SNMPv2-CONF -- [RFC2580]
```

```
    InterfaceIndexOrZero  
        FROM IF-MIB -- [RFC2863]
```

```
    InetAddress, InetAddressType, InetPortNumber  
        FROM INET-ADDRESS-MIB
```

```
    IndexIntegerNextFree  
        FROM DIFFSERV-MIB -- [RFC3289]
```

```
    BfdSessIndexTC, BfdIntervalTC, BfdMultiplierTC,  
    BfdCtrlDestPortNumberTC, BfdCtrlSourcePortNumberTC  
        FROM BFD-TC-STD-MIB
```

```
    IANAbfdDiagTC, IANAbfdSessTypeTC, IANAbfdSessOperModeTC,
```

```
IANAbfdSessStateTC, IANAbfdSessAuthenticationTypeTC,  
IANAbfdSessAuthenticationKeyTC  
FROM IANA-BFD-TC-STD-MIB;
```

```
bfdMIB MODULE-IDENTITY
```

```
LAST-UPDATED "201405091200Z" -- 9 May 2014 12:00:00 EST  
ORGANIZATION "IETF Bidirectional Forwarding Detection  
Working Group"
```

```
CONTACT-INFO
```

```
"Thomas D. Nadeau  
Brocade  
Email: tnadeau@lucidvision.com
```

```
Zafar Ali  
Cisco Systems, Inc.  
Email: zali@cisco.com
```

```
Nobo Akiya  
Cisco Systems, Inc.  
Email: nobo@cisco.com
```

```
Comments about this document should be emailed directly  
to the BFD working group mailing list at  
rtg-bfd@ietf.org"
```

```
DESCRIPTION
```

```
"Bidirectional Forwarding Management Information Base."
```

```
REVISION "201405091200Z" -- 9 May 2014 12:00:00 EST
```

```
DESCRIPTION
```

```
"Initial version. Published as RFC xxxx."
```

```
-- RFC Ed.: RFC-editor pls fill in xxxx
```

```
 ::= { mib-2 XXX }
```

```
-- RFC Ed.: assigned by IANA, see section 7.1 for details
```

```
-- Top level components of this MIB module.
```

```
bfdNotifications OBJECT IDENTIFIER ::= { bfdMIB 0 }
```

```
bfdObjects OBJECT IDENTIFIER ::= { bfdMIB 1 }
```

```
bfdConformance OBJECT IDENTIFIER ::= { bfdMIB 2 }
```

```
bfdScalarObjects OBJECT IDENTIFIER ::= { bfdObjects 1 }
```

```
-- BFD General Variables
```

```
-- These parameters apply globally to the Systems'
```

```
-- BFD Process.
```

```
bfdAdminStatus OBJECT-TYPE
    SYNTAX      INTEGER {
        enabled(1),
        disabled(2),
        adminDown(3),
        down(4)
    }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "The desired global administrative status of the BFD
        system in this device."
    ::= { bfdScalarObjects 1 }

bfdOperStatus OBJECT-TYPE
    SYNTAX      INTEGER {
        up(1),
        down(2),
        adminDown(3)
    }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Indicates the actual operational status of the
        BFD system in this device. When this value is
        down(2), all entries in the bfdSessTable MUST have
        their bfdSessOperStatus as down(2) as well. When
        this value is adminDown(3), all entries in the
        bfdSessTable MUST have their bfdSessOperStatus
        as adminDown(3) as well."
    ::= { bfdScalarObjects 2 }

bfdNotificationsEnable OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "If this object is set to true(1), then it enables
        the emission of bfdSessUp and bfdSessDown
        notifications; otherwise these notifications are not
        emitted."
    REFERENCE
        "See also RFC3413 for explanation that
        notifications are under the ultimate control of the
        MIB modules in this document."
    DEFVAL { false }
    ::= { bfdScalarObjects 3 }
```

```

bfdSessIndexNext OBJECT-TYPE
    SYNTAX      IndexIntegerNextFree (0..4294967295)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object contains an unused value for
        bfdSessIndex that can be used when creating
        entries in the table. A zero indicates that
        no entries are available, but MUST NOT be used
        as a valid index. "
    ::= { bfdScalarObjects 4 }

-- BFD Session Table
-- The BFD Session Table specifies BFD session specific
-- information.

bfdSessTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF BfdSessEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The BFD Session Table describes the BFD sessions."
    REFERENCE
        "Katz, D. and D. Ward, Bidirectional Forwarding
        Detection (BFD), RFC 5880, June 2012."
    ::= { bfdObjects 2 }

bfdSessEntry OBJECT-TYPE
    SYNTAX      BfdSessEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The BFD Session Entry describes BFD session."
    INDEX { bfdSessIndex }
    ::= { bfdSessTable 1 }

BfdSessEntry ::= SEQUENCE {
    bfdSessIndex          BfdSessIndexTC,
    bfdSessVersionNumber Unsigned32,
    bfdSessType           IANAbfdSessTypeTC,
    bfdSessDiscriminator Unsigned32,
    bfdSessRemoteDiscr   Unsigned32,
    bfdSessDestinationUdpPort BfdCtrlDestPortNumberTC,
    bfdSessSourceUdpPort  BfdCtrlSourcePortNumberTC,
    bfdSessEchoSourceUdpPort InetPortNumber,
    bfdSessAdminStatus    INTEGER,
    bfdSessOperStatus     INTEGER,
    bfdSessState          IANAbfdSessStateTC,

```

```

bfdSessRemoteHeardFlag      TruthValue,
bfdSessDiag                 IANAbfdDiagTC,
bfdSessOperMode             IANAbfdSessOperModeTC,
bfdSessDemandModeDesiredFlag TruthValue,
bfdSessControlPlaneIndepFlag TruthValue,
bfdSessMultipointFlag      TruthValue,
bfdSessInterface           InterfaceIndexOrZero,
bfdSessSrcAddrType         InetAddressType,
bfdSessSrcAddr             InetAddress,
bfdSessDstAddrType         InetAddressType,
bfdSessDstAddr             InetAddress,
bfdSessGTSM                TruthValue,
bfdSessGTSMTTL             Unsigned32,
bfdSessDesiredMinTxInterval BfdIntervalTC,
bfdSessReqMinRxInterval    BfdIntervalTC,
bfdSessReqMinEchoRxInterval BfdIntervalTC,
bfdSessDetectMult          BfdMultiplierTC,
bfdSessNegotiatedInterval  BfdIntervalTC,
bfdSessNegotiatedEchoInterval BfdIntervalTC,
bfdSessNegotiatedDetectMult BfdMultiplierTC,
bfdSessAuthPresFlag        TruthValue,
bfdSessAuthenticationType  IANAbfdSessAuthenticationTypeTC,
bfdSessAuthenticationKeyID Integer32,
bfdSessAuthenticationKey   IANAbfdSessAuthenticationKeyTC,
bfdSessStorageType         StorageType,
bfdSessRowStatus           RowStatus
}

```

bfdSessIndex OBJECT-TYPE

SYNTAX BfdSessIndexTC

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"This object contains an index used to represent a unique BFD session on this device. Managers should obtain new values for row creation in this table by reading bfdSessIndexNext."

::= { bfdSessEntry 1 }

bfdSessVersionNumber OBJECT-TYPE

SYNTAX Unsigned32 (0..7)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The version number of the BFD protocol that this session is running in. Write access is available for this object to provide ability to set desired version for this BFD session."

REFERENCE

"Katz, D. and D. Ward, Bidirectional Forwarding
Detection (BFD), RFC 5880, June 2012."

DEFVAL { 1 }

::= { bfdSessEntry 2 }

bfdSessType OBJECT-TYPE

SYNTAX IANAbfdSessTypeTC

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object specifies the type of this BFD session."

::= { bfdSessEntry 3 }

bfdSessDiscriminator OBJECT-TYPE

SYNTAX Unsigned32 (1..4294967295)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object specifies the local discriminator for this BFD
session, used to uniquely identify it."

::= { bfdSessEntry 4 }

bfdSessRemoteDiscr OBJECT-TYPE

SYNTAX Unsigned32 (0 | 1..4294967295)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object specifies the session discriminator chosen
by the remote system for this BFD session. The value may
be zero(0) if the remote discriminator is not yet known
or if the session is in the down or adminDown(1) state."

REFERENCE

"Section 6.8.6, from Katz, D. and D. Ward, Bidirectional
Forwarding Detection (BFD), RFC 5880, June 2012."

::= { bfdSessEntry 5 }

bfdSessDestinationUdpPort OBJECT-TYPE

SYNTAX BfdCtrlDestPortNumberTC

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object specifies the destination UDP port number
used for this BFD session's control packets. The value
may be zero(0) if the session is in adminDown(1) state."

DEFVAL { 0 }

::= { bfdSessEntry 6 }

bfdSessSourceUdpPort OBJECT-TYPE

SYNTAX BfdCtrlSourcePortNumberTC
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"This object specifies the source UDP port number used for this BFD session's control packets. The value may be zero(0) if the session is in adminDown(1) state. Upon creation of a new BFD session via this MIB, the value of zero(0) specified would permit the implementation to choose its own source port number."

DEFVAL { 0 }
 ::= { bfdSessEntry 7 }

bfdSessEchoSourceUdpPort OBJECT-TYPE

SYNTAX InetPortNumber
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"This object specifies the source UDP port number used for this BFD session's echo packets. The value may be zero(0) if the session is not running in the echo mode, or the session is in adminDown(1) state. Upon creation of a new BFD session via this MIB, the value of zero(0) would permit the implementation to choose its own source port number."

DEFVAL { 0 }
 ::= { bfdSessEntry 8 }

bfdSessAdminStatus OBJECT-TYPE

SYNTAX INTEGER {
 enabled(1),
 disabled(2),
 adminDown(3),
 down(4)
 }

MAX-ACCESS read-create
STATUS current
DESCRIPTION

"Denotes the desired operational status of the BFD Session.

A transition to enabled(1) will start the BFD state machine for the session. The state machine will have an initial state of down(2).

A transition to disabled(2) will stop the BFD state machine for the session. The state machine may first transition to adminDown(1) prior to stopping.

A transition to adminDown(3) will cause the BFD state machine to transition to adminDown(1), and will cause the session to remain in this state.

A transition to down(4) will cause the BFD state machine to transition to down(2), and will cause the session to remain in this state.

Care should be used in providing write access to this object without adequate authentication."

```
::= { bfdSessEntry 9 }
```

bfdSessOperStatus OBJECT-TYPE

```
SYNTAX      INTEGER {  
                up(1),  
                down(2),  
                adminDown(3)  
            }
```

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Denotes the actual operational status of the BFD Session. If the value of bfdOperStatus is down(2), this value MUST eventually be down(2) as well. If the value of bfdOperStatus is adminDown(3), this value MUST eventually be adminDown(3) as well."

```
::= { bfdSessEntry 10 }
```

bfdSessState OBJECT-TYPE

```
SYNTAX      IANAbfdSessStateTC
```

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"Configured BFD session state."

```
::= { bfdSessEntry 11 }
```

bfdSessRemoteHeardFlag OBJECT-TYPE

```
SYNTAX      TruthValue
```

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object specifies status of BFD packet reception from the remote system. Specifically, it is set to true(1) if the local system is actively receiving BFD packets from the remote system, and is set to false(2) if the local system has not received BFD packets recently (within the detection time) or if the local system is attempting to tear down the BFD session."

REFERENCE

"Katz, D. and D. Ward, Bidirectional Forwarding Detection (BFD), RFC 5880, June 2012."

::= { bfdSessEntry 12 }

bfdSessDiag OBJECT-TYPE

SYNTAX IANAbfdDiagTC

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A diagnostic code specifying the local system's reason for the last transition of the session from up(4) to some other state."

::= { bfdSessEntry 13 }

bfdSessOperMode OBJECT-TYPE

SYNTAX IANAbfdSessOperModeTC

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object specifies the operational mode of this BFD session."

::= { bfdSessEntry 14 }

bfdSessDemandModeDesiredFlag OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object indicates that the local system's desire to use Demand mode. Specifically, it is set to true(1) if the local system wishes to use Demand mode or false(2) if not"

DEFVAL { false }

::= { bfdSessEntry 15 }

bfdSessControlPlaneIndepFlag OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object indicates that the local system's ability to continue to function through a disruption of the control plane. Specifically, it is set to true(1) if the local system BFD implementation is independent of the control plane. Otherwise, the value is set to false(2)"

DEFVAL { false }

```
::= { bfdSessEntry 16 }
```

```
bfdSessMultipointFlag OBJECT-TYPE
```

```
SYNTAX      TruthValue
```

```
MAX-ACCESS  read-create
```

```
STATUS      current
```

```
DESCRIPTION
```

```
"This object indicates the Multipoint (M) bit for this session. It is set to true(1) if Multipoint (M) bit is set to 1. Otherwise, the value is set to false(2)"
```

```
DEFVAL { false }
```

```
::= { bfdSessEntry 17 }
```

```
bfdSessInterface OBJECT-TYPE
```

```
SYNTAX      InterfaceIndexOrZero
```

```
MAX-ACCESS  read-create
```

```
STATUS      current
```

```
DESCRIPTION
```

```
"This object contains an interface index used to indicate the interface which this BFD session is running on. This value can be zero if there is no interface associated with this BFD session."
```

```
::= { bfdSessEntry 18 }
```

```
bfdSessSrcAddrType OBJECT-TYPE
```

```
SYNTAX      InetAddressType
```

```
MAX-ACCESS  read-create
```

```
STATUS      current
```

```
DESCRIPTION
```

```
"This object specifies IP address type of the source IP address of this BFD session. The value of unknown(0) is allowed only when the session is singleHop(1) and the source IP address of this BFD session is derived from the outgoing interface, or when the BFD session is not associated with a specific interface. If any other unsupported values are attempted in a set operation, the agent MUST return an inconsistentValue error."
```

```
::= { bfdSessEntry 19 }
```

```
bfdSessSrcAddr OBJECT-TYPE
```

```
SYNTAX      InetAddress
```

```
MAX-ACCESS  read-create
```

```
STATUS      current
```

```
DESCRIPTION
```

```
"This object specifies the source IP address of this BFD session. The format of this object is controlled by the bfdSessSrcAddrType object."
```

```
::= { bfdSessEntry 20 }
```

```
bfdSessDstAddrType OBJECT-TYPE
    SYNTAX      InetAddressType
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object specifies IP address type of the neighboring IP
        address which is being monitored with this BFD session.
        The value of unknown(0) is allowed only when the session is
        singleHop(1) and the outgoing interface is of type
        point-to-point, or when the BFD session is not associated
        with a specific interface. If any other unsupported values
        are attempted in a set operation, the agent MUST return an
        inconsistentValue error."
    ::= { bfdSessEntry 21 }

bfdSessDstAddr OBJECT-TYPE
    SYNTAX      InetAddress
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object specifies the neighboring IP address which is
        being monitored with this BFD session. The format of this
        object is controlled by the bfdSessDstAddrType object."
    ::= { bfdSessEntry 22 }

bfdSessGTSM OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "Setting the value of this object to false(2) will disable
        GTSM protection of the BFD session. GTSM MUST be enabled
        on a singleHop(1) session if no authentication is in use."
    REFERENCE
        "RFC5082, The Generalized TTL Security Mechanism (GTSM).
        RFC5881, Section 5"
    DEFVAL { true }
    ::= { bfdSessEntry 23 }

bfdSessGTSMTTL OBJECT-TYPE
    SYNTAX      Unsigned32 (0..255)
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object is valid only when bfdSessGTSM protection is
        enabled on the system. This object indicates the minimum
        allowed TTL for received BFD control packets. For a
        singleHop(1) session, if GTSM protection is enabled,
```

this object SHOULD be set to maximum TTL value allowed for single hop.

By default, GTSM is enabled and TTL value is 255. For a multihop session, updating of maximum TTL value allowed is likely required."

REFERENCE

"RFC5082, The Generalized TTL Security Mechanism (GTSM).
RFC5881, Section 5"

DEFVAL { 255 }

::= { bfdSessEntry 24 }

bfdSessDesiredMinTxInterval OBJECT-TYPE

SYNTAX BfdIntervalTC

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object specifies the minimum interval, in microseconds, that the local system would like to use when transmitting BFD Control packets. The value of zero(0) is reserved in this case, and should not be used."

REFERENCE

"Section 4.1 from Katz, D. and D. Ward, Bidirectional Forwarding Detection (BFD), RFC 5880, June 2012."

::= { bfdSessEntry 25 }

bfdSessReqMinRxInterval OBJECT-TYPE

SYNTAX BfdIntervalTC

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object specifies the minimum interval, in microseconds, between received BFD Control packets the local system is capable of supporting. The value of zero(0) can be specified when the transmitting system does not want the remote system to send any periodic BFD control packets."

REFERENCE

"Section 4.1 from Katz, D. and D. Ward, Bidirectional Forwarding Detection (BFD), RFC 5880, June 2012."

::= { bfdSessEntry 26 }

bfdSessReqMinEchoRxInterval OBJECT-TYPE

SYNTAX BfdIntervalTC

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object specifies the minimum interval, in microseconds, between received BFD Echo packets that this system is capable of supporting. Value must be zero(0) if this is a multihop BFD session."
 ::= { bfdSessEntry 27 }

bfdSessDetectMult OBJECT-TYPE
SYNTAX BfdMultiplierTC
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This object specifies the Detect time multiplier."
 ::= { bfdSessEntry 28 }

bfdSessNegotiatedInterval OBJECT-TYPE
SYNTAX BfdIntervalTC
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object specifies the negotiated interval, in microseconds, that the local system is transmitting BFD Control packets."
 ::= { bfdSessEntry 29 }

bfdSessNegotiatedEchoInterval OBJECT-TYPE
SYNTAX BfdIntervalTC
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object specifies the negotiated interval, in microseconds, that the local system is transmitting BFD echo packets. Value is expected to be zero if the sessions is not running in echo mode."
 ::= { bfdSessEntry 30 }

bfdSessNegotiatedDetectMult OBJECT-TYPE
SYNTAX BfdMultiplierTC
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object specifies the Detect time multiplier."
 ::= { bfdSessEntry 31 }

bfdSessAuthPresFlag OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"This object indicates that the local system's desire to use Authentication. Specifically, it is set to true(1) if the local system wishes the session to be authenticated or false(2) if not."

REFERENCE

"Sections 4.2 - 4.4 from Katz, D. and D. Ward, Bidirectional Forwarding Detection (BFD), RFC 5880, June 2012."

DEFVAL { false }
 ::= { bfdSessEntry 32 }

bfdSessAuthenticationType OBJECT-TYPE

SYNTAX IANAbfdSessAuthenticationTypeTC

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The Authentication Type used for this BFD session. This field is valid only when the Authentication Present bit is set. Max-access to this object as well as other authentication related objects are set to read-create in order to support management of a single key ID at a time, key rotation is not handled. Key update in practice must be done by atomic update using a set containing all affected objects in the same varBindList or otherwise risk the session dropping."

REFERENCE

"Sections 4.2 - 4.4 from Katz, D. and D. Ward, Bidirectional Forwarding Detection (BFD), RFC 5880, June 2012."

DEFVAL { noAuthentication }
 ::= { bfdSessEntry 33 }

bfdSessAuthenticationKeyID OBJECT-TYPE

SYNTAX Integer32 (-1 | 0..255)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The authentication key ID in use for this session. This object permits multiple keys to be active simultaneously. The value -1 indicates that no Authentication Key ID will be present in the optional BFD Authentication Section."

REFERENCE

"Sections 4.2 - 4.4 from Katz, D. and D. Ward, Bidirectional Forwarding Detection (BFD), RFC 5880, June 2012."

DEFVAL { -1 }
 ::= { bfdSessEntry 34 }

bfdSessAuthenticationKey OBJECT-TYPE

SYNTAX IANAbfdSessAuthenticationKeyTC
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"The authentication key. When the bfdSessAuthenticationType is simplePassword(1), the value of this object is the password present in the BFD packets.

When the bfdSessAuthenticationType is one of the keyed authentication types, this value is used in the computation of the key present in the BFD authentication packet."

REFERENCE

"Sections 4.2 - 4.4 from Katz, D. and D. Ward, Bidirectional Forwarding Detection (BFD), RFC 5880, June 2012."

::= { bfdSessEntry 35 }

bfdSessStorageType OBJECT-TYPE

SYNTAX StorageType
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"This variable indicates the storage type for this object. Conceptual rows having the value 'permanent' need not allow write-access to any columnar objects in the row."

::= { bfdSessEntry 36 }

bfdSessRowStatus OBJECT-TYPE

SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION

"This variable is used to create, modify, and/or delete a row in this table. When a row in this table has a row in the active(1) state, no objects in this row can be modified except the bfdSessRowStatus and bfdSessStorageType."

::= { bfdSessEntry 37 }

-- BFD Session Performance Table

bfdSessPerfTable OBJECT-TYPE

SYNTAX SEQUENCE OF BfdSessPerfEntry
MAX-ACCESS not-accessible
STATUS current

DESCRIPTION

"This table specifies BFD Session performance counters."
 ::= { bfdObjects 3 }

bfdSessPerfEntry OBJECT-TYPE

SYNTAX BfdSessPerfEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An entry in this table is created by a BFD-enabled node for every BFD Session. bfdSessPerfDiscTime is used to indicate potential discontinuity for all counter objects in this table."

AUGMENTS { bfdSessEntry }

::= { bfdSessPerfTable 1 }

BfdSessPerfEntry ::= SEQUENCE {

bfdSessPerfCtrlPktIn	Counter32,
bfdSessPerfCtrlPktOut	Counter32,
bfdSessPerfCtrlPktDrop	Counter32,
bfdSessPerfCtrlPktDropLastTime	TimeStamp,
bfdSessPerfEchoPktIn	Counter32,
bfdSessPerfEchoPktOut	Counter32,
bfdSessPerfEchoPktDrop	Counter32,
bfdSessPerfEchoPktDropLastTime	TimeStamp,
bfdSessUpTime	TimeStamp,
bfdSessPerfLastSessDownTime	TimeStamp,
bfdSessPerfLastCommLostDiag	IANAbfdDiagTC,
bfdSessPerfSessUpCount	Counter32,
bfdSessPerfDiscTime	TimeStamp,

-- High Capacity Counters

bfdSessPerfCtrlPktInHC	Counter64,
bfdSessPerfCtrlPktOutHC	Counter64,
bfdSessPerfCtrlPktDropHC	Counter64,
bfdSessPerfEchoPktInHC	Counter64,
bfdSessPerfEchoPktOutHC	Counter64,
bfdSessPerfEchoPktDropHC	Counter64

}

bfdSessPerfCtrlPktIn OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of BFD control messages received for this BFD session."

It MUST be equal to the least significant 32 bits of bfdSessPerfCtrlPktInHC if supported, and MUST do so with the rules spelled out in RFC 2863."
 ::= { bfdSessPerfEntry 1 }

bfdSessPerfCtrlPktOut OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of BFD control messages sent for this BFD session.

It MUST be equal to the least significant 32 bits of bfdSessPerfCtrlPktOutHC if supported, and MUST do so with the rules spelled out in RFC 2863."
 ::= { bfdSessPerfEntry 2 }

bfdSessPerfCtrlPktDrop OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of BFD control messages received for this session yet dropped for being invalid.

It MUST be equal to the least significant 32 bits of bfdSessPerfCtrlPktDropHC if supported, and MUST do so with the rules spelled out in RFC 2863."
 ::= { bfdSessPerfEntry 3 }

bfdSessPerfCtrlPktDropLastTime OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime on the most recent occasion at which received BFD control message for this session was dropped. If no such up event exists, this object contains a zero value."

::= { bfdSessPerfEntry 4 }

bfdSessPerfEchoPktIn OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of BFD echo messages received for this

BFD session.

It MUST be equal to the least significant 32 bits of bfdSessPerfEchoPktInHC if supported, and MUST do so with the rules spelled out in RFC 2863."
 ::= { bfdSessPerfEntry 5 }

bfdSessPerfEchoPktOut OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of BFD echo messages sent for this BFD session.

It MUST be equal to the least significant 32 bits of bfdSessPerfEchoPktOutHC if supported, and MUST do so with the rules spelled out in RFC 2863."
 ::= { bfdSessPerfEntry 6 }

bfdSessPerfEchoPktDrop OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of BFD echo messages received for this session yet dropped for being invalid.

It MUST be equal to the least significant 32 bits of bfdSessPerfEchoPktDropHC if supported, and MUST do so with the rules spelled out in RFC 2863."
 ::= { bfdSessPerfEntry 7 }

bfdSessPerfEchoPktDropLastTime OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime on the most recent occasion at which received BFD echo message for this session was dropped. If no such up event has been issued, this object contains a zero value."

::= { bfdSessPerfEntry 8 }

bfdSessUpTime OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime on the most recent occasion at which the session came up. If no such event has been issued, this object contains a zero value."

::= { bfdSessPerfEntry 9 }

bfdSessPerfLastSessDownTime OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime on the most recent occasion at which the last time communication was lost with the neighbor. If no down event has been issued this object contains a zero value."

::= { bfdSessPerfEntry 10 }

bfdSessPerfLastCommLostDiag OBJECT-TYPE

SYNTAX IANAbfdDiagTC

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The BFD diag code for the last time communication was lost with the neighbor. If such an event has not been issued this object contains a zero value."

::= { bfdSessPerfEntry 11 }

bfdSessPerfSessUpCount OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of times this session has gone into the Up state since the system last rebooted."

::= { bfdSessPerfEntry 12 }

bfdSessPerfDiscTime OBJECT-TYPE

SYNTAX TimeStamp

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime on the most recent occasion at which any one or more of the session counters suffered a discontinuity.

The relevant counters are the specific instances associated with this BFD session of any Counter32 object contained in the BfdSessPerfTable. If no such discontinuities have

occurred since the last re-initialization of the local management subsystem, then this object contains a zero value."

::= { bfdSessPerfEntry 13 }

bfdSessPerfCtrlPktInHC OBJECT-TYPE

SYNTAX Counter64

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This value represents the total number of BFD control messages received for this BFD session.

The least significant 32 bits MUST equal to bfdSessPerfCtrlPktIn, and MUST do so with the rules spelled out in RFC 2863."

::= { bfdSessPerfEntry 14 }

bfdSessPerfCtrlPktOutHC OBJECT-TYPE

SYNTAX Counter64

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This value represents the total number of BFD control messages transmitted for this BFD session.

The least significant 32 bits MUST equal to bfdSessPerfCtrlPktOut, and MUST do so with the rules spelled out in RFC 2863."

::= { bfdSessPerfEntry 15 }

bfdSessPerfCtrlPktDropHC OBJECT-TYPE

SYNTAX Counter64

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This value represents the total number of BFD control messages received for this BFD session yet dropped for being invalid.

The least significant 32 bits MUST equal to bfdSessPerfCtrlPktDrop, and MUST do so with the rules spelled out in RFC 2863."

::= { bfdSessPerfEntry 16 }

bfdSessPerfEchoPktInHC OBJECT-TYPE

SYNTAX Counter64

MAX-ACCESS read-only

```
STATUS      current
DESCRIPTION
    "This value represents the total number of BFD echo
    messages received for this BFD session.

    The least significant 32 bits MUST equal to
    bfdSessPerfEchoPktIn, and MUST do so with
    the rules spelled out in RFC 2863."
 ::= { bfdSessPerfEntry 17 }
```

```
bfdSessPerfEchoPktOutHC OBJECT-TYPE
SYNTAX      Counter64
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "This value represents the total number of BFD echo
    messages transmitted for this BFD session.

    The least significant 32 bits MUST equal to
    bfdSessPerfEchoPktOut, and MUST do so with
    the rules spelled out in RFC 2863."
 ::= { bfdSessPerfEntry 18 }
```

```
bfdSessPerfEchoPktDropHC OBJECT-TYPE
SYNTAX      Counter64
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "This value represents the total number of BFD echo
    messages received for this BFD session yet dropped
    for being invalid.

    The least significant 32 bits MUST equal to
    bfdSessPerfEchoPktDrop, and MUST do so with
    the rules spelled out in RFC 2863."
 ::= { bfdSessPerfEntry 19 }
```

-- BFD Session Discriminator Mapping Table

```
bfdSessDiscMapTable OBJECT-TYPE
SYNTAX      SEQUENCE OF BfdSessDiscMapEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "The BFD Session Discriminator Mapping Table maps a
    local discriminator value to associated BFD session's
    bfdSessIndex found in the bfdSessionTable."
 ::= { bfdObjects 4 }
```

```
bfdSessDiscMapEntry OBJECT-TYPE
    SYNTAX      BfdSessDiscMapEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The BFD Session Discriminator Mapping Entry
         specifies a mapping between a local discriminator
         and a BFD session."
    INDEX { bfdSessDiscriminator }
    ::= { bfdSessDiscMapTable 1 }

BfdSessDiscMapEntry ::= SEQUENCE {
    bfdSessDiscMapIndex          BfdSessIndexTC
}

bfdSessDiscMapIndex OBJECT-TYPE
    SYNTAX      BfdSessIndexTC
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object specifies a mapping between a
         local discriminator and a BFD Session in
         the BfdSessTable."
    ::= { bfdSessDiscMapEntry 1 }

-- BFD Session IP Mapping Table

bfdSessIpMapTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF BfdSessIpMapEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The BFD Session IP Mapping Table maps given
         bfdSessInterface, bfdSessSrcAddrType, bfdSessSrcAddr,
         bfdSessDstAddrType and bfdSessDstAddr
         to an associated BFD session found in the
         bfdSessionTable."
    ::= { bfdObjects 5 }

bfdSessIpMapEntry OBJECT-TYPE
    SYNTAX      BfdSessIpMapEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The BFD Session IP Map Entry contains a mapping
         from the IP information for a session, to the session
         in the bfdSessionTable."
    INDEX {
```

```

        bfdSessInterface,
        bfdSessSrcAddrType,
        bfdSessSrcAddr,
        bfdSessDstAddrType,
        bfdSessDstAddr
    }
    ::= { bfdSessIpMapTable 1 }

```

```

BfdSessIpMapEntry ::= SEQUENCE {
    bfdSessIpMapIndex          BfdSessIndexTC
}

```

```

bfdSessIpMapIndex OBJECT-TYPE
    SYNTAX      BfdSessIndexTC
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object specifies the BfdSessIndexTC referred
         to by the indexes of this row. In essence, a mapping is
         provided between these indexes and the BfdSessTable."
    ::= { bfdSessIpMapEntry 1 }

```

-- Notification Configuration

```

bfdSessUp NOTIFICATION-TYPE
    OBJECTS {
        bfdSessDiag, -- low range value
        bfdSessDiag -- high range value
    }
    STATUS      current
    DESCRIPTION
        "This notification is generated when the
         bfdSessState object for one or more contiguous
         entries in bfdSessTable are about to enter the up(4)
         state from some other state. The included values of
         bfdSessDiag MUST both be set equal to this
         new state (i.e: up(4)). The two instances of
         bfdSessDiag in this notification indicate the range
         of indexes that are affected. Note that all the indexes
         of the two ends of the range can be derived from the
         instance identifiers of these two objects. For the
         cases where a contiguous range of sessions
         have transitioned into the up(4) state at roughly
         the same time, the device SHOULD issue a single
         notification for each range of contiguous indexes in
         an effort to minimize the emission of a large number
         of notifications. If a notification has to be
         issued for just a single bfdSessEntry, then

```

```
        the instance identifier (and values) of the two
        bfdSessDiag objects MUST be the identical."
 ::= { bfdNotifications 1 }
```

```
bfdSessDown NOTIFICATION-TYPE
```

```
OBJECTS {
    bfdSessDiag, -- low range value
    bfdSessDiag -- high range value
}
```

```
STATUS current
```

```
DESCRIPTION
```

```
"This notification is generated when the
bfdSessState object for one or more contiguous
entries in bfdSessTable are about to enter the down(2)
or adminDown(1) states from some other state. The included
values of bfdSessDiag MUST both be set equal to this new
state (i.e: down(2) or adminDown(1)). The two instances
of bfdSessDiag in this notification indicate the range
of indexes that are affected. Note that all the indexes
of the two ends of the range can be derived from the
instance identifiers of these two objects. For
cases where a contiguous range of sessions
have transitioned into the down(2) or adminDown(1) states
at roughly the same time, the device SHOULD issue a single
notification for each range of contiguous indexes in
an effort to minimize the emission of a large number
of notifications. If a notification has to be
issued for just a single bfdSessEntry, then
the instance identifier (and values) of the two
bfdSessDiag objects MUST be the identical."
```

```
 ::= { bfdNotifications 2 }
```

```
-- Module compliance.
```

```
bfdGroups
```

```
OBJECT IDENTIFIER ::= { bfdConformance 1 }
```

```
bfdCompliances
```

```
OBJECT IDENTIFIER ::= { bfdConformance 2 }
```

```
-- Compliance requirement for fully compliant implementations.
```

```
bfdModuleFullCompliance MODULE-COMPLIANCE
```

```
STATUS current
```

```
DESCRIPTION
```

```
"Compliance statement for agents that provide full
support for the BFD-MIB module. Such devices can
then be monitored and also be configured using
```

```

    this MIB module."

MODULE -- This module.

MANDATORY-GROUPS {
    bfdSessionGroup,
    bfdSessionReadOnlyGroup,
    bfdSessionPerfGroup,
    bfdNotificationGroup
}

GROUP          bfdSessionPerfHCGroup
DESCRIPTION    "This group is mandatory for all systems that
                are able to support the Counter64 date type."

OBJECT         bfdSessSrcAddrType
SYNTAX        InetAddressType { unknown(0), ipv4(1),
                                ipv6(2), ipv6z(4) }
DESCRIPTION    "Only unknown(0), ipv4(1), ipv6(2) and ipv6z(4)
                support are required. ipv4z(3) is not required
                and dns(16) is not allowed."

OBJECT         bfdSessSrcAddr
SYNTAX        InetAddress (SIZE (0|4|16|20))
DESCRIPTION    "An implementation is only required to support
                unknown(0), ipv4(1), ipv6(2) and ipv6z(4) sizes."

OBJECT         bfdSessDstAddrType
SYNTAX        InetAddressType { unknown(0), ipv4(1),
                                ipv6(2), ipv6z(4) }
DESCRIPTION    "Only unknown(0), ipv4(1), ipv6(2) and ipv6z(4)
                support are required. ipv4z(3) is not required
                and dns(16) is not allowed."

OBJECT         bfdSessDstAddr
SYNTAX        InetAddress (SIZE (0|4|16|20))
DESCRIPTION    "An implementation is only required to support
                unknown(0), ipv4(1), ipv6(2) and ipv6z(4) sizes."

OBJECT         bfdSessRowStatus
SYNTAX        RowStatus { active(1), notInService(2) }
WRITE-SYNTAX  RowStatus { active(1), notInService(2),
                          createAndGo(4), destroy(6) }
DESCRIPTION    "Support for createAndWait and notReady is not
                required."

 ::= { bfdCompliances 1 }

```

```
bfdModuleReadOnlyCompliance MODULE-COMPLIANCE
  STATUS current
  DESCRIPTION
    "Compliance requirement for implementations that only
    provide read-only support for BFD-MIB. Such devices
    can then be monitored but cannot be configured using
    this MIB module."

  MODULE -- This module.

  MANDATORY-GROUPS {
    bfdSessionGroup,
    bfdSessionReadOnlyGroup,
    bfdSessionPerfGroup,
    bfdNotificationGroup
  }

  GROUP          bfdSessionPerfHCGroup
  DESCRIPTION    "This group is mandatory for all systems that
                 are able to support the Counter64 date type."

  OBJECT         bfdSessVersionNumber
  MIN-ACCESS     read-only
  DESCRIPTION    "Write access is not required."

  OBJECT         bfdSessType
  MIN-ACCESS     read-only
  DESCRIPTION    "Write access is not required."

  OBJECT         bfdSessDiscriminator
  MIN-ACCESS     read-only
  DESCRIPTION    "Write access is not required."

  OBJECT         bfdSessDestinationUdpPort
  MIN-ACCESS     read-only
  DESCRIPTION    "Write access is not required."

  OBJECT         bfdSessSourceUdpPort
  MIN-ACCESS     read-only
  DESCRIPTION    "Write access is not required."

  OBJECT         bfdSessEchoSourceUdpPort
  MIN-ACCESS     read-only
  DESCRIPTION    "Write access is not required."

  OBJECT         bfdSessAdminStatus
  MIN-ACCESS     read-only
  DESCRIPTION    "Write access is not required."
```

OBJECT bfdSessOperMode
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessDemandModeDesiredFlag
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessControlPlaneIndepFlag
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessMultipointFlag
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessInterface
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessSrcAddrType
SYNTAX InetAddressType { unknown(0), ipv4(1),
ipv6(2), ipv6z(4) }
MIN-ACCESS read-only
DESCRIPTION "Only unknown(0), ipv4(1), ipv6(2) and ipv6z(4)
support are required. ipv4z(3) is not required
and dns(16) is not allowed."

OBJECT bfdSessSrcAddr
SYNTAX InetAddress (SIZE (0|4|16|20))
MIN-ACCESS read-only
DESCRIPTION "An implementation is only required to support
unknown(0), ipv4(1), ipv6(2) and ipv6z(4) sizes."

OBJECT bfdSessDstAddrType
SYNTAX InetAddressType { unknown(0), ipv4(1),
ipv6(2), ipv6z(4) }
MIN-ACCESS read-only
DESCRIPTION "Only unknown(0), ipv4(1), ipv6(2) and ipv6z(4)
support are required. ipv4z(3) is not required
and dns(16) is not allowed."

OBJECT bfdSessDstAddr
SYNTAX InetAddress (SIZE (0|4|16|20))
MIN-ACCESS read-only
DESCRIPTION "An implementation is only required to support
unknown(0), ipv4(1), ipv6(2) and ipv6z(4) sizes."

OBJECT bfdSessGTSM
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessGTSM TTL
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessDesiredMinTxInterval
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessReqMinRxInterval
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessReqMinEchoRxInterval
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessDetectMult
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessAuthPresFlag
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessAuthenticationType
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessAuthenticationKeyID
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessAuthenticationKey
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessStorageType
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

OBJECT bfdSessRowStatus
SYNTAX RowStatus { active(1) }
MIN-ACCESS read-only
DESCRIPTION "Write access is not required."

```
::= { bfdCompliances 2 }
```

```
-- Units of conformance.
```

```
bfdSessionGroup OBJECT-GROUP
```

```
OBJECTS {
```

```
    bfdAdminStatus,  
    bfdOperStatus,  
    bfdNotificationsEnable,  
    bfdSessVersionNumber,  
    bfdSessType,  
    bfdSessIndexNext,  
    bfdSessDiscriminator,  
    bfdSessDestinationUdpPort,  
    bfdSessSourceUdpPort,  
    bfdSessEchoSourceUdpPort,  
    bfdSessAdminStatus,  
    bfdSessOperStatus,  
    bfdSessOperMode,  
    bfdSessDemandModeDesiredFlag,  
    bfdSessControlPlaneIndepFlag,  
    bfdSessMultipointFlag,  
    bfdSessInterface,  
    bfdSessSrcAddrType,  
    bfdSessSrcAddr,  
    bfdSessDstAddrType,  
    bfdSessDstAddr,  
    bfdSessGTSM,  
    bfdSessGTSMTTL,  
    bfdSessDesiredMinTxInterval,  
    bfdSessReqMinRxInterval,  
    bfdSessReqMinEchoRxInterval,  
    bfdSessDetectMult,  
    bfdSessAuthPresFlag,  
    bfdSessAuthenticationType,  
    bfdSessAuthenticationKeyID,  
    bfdSessAuthenticationKey,  
    bfdSessStorageType,  
    bfdSessRowStatus
```

```
}
```

```
STATUS current
```

```
DESCRIPTION
```

```
"Collection of objects needed for BFD sessions."
```

```
::= { bfdGroups 1 }
```

```
bfdSessionReadOnlyGroup OBJECT-GROUP
```

```
OBJECTS {
```

```
    bfdSessRemoteDiscr,
```

```
        bfdSessState,
        bfdSessRemoteHeardFlag,
        bfdSessDiag,
        bfdSessNegotiatedInterval,
        bfdSessNegotiatedEchoInterval,
        bfdSessNegotiatedDetectMult,
        bfdSessDiscMapIndex,
        bfdSessIpMapIndex
    }
    STATUS      current
    DESCRIPTION
        "Collection of read-only objects needed for BFD sessions."
    ::= { bfdGroups 2 }
```

bfdSessionPerfGroup OBJECT-GROUP

```
    OBJECTS {
        bfdSessPerfCtrlPktIn,
        bfdSessPerfCtrlPktOut,
        bfdSessPerfCtrlPktDrop,
        bfdSessPerfCtrlPktDropLastTime,
        bfdSessPerfEchoPktIn,
        bfdSessPerfEchoPktOut,
        bfdSessPerfEchoPktDrop,
        bfdSessPerfEchoPktDropLastTime,
        bfdSessUpTime,
        bfdSessPerfLastSessDownTime,
        bfdSessPerfLastCommLostDiag,
        bfdSessPerfSessUpCount,
        bfdSessPerfDiscTime
    }
    STATUS      current
    DESCRIPTION
        "Collection of objects needed to monitor the
         performance of BFD sessions."
    ::= { bfdGroups 3 }
```

bfdSessionPerfHCGroup OBJECT-GROUP

```
    OBJECTS {
        bfdSessPerfCtrlPktInHC,
        bfdSessPerfCtrlPktOutHC,
        bfdSessPerfCtrlPktDropHC,
        bfdSessPerfEchoPktInHC,
        bfdSessPerfEchoPktOutHC,
        bfdSessPerfEchoPktDropHC
    }

    STATUS      current
    DESCRIPTION
```

```
    "Collection of objects needed to monitor the
    performance of BFD sessions for which the
    values of bfdSessPerfPktIn, bfdSessPerfPktOut
    wrap around too quickly."
 ::= { bfdGroups 4 }
```

```
bfdNotificationGroup NOTIFICATION-GROUP
  NOTIFICATIONS {
    bfdSessUp,
    bfdSessDown
  }
  STATUS          current
  DESCRIPTION
    "Set of notifications implemented in this
    module."
 ::= { bfdGroups 5 }
```

END

6. Security Considerations

As BFD may be tied into the stability of the network infrastructure (such as routing protocols), the effects of an attack on a BFD session may be very serious. This ultimately has denial-of-service effects, as links may be declared to be down (or falsely declared to be up.) As such, improper manipulation of the objects represented by this MIB may result in denial of service to a large number of end-users.

There are a number of management objects defined in this MIB module with a MAX-ACCESS clause of read-write and/or read-create. Such objects may be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations. These are the tables and objects and their sensitivity/vulnerability:

- o bfdAdminStatus - Improper change of bfdAdminStatus, to disabled(2), adminDown(3) or down(4), can cause significant disruption of the connectivity to those portions of the Internet reached via all the applicable remote BFD peers.
- o bfdSessAdminStatus - Improper change of bfdSessAdminStatus, to disabled(2), adminDown(3) or down(4), can cause significant disruption of the connectivity to those portions of the Internet reached via all the applicable remote BFD peers.

- o bfdSessDesiredMinTxInterval, bfdSessReqMinRxInterval, bfdSessReqMinEchoRxInterval, bfdSessDetectMult - Improper change of this object can cause connections to be disrupted for extremely long time periods when otherwise they would be restored in a relatively short period of time.
- o Some management objects define the BFD session whilst other management objects define the parameter of the BFD session. It is particularly important to control the support for SET access to those management objects that define the BFD session, as changes to them can be disruptive. Implementation SHOULD NOT allow changes to following management objects when bfdSessState is up(4):
 - * bfdSessVersionNumber
 - * bfdSessType
 - * bfdSessDestinationUdpPort
 - * bfdSessMultipointFlag
 - * bfdSessInterface
 - * bfdSessSrcAddrType
 - * bfdSessSrcAddr
 - * bfdSessDstAddrType
 - * bfdSessDstAddr

There are a number of management objects defined in this MIB module with a MAX-ACCESS clause of read-write and/or read-create. Such objects may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP.

- o The bfdSessTable may be used to directly configure BFD sessions. The bfdSessMapTable can be used indirectly in the same way. Unauthorized access to objects in this table could result in disruption of traffic on the network. This is especially true if an unauthorized user configures enough tables to invoke a denial of service attack on the device where they are configured, or on a remote device where the sessions terminate.

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

- o The bfdSessPerfTable both allows access to the performance characteristics of BFD sessions. Network administrators not wishing to show this information should consider this table sensitive.

The bfdSessAuthenticationType, bfdSessAuthenticationKeyID, and bfdSessAuthenticationKey objects hold security methods and associated security keys of BFD sessions. These objects are highly sensitive. In order to prevent this sensitive information from being improperly accessed, implementers SHOULD disallow access to these objects.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module, is properly configured to give access to the objects only to those principals "users" that have legitimate rights to indeed GET or SET "change/create/delete" them.

7. IANA Considerations

The MIB module in this document uses the following IANA-assigned OBJECT IDENTIFIER values recorded in the SMI Numbers registry:

Descriptor -----	OBJECT IDENTIFIER value -----
bfdMib	{ mib-2 XXX }

[RFC-Editor's Note (to be removed prior to publication): the IANA is requested to assign a value for "XXX" under the 'mib-2' subtree and to record the assignment in the SMI Numbers registry. When the assignment has been made, the RFC Editor is asked to replace "XXX" (here and in the MIB module) with the assigned value and to remove this note.]

8. Acknowledgments

Authors would like to thank Adrian Farrel and Jeffrey Haas for performing thorough reviews and providing number of suggestions. Authors would also like to thank David Ward, Reshad Rahman, David Toscano, Sylvain Masse, Mark Tooker, Kiran Koushik Agrahara Sreenivasa, David Black and Bert Wijnen for their comments and suggestions.

9. References

9.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.
- [RFC2578] McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.
- [RFC2579] McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.
- [RFC2580] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.
- [RFC5082] Gill, V., Heasley, J., Meyer, D., Savola, P., and C. Pignataro, "The Generalized TTL Security Mechanism (GTSM)", RFC 5082, October 2007.
- [RFC5880] Katz, D. and D. Ward, "Bidirectional Forwarding Detection (BFD)", RFC 5880, June 2010.
- [RFC5881] Katz, D. and D. Ward, "Bidirectional Forwarding Detection (BFD) for IPv4 and IPv6 (Single Hop)", RFC 5881, June 2010.
- [RFC5883] Katz, D. and D. Ward, "Bidirectional Forwarding Detection (BFD) for Multihop Paths", RFC 5883, June 2010.

[RFC7130] Bhatia, M., Chen, M., Boutros, S., Binderberger, M., and J. Haas, "Bidirectional Forwarding Detection (BFD) on Link Aggregation Group (LAG) Interfaces", RFC 7130, February 2014.

[I-D.ietf-bfd-tc-mib]
Nadeau, T., Ali, Z., and N. Akiya, "Definitions of Textual Conventions (TCs) for Bidirectional Forwarding Detection (BFD) Management", draft-ietf-bfd-tc-mib-08 (work in progress), May 2014.

9.2. Informative References

[RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", RFC 3410, December 2002.

[RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB", RFC 2863, June 2000.

[RFC3413] Levi, D., Meyer, P., and B. Stewart, "Simple Network Management Protocol (SNMP) Applications", STD 62, RFC 3413, December 2002.

[RFC3289] Baker, F., Chan, K., and A. Smith, "Management Information Base for the Differentiated Services Architecture", RFC 3289, May 2002.

Authors' Addresses

Thomas D. Nadeau
Brocade

EMail: tnadeau@lucidvision.com

Zafar Ali
Cisco Systems

EMail: zali@cisco.com

Nobo Akiya
Cisco Systems

EMail: nobo@cisco.com