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

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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"
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."
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
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
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
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
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
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
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

This notification is generated when the bfdSessDiag 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
}

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 the 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 {
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 bfdSessGTSMTTL
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) } 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,
    bfdSessGTS,
    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:
- 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.

- 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.

- 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:

- 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:

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>OBJECT IDENTIFIER value</th>
</tr>
</thead>
<tbody>
<tr>
<td>bfdMib</td>
<td>{ mib-2 XXX }</td>
</tr>
</tbody>
</table>

[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


8.2. Informative References


Appendix A. Acknowledgments

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