BFD Management Information Base
draft-ietf-bfd-mib-07

Status of this Memo

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

Internet-Drafts are working documents of the Internet Engineering
Task Force (IETF), its areas, and its working groups. Note that
other groups may also distribute working documents as Internet-
Drafts.

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

The list of current Internet-Drafts can be accessed at
http://www.ietf.org/ietf/1id-abstracts.txt.

The list of Internet-Draft Shadow Directories can be accessed at

This Internet-Draft will expire on October 28, 2009.

Copyright Notice

Copyright (c) 2009 IETF Trust and the persons identified as the
document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust’s Legal
Provisions Relating to IETF Documents in effect on the date of
publication of this document (http://trustee.ietf.org/license-info).
Please review these documents carefully, as they describe your rights
and restrictions with respect to this document.
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.

Table of Contents

1. Requirements notation ............................................. 3
2. The Internet-Standard Management Framework ....................... 3
3. Introduction .......................................................... 3
4. Terminology .......................................................... 3
5. Brief Description of MIB Objects ................................. 3
   5.1. General Variables .................................................. 4
   5.2. Session Table (bfdSessionTable) ................................. 4
   5.3. Session Performance Table (bfdSessionPerfTable) .............. 4
   5.4. BFD Session Discriminator Mapping Table
       (bfdSessDiscMapTable) ........................................... 4
   5.5. BFD Session IP Mapping Table (bfdSessIpMapTable) ........... 4
6. BFD MIB Module Definitions ........................................ 4
7. Security Considerations ............................................ 27
8. IANA Considerations ................................................ 29
9. References ............................................................ 29
   9.1. Normative References ............................................. 29
   9.2. Informative References .......................................... 30
Appendix A. Acknowledgments ........................................... 30
Authors’ Addresses ..................................................... 30
1. Requirements notation

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

2. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of [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, [RFC2578], STD 58, [RFC2579] and STD 58, [RFC2580].

3. 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 [BFD], [BFD-1HOP] and [BFD-MH], 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.

4. Terminology

This document adopts the definitions, acronyms and mechanisms described in [BFD], [BFD-1HOP] and [BFD-MH]. Unless otherwise stated, the mechanisms described therein will not be re-described here.

5. Brief Description of MIB Objects

This section describes objects pertaining to BFD. The MIB objects are derived from [BFD] and [BFD-MH].
5.1. General Variables

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

5.2. Session Table (bfdSessionTable)

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

5.3. Session Performance Table (bfdSessionPerfTable)

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

5.4. BFD Session Discriminator Mapping Table (bfdSessDiscMapTable)

The BFD Session Discriminator Mapping Table maps a local discriminator value to associated BFD sessions’ BfdSessIndexTC used in the bfdSessionTable.

5.5. BFD Session IP Mapping Table (bfdSessIpMapTable)

The BFD Session IP Mapping Table maps, given bfdSessInterface, bfdSessAddrType, and bfdSessAddr, to an associated BFD sessions’ BfdSessIndexTC used in the bfdSessionTable. This table SHOULD contain those BFD sessions are of IP type.

6. 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

   TEXTUAL-CONVENTION, 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;

bfdMib MODULE-IDENTITY
    LAST-UPDATED "200904261200Z" -- 26 April 2009 12:00:00 EST
    ORGANIZATION "IETF Bidirectional Forwarding Detection
                   Working Group"
    CONTACT-INFO
    "Thomas D. Nadeau
     BT
     Email: tom.nadeau@bt.com

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

    Nobo Akiya
    Cisco Systems, G.K.
    Email: nobo@cisco.com"
    DESCRIPTION
    "Bidirectional Forwarding Management Information Base."
    REVISION "200904261200Z" -- 26 April 2009 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 }

    -- Textual Conventions
    BfdSessIndexTC ::= TEXTUAL-CONVENTION
    DISPLAY-HINT "d"
    STATUS current
An index used to uniquely identify BFD sessions.
SYNTAX Unsigned32 (1..4294967295)

BfdInterval ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS current
DESCRIPTION "The BFD interval delay in microseconds."
SYNTAX Unsigned32 (0..4294967295)

BfdMultiplier ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS current
DESCRIPTION "The BFD failure detection multiplier."
SYNTAX Unsigned32 (1..255)

BfdDiag ::= TEXTUAL-CONVENTION
STATUS current
DESCRIPTION "A common BFD diagnostic code."
SYNTAX INTEGER {
    noDiagnostic(0),
    controlDetectionTimeExpired(1),
    echoFunctionFailed(2),
    neighborSignaledSessionDown(3),
    forwardingPlaneReset(4),
    pathDown(5),
    concatenatedPathDown(6),
    administrativelyDown(7),
    reverseConcatenatedPathDown(8)
}

-- 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 router."
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
"BFD Version 0 (draft-katz-ward-bfd-02.txt) and BFD Version 1 (draft-ietf-bfd-base-08.txt)"
 ::= { 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 INTEGER,
bfdSessMultiHopUniLinkMode INTEGER,
bfdSessDiscriminator Unsigned32,
bfdSessRemoteDiscr Unsigned32,
bfdSessDestinationUdpPort InetPortNumber,
bfdSessSourceUdpPort InetPortNumber,
bfdSessEchoSourceUdpPort InetPortNumber,
bfdSessAdminStatus INTEGER,
bfdSessState INTEGER,
bfdSessRemoteHeardFlag TruthValue,
bfdSessDiag BfdDiag,
bfdSessOperMode INTEGER,
bfdSessDemandModeDesiredFlag TruthValue,
bfdSessControlPlaneIndepFlag TruthValue,
bfdSessInterface InterfaceIndexOrZero,
bfdSessAddrType InetAddressType,
bfdSessAddr InetAddress,
bfdSessGTSM TruthValue,
bfdSessGTSMTTL Unsigned32,
bfdSessDesiredMinTxInterval BfdInterval,
bfdSessReqMinRxInterval BfdInterval,
bfdSessReqMinEchoRxInterval BfdInterval,
bfdSessDetectMult BfdMultiplier,
bfdSessNegotiatedInterval BfdInterval,
bfdSessNegotiatedEchoInterval BfdInterval,
bfdSessNegotiatedDetectMult BfdMultiplier,
bfdSessAuthPresFlag TruthValue,
bfdSessAuthenticationType INTEGER,
bfdSessAuthenticationKeyId Integer32,
bfdSessAuthenticationKey OCTET STRING,
bfdSessStorType 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
"BFD Version 0 (draft-katz-ward-bfd-02.txt) and BFD Version 1 (draft-ietf-bfd-base-08.txt)"
DEFVAL { 1 }
::= { bfdSessEntry 2 }

bfdSessType OBJECT-TYPE
SYNTAX INTEGER {
    singleHop(1),
    multiHopTotallyArbitraryPaths(2),
    multiHopOutOfBandSignaling(3),
    multiHopUnidirectionalLinks(4)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION "This object specifies the type of this BFD session."
REFERENCE
"draft-ietf-bfd-v4v6-1hop-08 and draft-ietf-bfd-multihop-06"
::= { bfdSessEntry 3 }

bfdSessMultiHopUniLinkMode OBJECT-TYPE
SYNTAX INTEGER {
    none(1),
    active(2),
    passive(3)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION "For bfdSessType of multiHopUnidirectionalLinks(4), this object specifies whether this BFD session is running in active(2) mode or passive(3) mode. For all other BFD bfdSessType BFD sessions, none(1) MUST be specified."
REFERENCE
"draft-ietf-bfd-multihop-06, Section 3.3"
::= { bfdSessEntry 4 }

bfdSessDiscriminator OBJECT-TYPE
SYNTAX Unsigned32 (1..4294967295)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object specifies the local discriminator for this BFD session, used to uniquely identify it."
 ::= { bfdSessEntry 5 }

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
"draft-ietf-bfd-base-08, Section 6.8.6."
 ::= { bfdSessEntry 6 }

bfdSessDestinationUdpPort OBJECT-TYPE
SYNTAX    InetPortNumber
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"This object specifies the destination UDP port used for this BFD session. The value maybe zero(0) if the session is in adminDown(1) state."
REFERENCE
"Port 3784 (draft-ietf-bfd-v4v6-1hop-08),
Port 3785 (draft-ietf-bfd-v4v6-1hop-08), and
Port 4784 (draft-ietf-bfd-multihop-06)"
DEFVAL { 0 }
 ::= { bfdSessEntry 7 }

bfdSessSourceUdpPort OBJECT-TYPE
SYNTAX    InetPortNumber
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"This object specifies the source UDP port of BFD control packets for this BFD session. The value maybe zero(0) if the session is in adminDown(1) state."
REFERENCE
"draft-ietf-bfd-v4v6-1hop-08 and
draft-ietf-bfd-multihop-06"
DEFVAL { 0 }
 ::= { bfdSessEntry 8 }

bfdSessEchoSourceUdpPort OBJECT-TYPE
SYNTAX     InetPortNumber
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"This object specifies the source UDP port of BFD echo packets for this BFD session. The value maybe zero(0) if the session is not running in the echo mode, or the session is in adminDown(1) state."
REFERENCE
"draft-ietf-bfd-v4v6-1hop-08" and "draft-ietf-bfd-multihop-06"
DEFVAL { 0 }
::= { bfdSessEntry 9 }

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 10 }

bfdSessState OBJECT-TYPE
SYNTAX     INTEGER {
            adminDown(1),
            down(2),
            init(3),
            up(4),
            failing(5)
        }
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The perceived state of the BFD session. BFD State failing(5) is only applicable if this BFD session is running version 0. Upon creation of a new BFD session via this MIB, the
suggested initial state is down(2)."
DEFVAL { 2 }
::= { bfdSessEntry 11 }

bfdSessRemoteHeardFlag OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION "This object specifies status of BFD packet reception from
the remote system. Specifically, it is set to true(1) if
the local system is actively receiving BFD packets from the
remote system, and is set to false(2) if the local system
has not received BFD packets recently (within the detection
time) or if the local system is attempting to tear down
the BFD session."
REFERENCE
"BFD Version 0 (draft-katz-ward-bfd-02.txt) and
BFD Version 1 (draft-ietf-bfd-base-08.txt)"
DEFVAL { false }
::= { bfdSessEntry 12 }

bfdSessDiag OBJECT-TYPE
SYNTAX BfdDiag
MAX-ACCESS accessible-for-notify
STATUS current
DESCRIPTION "A diagnostic code specifying the local system’s reason
for the last transition of the session from up(4)
to some other state."
::= { bfdSessEntry 13 }

bfdSessOperMode OBJECT-TYPE
SYNTAX INTEGER {
  asyncModeWEchoFun(1),
  asyncModeWOEchoFun(2),
  demandModeWEchoFunction(3),
  demandModeWOEchoFunction(4)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION "This object specifies current operating mode that BFD
session is operating in."
::= { bfdSessEntry 14 }

bfdSessDemandModeDesiredFlag OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This object indicates that the local system’s desire to use Demand mode. Specifically, it is set to true(1) if the local system wishes to use Demand mode or false(2) if not"
DEFVAL { false }
::= { bfdSessEntry 15 }

bfdSessControlPlaneIndepFlag OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object indicates that the local system’s ability to continue to function through a disruption of the control plane. Specifically, it is set to true(1) if the local system BFD implementation is independent of the control plane. Otherwise, the value is set to false(2)"
DEFVAL { false }
::= { bfdSessEntry 16 }

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 }

bfdSessAddrType 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. A value of unknown(0) is allowed only when 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 18 }

bfdSessAddr 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. It can also be used to enabled BFD on a specific interface. The value is set to zero when BFD session is not associated with a specific interface."

 ::= { bfdSessEntry 19 }

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
draft-ietf-bfd-v4v6-1hop-08, Sec. 5"
DEFVAL { false }

 ::= { bfdSessEntry 20 }

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."

REFERENCE
draft-ietf-bfd-v4v6-1hop-08, Sec. 5"
DEFVAL { 0 } ::= { bfdSessEntry 21 }

bfdSessDesiredMinTxInterval OBJECT-TYPE
SYNTAX BfdInterval
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."
 ::= { bfdSessEntry 22 }

bfdSessReqMinRxInterval OBJECT-TYPE
SYNTAX BfdInterval
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."
 ::= { bfdSessEntry 23 }

bfdSessReqMinEchoRxInterval OBJECT-TYPE
SYNTAX BfdInterval
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."
 ::= { bfdSessEntry 24 }

bfdSessDetectMult OBJECT-TYPE
SYNTAX BfdMultiplier
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This object specifies the Detect time multiplier."
 ::= { bfdSessEntry 25 }

bfdSessNegotiatedInterval OBJECT-TYPE
SYNTAX BfdInterval
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 26 }

bfdSessNegotiatedEchoInterval OBJECT-TYPE
SYNTAX BfdInterval
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 27 }

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

bfdSessAuthPresFlag OBJECT-TYPE
SYNTAX TruthValue
MAX-ACCESS read-only
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
"draft-ietf-bfd-base-08, Sections 4.2 - 4.4"
DEFVAL { false }
::= { bfdSessEntry 29 }

bfdSessAuthenticationType OBJECT-TYPE
SYNTAX INTEGER {
  reserved(0),
  simplePassword(1),
  keyedMD5(2),
  meticulousKeyedMD5(3),
  keyedSHA1(4),
  meticulousKeyedSHA1(5)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The Authentication Type used for this BFD session. This field is valid only when the Authentication Present bit is set."

REFERENCE
"draft-ietf-bfd-base-08, Sections 4.2 - 4.4"

:= { bfdSessEntry 30 }

bfdSessAuthenticationKeyID OBJECT-TYPE
SYNTAX Integer32 (-1 | 0..255)
MAX-ACCESS read-only
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
"draft-ietf-bfd-base-08, Sections 4.2 - 4.4"

DEFVAL { -1 }

:= { bfdSessEntry 31 }

bfdSessAuthenticationKey OBJECT-TYPE
SYNTAX OCTET STRING (SIZE (0..252))
MAX-ACCESS read-only
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
"draft-ietf-bfd-base-08, Sections 4.2 - 4.4"

:= { bfdSessEntry 32 }

bfdSessStorType 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 33 }

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 34 }

-- 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. bfdCounterDiscontinuityTime is used to
indicate potential discontinuity for all counter objects
in this table."
AUGMENTS    { bfdSessEntry }
::= { bfdSessPerfTable 1 }

BfdSessPerfEntry ::= SEQUENCE {
   bfdSessPerfPktIn               Counter32,
   bfdSessPerfPktOut              Counter32,
   bfdSessUpTime                  TimeStamp,
   bfdSessPerfLastSessDownTime    TimeStamp,
   bfdSessPerfLastCommLostDiag    BfdDiag,
   bfdSessPerfSessUpCount         Counter32,
   bfdSessPerfDiscTime            TimeStamp,

   -- High Capacity Counters

...
bfdSessPerfPktInHC Counter64,  
bfdSessPerfPktOutHC Counter64  
}

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

bfdSessPerfPktIn OBJECT-TYPE  
SYNTAX Counter32  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"The total number of BFD messages received for this BFD  
session."  
::= { bfdSessPerfEntry 1 }

bfdSessPerfPktOut OBJECT-TYPE  
SYNTAX Counter32  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION  
"The total number of BFD messages sent for this BFD  
session."  
::= { bfdSessPerfEntry 2 }

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 3 }

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 4 }

bfdSessPerfLastCommLostDiag OBJECT-TYPE  
SYNTAX BfdDiag  
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 5 }

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 6 }

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 7 }

bfdSessPerfPktInHC OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION "This value represents the total number of BFD messages received for this BFD session. It MUST be equal to the least significant 32 bits of bfdSessPerfPktIn if bfdSessPerfPktInHC is supported according to the rules spelled out in RFC2863."
 ::= { bfdSessPerfEntry 8 }

bfdSessPerfPktOutHC OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
This value represents the total number of total number of BFD messages transmitted for this BFD session. It MUST be equal to the least significant 32 bits of bfdSessPerfPktIn if bfdSessPerfPktOutHC is supported according to the rules spelled out in RFC2863.

 ::= { bfdSessPerfEntry 9 }

-- 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 sessions’ 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
}

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

-- BFD Session IP Mapping Table

bfdSessIpMapTable OBJECT-TYPE
SYNTAX SEQUENCE OF BfdSessIpMapEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The BFD Session IP Mapping Table maps given bfdSessInterface, bfdSessAddrType, and bfdSessAddr to an associated BFD sessions’ BfdSessIndexTC used in the bfdSessionTable. This table SHOULD contains those BFD sessions of singleHop(1) type."
 ::= { 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,
  bfdSessAddrType,
  bfdSessAddr
}
 ::= { bfdSessIpMapTable 1 } 

BfdSessIpMapEntry ::= SEQUENCE {
  bfdSessIpMapIndex BfdSessIndexTC
}

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

-- Notification Configuration

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

::= { bfdNotifications 1 }

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

::= { bfdNotifications 2 }
-- 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.
-- Similarly, changes in the operating mode (bfdSessOperMode)
-- also need to be notified.

-- 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 BFD-MIB. Such devices can
                  then be monitored and also be configured using
                  this MIB module."
    MODULE -- This module.
    MANDATORY-GROUPS {
        bfdSessionGroup,
        bfdSessionReadOnlyGroup,
        bfdSessionPerfGroup,
        bfdSessionPerfHCGroup,
        bfdNotificationGroup
    }

GROUP bfdSessionPerfHCGroup
    DESCRIPTION "This group is mandatory for those bfdPerfTable
                  entries for which any of the objects
                  bfdSessPerfPktInHC or bfdSessPerfPktOutHC
                  wraps around too quickly
                  based on the criteria specified in RFC 2863 for
                  high-capacity counters."

GROUP bfdNotificationGroup
    DESCRIPTION "This group is only mandatory for those
                  implementations which can efficiently implement
                  the notifications contained in this group."

OBJECT bfdSessAddrType
    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 bfdSessAddr
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."

::= { bfdCompliances 1 }

-- Units of conformance.

bfdSessionGroup OBJECT-GROUP
OBJECTS {
  bfdSessNotificationsEnable,
  bfdAdminStatus,
  bfdSessVersionNumber,
  bfdSessSourceUdpPort,
  bfdSessEchoSourceUdpPort,
  bfdSessAdminStatus,
  bfdSessDiag,
  bfdSessDemandModeDesiredFlag,
  bfdSessInterface,
  bfdSessAddrType,
  bfdSessAddr,
  bfdSessGTSM,
  bfdSessGTSMTTL,
  bfdSessDesiredMinTxInterval,
  bfdSessReqMinRxInterval,
  bfdSessReqMinEchoRxInterval,
  bfdSessDetectMult,
  bfdSessStorType,
  bfdSessRowStatus
}

STATUS current

DESCRIPTION "Collection of objects needed for BFD sessions."
::= { bfdGroups 1 }

bfdSessionReadOnlyGroup OBJECT-GROUP
OBJECTS {
  bfdSessType,
  bfdSessMultiHopUniLinkMode,
  bfdSessDiscriminator,
  bfdSessRemoteDiscr,
bfdSessDestinationUdpPort,
bfdSessState,
bfdSessRemoteHeardFlag,
bfdSessOperMode,
bfdSessControlPlaneIndepFlag,
bfdSessNegotiatedInterval,
bfdSessNegotiatedEchoInterval,
bfdSessNegotiatedDetectMult,
bfdSessAuthPresFlag,
bfdSessAuthenticationType,
bfdSessAuthenticationKeyId,
bfdSessAuthenticationKey,
bfdSessDiscMapIndex,
bfdSessIpMapIndex

}\n
STATUS current
DESCRIPTION
"Collection of read-only objects needed for BFD sessions."
 ::= { bfdGroups 2 }

bfdSessionPerfGroup OBJECT-GROUP
OBJECTS {
  bfdSessPerfPktIn,
  bfdSessPerfPktOut,
  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 {
  bfdSessPerfPktInHC,
  bfdSessPerfPktOutHC
}
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 }

7. 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, implementors MAY wish to disallow read 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.

8. 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 BfdDiag object.

9. References

9.1. Normative References


9.2. Informative References


Appendix A. Acknowledgments

We would like to thank David Ward, Jeffrey Haas, Reshad Rahman, David Toscano, Sylvain Masse, Mark Tooker, and Kiran Koushik Agrahara Sreenivasa for their comments and suggestions.

Authors’ Addresses

Thomas D. Nadeau
BT
BT Centre
81 Newgate Street
London  EC1A 7AJ
United Kingdom

Email: tom.nadeau@bt.com
Zafar Ali
Cisco Systems, Inc.
2000 Innovation Drive
Kanata, Ontario K2K 3E8
Canada

Email: zali@cisco.com

Nobo Akiya
Cisco Systems G.K.
Shinjuku Mitsui Building
2-1-1 Nishi-Shinjuku, Shinjuku-Ku
Tokyo 163-0409
Japan

Email: nobo@cisco.com