BFD Management Information Base
draft-ietf-bfd-mib-05

Status of this Memo

By submitting this Internet-Draft, each author represents that any applicable patent or other IPR claims of which he or she is aware have been or will be disclosed, and any of which he or she becomes aware will be disclosed, in accordance with Section 6 of 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 http://www.ietf.org/shadow.html.

This Internet-Draft will expire on February 5, 2009.

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 .............................................. 26
8. IANA Considerations .................................................. 28
9. References ............................................................ 29
  9.1. Normative References .............................................. 29
  9.2. Informative References .......................................... 29
Appendix A. Acknowledgments ............................................ 30
Authors’ Addresses ...................................................... 30
Intellectual Property and Copyright Statements .......................... 31
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] and [BFD-MH], BFD versions 0 and/or 1, on devices supporting this feature.

-- Ed Note: TBA, support for [BFD-LSP].

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-MH] and [BFD-LSP]. 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 contains 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 "200808041200Z" -- 4 August 2008 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 "200808041200Z" -- 4 August 2008 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

BfdsSessIndexTC ::= TEXTUAL-CONVENTION
DISPLAY-HINT "d"
STATUS current
DESCRIPTION
"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)

BfdDiag ::= TEXTUAL-CONVENTION
STATUS current
DESCRIPTION
"A common BFD diagnostic code."
SYNTAX INTEGER {
  noDiagnostic(1),
  controlDetectionTimeExpired(2),
  echoFunctionFailed(3),
  neighborSignaledSessionDown(4),
  forwardingPlaneReset(5),
  pathDown(6),
  concatenatedPathDown(7),
  administrativelyDown(8),
  reverseConcatenatedPathDown(9)
}

-- 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, 
  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 Unsigned32,
bfdSessNegotiatedInterval BfdInterval,
bfdSessNegotiatedEchoInterval BfdInterval,
bfdSessNegotiatedDetectMult Unsigned32,
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),
   multiHop(2)
} MAX-ACCESS read-only
STATUS current
DESCRIPTION "The type of this BFD session."
 ::= { bfdSessEntry 3 }

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 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 "draft-ietf-bfd-base-08, Section 6.8.6."
 ::= { bfdSessEntry 5 }

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 6 }

bfdSessSourceUdpPort OBJECT-TYPE
 SYNNTAX 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 7 }

bfdSessEchoSourceUdpPort OBJECT-TYPE
 SYNNTAX 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 8 }

bfdSessAdminStatus OBJECT-TYPE
 SYNNTAX 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 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 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
"BFD Version 0 (draft-katz-ward-bfd-02.txt) and BFD Version 1
draft-ietf-bfd-base-08.txt"
DEFVAL { false }
 ::= { bfdSessEntry 11 }

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 12 }

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 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-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 15 }

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 16 }

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 17 }

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 18 }

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
"RFC 5082 - The Generalized TTL Security Mechanism (GTSM)."
draft-ietf-bfd-v4v6-1hop-08, Sec. 5"
DEFVAL { false }
 ::= { bfdSessEntry 19 }

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 20 }

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 21 }

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 22 }

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 23 }

bfdSessDetectMult OBJECT-TYPE
SYNTAX     Unsigned32
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
   "This object specifies the Detect time multiplier."
 ::= { bfdSessEntry 24 }

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 25 }

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 26 }

bfdSessNegotiatedDetectMult OBJECT-TYPE
SYNTAX     Unsigned32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
   "This object specifies the Detect time multiplier."
 ::= { bfdSessEntry 27 }

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
bfxSessAuthenticationType OBJECT-TYPE
SYNTAX INTEGER {
  reserved(0),
  simplePassword(1),
  keyedMD5(2),
  meticulousKeyedMD5(3),
  keyedSHA1(4),
  meticulousKeyedSHA1(5)
}
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."
REFERENCE
"draft-ietf-bfd-base-08, Sections 4.2 - 4.4"
::= { bfxSessEntry 28 }

bfxSessAuthenticationKeyID 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 bfxSessAuthPresFlag 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 }
::= { bfxSessEntry 29 }

bfxSessAuthenticationKey OBJECT-TYPE
SYNTAX OCTET STRING (SIZE (0..252))
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.

Implementations may further restrict the length of this key. When doing so, a SET of this object should return tooBig.

Note that due to the highly sensitive nature of the data managed by this object an implementation may choose to implement this object as 'write-only'. SET operations will succeed normally but GET and GET-BULK operations are permitted to return noSuchName."
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
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
DESCRIPTION
"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 are of IP type: SingleHop(1) and
MultiHop(2)."
::= { 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,
bfdSessAuthPresFlag,
bfdSessAuthenticationType,
bfdSessAuthenticationKeyId,
bfdSessAuthenticationKey
}

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

bfdSessionReadOnlyGroup OBJECT-GROUP
OBJECTS {
   bfdSessType,
bfdSessDiscriminator,
bfdSessRemoteDiscr,
bfdSessDestinationUdpPort,
bfdSessState,
bfdSessRemoteHeardFlag,
bfdSessOperMode,
bfdSessControlPlaneIndepFlag,
bfdSessNegotiatedInterval,
bfdSessNegotiatedEchoInterval,
bfdSessNegotiatedDetectMult,
bfdSessDiscMapIndex,
bfdSessIpMapIndex
}

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 }

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

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 allow only write-only access to these objects. Even in such case, SET operations SHOULD be performed with security features.

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 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