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T. Nadeau
Juniper Networks
Z. Ali
N. Akiya
Cisco Systems
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BFD Management Information Base
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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.

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1. 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].

2. Introduction

This memo defines an 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 Bi-Directional Forwarding Detection for [RFC5880], [RFC5881] and [RFC5883], BFD versions 0 and/or 1, on devices supporting this feature.

Comments should be made directly to the BFD mailing list at rtg-bfd@ietf.org.

3. Terminology

This document adopts the definitions, acronyms and mechanisms described in [RFC5880], [RFC5881] and [RFC5883]. 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] and [RFC5883], 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 maps a local discriminator value to associated BFD session's BfdSessIndexTC used 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's `BfdSessIndexTC` used in the `bfdSessionTable`. This table SHOULD contain those BFD sessions that are of IP type.

5. BFD MIB Module Definitions

This MIB module makes references to the following documents. [RFC2579], [RFC2580], [RFC2863], [RFC4001], and [RFC3413].

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

```
IMPORTS
```

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

```
    TruthValue, RowStatus, StorageType, TimeStamp  
    FROM SNMPv2-TC
```

```
    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP  
    FROM SNMPv2-CONF
```

```
    InterfaceIndexOrZero  
    FROM IF-MIB
```

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

```
    BfdSessIndexTC, BfdIntervalTC, BfdMultiplierTC, BfdDiagTC,  
    BfdSessTypeTC, BfdSessOperModeTC, BfdCtrlDestPortNumberTC,  
    BfdCtrlSourcePortNumberTC, BfdSessStateTC,  
    BfdSessAuthenticationTypeTC, BfdSessionAuthenticationKeyTC  
    FROM BFD-TC-STD-MIB;
```

```
bfdMIB MODULE-IDENTITY
```

```
    LAST-UPDATED "201311111200Z" -- 11 Nov. 2013 12:00:00 EST  
    ORGANIZATION "IETF Bidirectional Forwarding Detection  
        Working Group"
```

```
CONTACT-INFO
```

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

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

```

    Nobo Akiya
    Cisco Systems, Inc.
    Email: nobo@cisco.com"
DESCRIPTION
    "Bidirectional Forwarding Management Information Base."
REVISION "201311111200Z" -- 11 Nov. 2013 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)
    }
    MAX-ACCESS read-write
    STATUS      current
    DESCRIPTION
        "The global administrative status of BFD in this device.
        The value 'enabled' denotes that the BFD Process is
        active on at least one interface; 'disabled' disables
        it on all interfaces."
    DEFVAL { enabled }
    ::= { bfdScalarObjects 1 }

bfdSessNotificationsEnable 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 2 }

-- 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	BfdSessTypeTC,
bfdSessDiscriminator	Unsigned32,
bfdSessRemoteDiscr	Unsigned32,
bfdSessDestinationUdpPort	BfdCtrlDestPortNumberTC,
bfdSessSourceUdpPort	BfdCtrlSourcePortNumberTC,
bfdSessEchoSourceUdpPort	InetPortNumber,
bfdSessAdminStatus	INTEGER,
bfdSessState	BfdSessStateTC,
bfdSessRemoteHeardFlag	TruthValue,
bfdSessDiag	BfdDiagTC,
bfdSessOperMode	BfdSessOperModeTC,

```

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          BfdSessAuthenticationTypeTC,
bfdSessAuthenticationKeyID         Integer32,
bfdSessAuthenticationKey           BfdSessionAuthenticationKeyTC,
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."

```
 ::= { 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      BfdSessTypeTC
    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 {
 stop(1),
 start(2)
 }

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"A transition from 'stop' to 'start' will start the BFD state machine for the session. The state machine will have an initial state of down. A transition from 'start' to 'stop' will cause the BFD session to be brought down to adminDown(1). Care should be used in providing write access to this object without adequate authentication."

DEFVAL { 2 }
 ::= { bfdSessEntry 9 }

bfdSessState OBJECT-TYPE

SYNTAX BfdSessStateTC

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"BFD session state."

```
DEFVAL { 2 }
 ::= { bfdSessEntry 10 }
```

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."

DEFVAL { false }

::= { bfdSessEntry 11 }

bfdSessDiag OBJECT-TYPE

SYNTAX BfdDiagTC

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 12 }

bfdSessOperMode OBJECT-TYPE

SYNTAX BfdSessOperModeTC

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object specifies current operating mode that BFD session is operating in."

::= { bfdSessEntry 13 }

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 14 }
```

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 15 }
```

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 16 }
```

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 17 }
```

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. Only values unknown(0),
    ipv4(1), ipv6(2), or ipv6z(4) have to be supported.
```

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 18 }

bfdSessSrcAddr OBJECT-TYPE

SYNTAX InetAddress

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object specifies the source IP address of this BFD session."

::= { bfdSessEntry 19 }

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. Only values unknown(0), ipv4(1), ipv6(2), or ipv6z(4) have to be supported. 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 20 }

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."

::= { bfdSessEntry 21 }

bfdSessGTSM OBJECT-TYPE

SYNTAX TruthValue

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"Setting the value of this object to true(1) will enable 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 { false }

::= { bfdSessEntry 22 }

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 specifies the minimum allowed TTL for received BFD control packets. For singleHop(1) session, if GTSM protection is enabled, this object SHOULD be set to maximum TTL allowed for single hop. The value of zero(0) indicates that bfdSessGTSM is disabled."

REFERENCE

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

DEFVAL { 0 }

::= { bfdSessEntry 23 }

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, and should not be used."

REFERENCE

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

::= { bfdSessEntry 24 }

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 25 }

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 26 }

bfdSessDetectMult OBJECT-TYPE

SYNTAX BfdMultiplierTC

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object specifies the Detect time multiplier."

::= { bfdSessEntry 27 }

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 28 }

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 29 }

bfdSessNegotiatedDetectMult OBJECT-TYPE

SYNTAX BfdMultiplierTC

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object specifies the Detect time multiplier."

::= { bfdSessEntry 30 }

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 31 }

bfdSessAuthenticationType OBJECT-TYPE

SYNTAX BfdSessAuthenticationTypeTC

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. Value -1 indicates that no authentication is in use for this session."

REFERENCE

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

DEFVAL { -1 }

::= { bfdSessEntry 32 }

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.
    When bfdSessAuthPresFlag is false(2), then the value
    of this object MUST be -1.  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 33 }
```

bfdSessAuthenticationKey OBJECT-TYPE

```
SYNTAX      BfdSessionAuthenticationKeyTC
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 bfdSessAuthentication type 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 34 }
```

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 35 }
```

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 36 }

```

-- 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   BfdDiagTC,
    bfdSessPerfSessUpCount        Counter32,
    bfdSessPerfDiscTime           TimeStamp,

```

```
-- High Capacity Counters
bfdSessPerfCtrlPktInHC          Counter64,
bfdSessPerfCtrlPktOutHC         Counter64,
bfdSessPerfCtrlPktDropHC        Counter64,
bfdSessPerfEchoPktInHC          Counter64,
bfdSessPerfEchoPktOutHC         Counter64,
bfdSessPerfEchoPktDropHC        Counter64
}
```

-- Ed Note: should we add per-diag code counts here,

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 exists, 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 up event exists 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 such down event exist this object contains a zero value."

```
 ::= { bfdSessPerfEntry 10 }
```

bfdSessPerfLastCommLostDiag OBJECT-TYPE

SYNTAX BfdDiagTC

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The BFD diag code for the last time communication was lost with the neighbor. If no such down event exists 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 BfdSessIndexTC used in the bfdSessionTable."

```
::= { bfdObjects 4 }
```

```
bfdSessDiscMapEntry OBJECT-TYPE
```

```
SYNTAX BfdSessDiscMapEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS current
```

```
DESCRIPTION
```

"The BFD Session Discriminator Map Entry describes BFD session that is mapped to this BfdSessIndexTC."

```
INDEX { bfdSessDiscriminator }
```

```
::= { bfdSessDiscMapTable 1 }
```

```
BfdSessDiscMapEntry ::= SEQUENCE {
    bfdSessDiscMapIndex          BfdSessIndexTC,
    bfdSessDiscMapStorageType    StorageType,
    bfdSessDiscMapRowStatus      RowStatus
}
```

```
bfdSessDiscMapIndex OBJECT-TYPE
```

```
SYNTAX BfdSessIndexTC
```

```
MAX-ACCESS read-only
```

```
STATUS current
```

```
DESCRIPTION
```

"This object specifies the BfdSessIndexTC referred to by the indices of this row. In essence, a mapping is provided between these indexes and the BfdSessTable."

```
::= { bfdSessDiscMapEntry 1 }
```

```
bfdSessDiscMapStorageType 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."
 ::= { bfdSessDiscMapEntry 2 }

```

```

bfdSessDiscMapRowStatus 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
    bfdSessDiscMapRowStatus and bfdSessDiscMapStorageType."
 ::= { bfdSessDiscMapEntry 3 }

```

-- 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's BfdSessIndexTC used in
    the bfdSessionTable."
 ::= { bfdObjects 5 }

```

```

bfdSessIpMapEntry OBJECT-TYPE
SYNTAX BfdSessIpMapEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
    "The BFD Session IP Map Entry describes
    BFD session that is mapped to this BfdSessIndexTC."
INDEX {
    bfdSessInterface,
    bfdSessSrcAddrType,
    bfdSessSrcAddr,
    bfdSessDstAddrType,
    bfdSessDstAddr

```



```
    }
    ::= { bfdSessIpMapTable 1 }

BfdSessIpMapEntry ::= SEQUENCE {
    bfdSessIpMapIndex          BfdSessIndexTC,
    bfdSessIpMapStorageType    StorageType,
    bfdSessIpMapRowStatus      RowStatus
}

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 }

bfdSessIpMapStorageType 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."
    ::= { bfdSessIpMapEntry 2 }

bfdSessIpMapRowStatus 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
        bfdSessIpMapRowStatus and bfdSessIpMapStorageType."
    ::= { bfdSessIpMapEntry 3 }

-- 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 }

```

```

-- Ed Note: We need to add notification for changes
-- when the two ends automatically negotiate to a new detection time
-- value or when detection multiplier changes.

```

```

-- 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."

```

```

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."

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."

OBJECT       bfdSessDiscMapRowStatus
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."

OBJECT       bfdSessIpMapRowStatus
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."

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."

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."

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

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

OBJECT bfdSessIpMapStorageType
MIN-ACCESS read-only

```
DESCRIPTION  "Write access is not required."

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

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

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

```
bfdSessionGroup OBJECT-GROUP
OBJECTS {
    bfdAdminStatus,
    bfdSessNotificationsEnable,
    bfdSessVersionNumber,
    bfdSessType,
    bfdSessDiscriminator,
    bfdSessDestinationUdpPort,
    bfdSessSourceUdpPort,
    bfdSessEchoSourceUdpPort,
    bfdSessAdminStatus,
    bfdSessOperMode,
    bfdSessDemandModeDesiredFlag,
    bfdSessControlPlaneIndepFlag,
    bfdSessMultipointFlag,
    bfdSessInterface,
    bfdSessSrcAddrType,
    bfdSessSrcAddr,
    bfdSessDstAddrType,
    bfdSessDstAddr,
    bfdSessGTSM,
    bfdSessGTSMTTL,
    bfdSessDesiredMinTxInterval,
    bfdSessReqMinRxInterval,
    bfdSessReqMinEchoRxInterval,
    bfdSessDetectMult,
    bfdSessAuthPresFlag,
    bfdSessAuthenticationType,
    bfdSessAuthenticationKeyID,
    bfdSessAuthenticationKey,
    bfdSessStorageType,
    bfdSessRowStatus,
    bfdSessDiscMapStorageType,
    bfdSessDiscMapRowStatus,
    bfdSessIpMapStorageType,
    bfdSessIpMapRowStatus
}
```



```
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 bfdSessAdminStatus - Improper change of bfdSessAdminStatus, from start to stop, can cause significant disruption of the connectivity to those portions of the Internet reached via the applicable remote BFD peer.
- 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.

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 SHOULD be considered highly sensitive objects. In order for these sensitive information from being improperly accessed, implementers MAY wish to disallow read and create 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 these MIB modules.

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 }

[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.]

This document also requests IANA to manage the registry for the BfdDiagTC object.

8. References

8.1. Normative References

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Appendix A. Acknowledgments

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Authors' Addresses

Thomas D. Nadeau
Juniper Networks

EMail: tnadeau@juniper.net

Zafar Ali
Cisco Systems

EMail: zali@cisco.com

Nobo Akiya
Cisco Systems

EMail: nobo@cisco.com