

Network Working Group
INTERNET-DRAFT
Intended Status: Standards Track
Expires: June 04, 2016

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December 02, 2015

BFD Management Information Base (MIB) extensions
for MPLS and MPLS-TP Networks
draft-ietf-bfd-mpls-mib-07

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 extends the BFD Management Information Base and describes the managed objects for modeling Bidirectional Forwarding Detection (BFD) protocol for MPLS and MPLS-TP networks.

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BFD Extensions for MPLS MIB

December 02, 2015

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1 Introduction

The current MIB for BFD as defined by [[RFC7331](#)] is used for neighbor monitoring in IP networks. The BFD session association to the neighbors being monitored is done using the source and destination IP addresses of the neighbors configured using the respective MIB objects.

To monitor MPLS/MPLS-TP paths like tunnels or Pseudowires, there is a necessity to identify or associate the BFD session to those paths.

This memo defines an portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it extends the BFD Management Information Base [[RFC7331](#)] and describes the managed objects to configure and/or monitor Bidirectional Forwarding Detection (BFD) protocol for MPLS [[RFC5884](#)] and MPLS-TP networks [[RFC6428](#)].

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](#) [[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 STD58, [RFC2580](#).

3. Overview

3.1 Conventions used in this document

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 [RFC-2119](#) [[RFC2119](#)].

[3.2](#) Terminology

This document adopts the definitions, acronyms and mechanisms described in [[RFC5880](#)], [[RFC5881](#)], [[RFC5883](#)], [[RFC7130](#)], [[RFC5884](#)], and [[RFC6428](#)]. Unless otherwise stated, the mechanisms described therein will not be re-described here.

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[4.](#) Acronyms

BFD: Bidirectional Forwarding Detection
CC: Continuity Check
CV: Connectivity Verification
IP: Internet Protocol
LDP: Label Distribution Protocol
LOC: Loss Of Continuity
LSP: Label Switching Path
LSR: Label Switching Router
ME: Maintenance Entity
MEG: Maintenance Entity Group
MEP: Maintenance Entity End-Point
MIP: Maintenance Entity Group Intermediate Point
MIB: Management Information Base
MPLS: Multi-Protocol Label Switching
MPLS-TP: MPLS Transport Profile
OAM: Operations, Administration, and Maintenance
PW: Pseudo Wire
RDI: Remote Defect Indication
TE: Traffic Engineering
TP: Transport Profile

[5.](#) Brief description of MIB Objects

The objects described in this section support the functionality described in documents [[RFC5884](#)] and [[RFC6428](#)]. The objects are defined as an extension to the BFD base MIB defined by [[RFC7331](#)].

[5.1](#). Extensions to the BFD session table (bfdSessTable)

The BFD session table used to identify a BFD session between a pair of nodes, as defined in [[RFC7331](#)], is extended with managed objects to achieve the required functionality in MPLS and MPLS-TP networks as described below:

1. SessionRole - Active/Passive role specification for the BFD session configured on the node. Either end of a BFD session can be configured as Active/Passive to determine which end starts transmitting the BFD control packets.
2. SessionMode - Defines the mode in which BFD session is running, defined as below:
 - i. CC - Indicates Continuity Check and RDI operations.
 - ii. CV - Indicates Continuity Check, Connectivity Verification and RDI operations.

3. Timer Negotiation Flag - Provides for timer negotiation to be enabled or disabled. This object can be used to tune the detection of period mis-configuration.
4. Map Type - Indicates the type of the path being monitored by the BFD session.
This object can take the following values:

For BFD session over MPLS based paths:

- nonTeIpv4 (1) - BFD session configured for Non-TE
IPv4 path
- nonTeIpv6 (2) - BFD session configured for Non-TE
IPv6 path
- teIpv4 (3) - BFD session configured for a TE
IPv4 path
- teIpv6 (4) - BFD session configured for a TE
IPv6 path
- pw (5) - BFD session configured for a pseudowire

For MPLS-TP based paths:

mep (6) - BFD session configured for an MPLS-TP path (Bidirectional tunnel, PW or Sections) will map to the corresponding maintenance entity.

5. Map Pointer

A Row Pointer object which can be used to point to the first accessible object in the respective instance of the table entry identifying the path being monitored (mplsXCEntry[RFC3813]/mplsTunnelEntry[RFC3812]/pwEntry[RFC5601] respectively for LSP/Tunnel/PW).

For NON-TE LSP, the map pointer points to the corresponding mplsXCEntry.

For TE based tunnel, the map pointer points to the corresponding instance of the mplsTunnelEntry.

For PW, this object points to the corresponding instance of pwEntry.

For MPLS-TP paths, this object points to the corresponding instance of mplsOamIdMeEntry[MPLS-OAM-ID-STD-MIB] configured to monitor the MPLS-TP path associated with the BFD session.

6. Usage of existing object bfdSessType:

Additionally existing object "bfdSessType" in the BFD base MIB [[RFC7331](#)] can be used with the already defined value multiHopOutOfBandSignaling(3) to specify an OOB (Out of band) mechanism [E.g. LSP Ping] for bootstrapping the BFD session.

[5.2](#). Example of BFD session configuration

This section provides an example of BFD session configuration for an MPLS and MPLS-TP TE tunnel. This example is only meant to enable an understanding of the proposed extension and does not illustrate every permutation of the MIB.

[5.2.1](#) Example of BFD Session configuration for MPLS TE tunnel

This section provides an example BFD session configuration for an MPLS TE tunnel.

The following denotes the configured tunnel "head" entry:

```
In mplsTunnelTable:
{
  mplsTunnelIndex          = 100,
  mplsTunnelInstance       = 1,
  mplsTunnelIngressLSRId   = 192.0.2.1,
  mplsTunnelEgressLSRId    = 192.0.2.3,
  mplsTunnelName           = "Tunnel",
  ...
  mplsTunnelSignallingProto = none (1),
  mplsTunnelSetupPrio       = 0,
  mplsTunnelHoldingPrio     = 0,
  mplsTunnelSessionAttributes = 0,
  mplsTunnelLocalProtectInUse = false (0),
  mplsTunnelResourcePointer  = mplsTunnelResourceMaxRate.5,
  mplsTunnelInstancePriority = 1,
  mplsTunnelHopTableIndex   = 1,
  mplsTunnelIncludeAnyAffinity = 0,
  mplsTunnelIncludeAllAffinity = 0,
  mplsTunnelExcludeAnyAffinity = 0,
  mplsTunnelPathInUse       = 1,
  mplsTunnelRole            = head (1),
  ...
  mplsTunnelRowStatus       = Active
}
```

BFD session parameters used to monitor this tunnel should be configured on head-end as follows:

```
In bfdSessTable:
BfdSessEntry ::= SEQUENCE {
  -- BFD session index
  bfdSessIndex          = 2,
  bfdSessVersionNumber  = 1,
  -- LSP Ping used for OOB bootstrapping
  bfdSessType = multiHopOutOfBandSignaling,
  ...
}
```

```

bfdSessAdminStatus          = start,
...
bfdSessDemandModeDesiredFlag = false,
bfdSessControlPlaneIndepFlag = false,
bfdSessMultipointFlag       = false,
bfdSessDesiredMinTxInterval  = 100000,
bfdSessReqMinRxInterval     = 100000,
...
-- Indicates that the BFD session is to monitor
-- an MPLS TE tunnel
bfdMplsSessMapType          = teIpv4(3),

-- OID of the first accessible object (mplsTunnelName) of
-- the mplsTunnelEntry identifying the MPLS TE tunnel (being
-- monitored using BFD) in the MPLS tunnel table.
-- A value of zeroDotzero indicates that no association
-- has been made as yet between the BFD session and the path
-- being monitored.
-- In the above OID example:
-- 100 -> Tunnel Index
-- 1 -> Tunnel instance
-- 3221225985 -> Ingress LSR Id 192.0.2.1
-- 3221225987 -> Egress LSR Id 192.0.2.3
bfdMplsSessMapPointer
    = mplsTunnelName.100.1.3221225985.3221225987,
bfdSessRowStatus            = createAndGo
}

```

Similarly, the BFD session would be configured on the tail-end of the tunnel. Creating the above row will trigger the bootstrapping of the session using LSP Ping and its subsequent establishment over the path by de-multiplexing of the control packets using the BFD session discriminators.

[5.2.2](#) Example of BFD Session configuration for ME of MPLS-TP TE tunnel

This example considers the OAM identifiers configuration on a head-end LSR to manage and monitor a co-routed bidirectional MPLS tunnel.

Only relevant objects which are applicable for IP based OAM

identifiers of co-routed MPLS tunnel are illustrated here.

In mplsOamIdMegTable:

```
{
  -- MEG index (Index to the table)
  mplsOamIdMegIndex          = 1,
  mplsOamIdMegName           = "MEG1",
  mplsOamIdMegOperatorType   = ipCompatible (1),
  mplsOamIdMegServiceType    = lsp (1),
  mplsOamIdMegMpLocation     = perNode(1),
  -- Mandatory parameters needed to activate the row go here
  mplsOamIdMegRowStatus      = createAndGo (4)
}
```

This will create an entry in the mplsOamIdMegTable to manage and monitor the MPLS tunnel.

The following ME table is used to associate the path information to a MEG.

In mplsOamIdMeTable:

```
{
  -- ME index (Index to the table)
  mplsOamIdMeIndex          = 1,
  -- MP index (Index to the table)
  mplsOamIdMeMpIndex        = 1,
  mplsOamIdMeName           = "ME1",
  mplsOamIdMeMpIfIndex      = 0,
  -- Source MEP id is derived from the IP compatible MPLS tunnel
  mplsOamIdMeSourceMepIndex = 0,
  -- Source MEP id is derived from the IP compatible MPLS tunnel
  mplsOamIdMeSinkMepIndex   = 0,
  mplsOamIdMeMpType         = mep (1),
  mplsOamIdMeMepDirection   = down (2),
  mplsOamIdMeProactiveOamPhbTCValue = 0,
  mplsOamIdMeOnDemandOamPhbTCValue = 0,
  -- RowPointer MUST point to the first accessible column of an
  -- MPLS tunnel
  mplsOamIdMeServicePointer = mplsTunnelName.1.1.1.2,
  -- Mandatory parameters needed to activate the row go here
  mplsOamIdMeRowStatus      = createAndGo (4)
}
```

BFD session parameters used to monitor this tunnel should be configured on head-end as follows:

In bfdSessTable:

```
BfdSessEntry ::= SEQUENCE {
```

```
-- BFD session index
bfdSessIndex                = 2,
bfdSessVersionNumber        = 1,
-- LSP Ping used for OOB bootstrapping
bfdSessType = multiHopOutOfBandSignaling,
...
bfdSessAdminStatus          = start,
...
bfdSessDemandModeDesiredFlag = false,
bfdSessControlPlaneIndepFlag = false,
bfdSessMultipointFlag        = false,
bfdSessDesiredMinTxInterval  = 100000,
bfdSessReqMinRxInterval      = 100000,
...
-- Indicates that the BFD session is to monitor
-- a ME of an MPLS-TP TE tunnel
bfdMplsSessMapType           = mep(6),

bfdMplsSessMapPointer
    = mplsOamIdMeName.1.1.1,
bfdSessRowStatus              = createAndGo
}
```

Similarly, the BFD session would be configured on the tail-end of the tunnel and creating the above row will trigger the bootstrapping of the session using LSP Ping and its subsequent establishment over the path by de-multiplexing of the control packets using the BFD session discriminators.

[5.3](#). BFD objects for session performance counters

[RFC7331] defines BFD Session Performance Table (bfdSessPerfTable), for collecting per-session BFD performance counters, as an extension to the bfdSessTable.

The bfdSessPerfTable is extended with the performance counters to collect Mis-connectivity Defect, Loss of Continuity Defect and RDI (Remote Defect Indication) counters.

1. bfdMplsSessPerfMisDefCount - Mis-connectivity defect count for this BFD session.
2. bfdMplsSessPerfLocDefCount - Loss of continuity defect count for this BFD session.
3. bfdMplsSessPerfRdiInCount - Total number of RDI messages received for this BFD session.
4. bfdMplsSessPerfRdiOutCount - Total number of RDI messages sent

6. BFD-EXT-STD-MIB Module Definition

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

IMPORTS

MODULE-IDENTITY, OBJECT-TYPE, mib-2,
Counter32, zeroDotZero
FROM SNMPv2-SMI -- [[RFC2578](#)]

RowPointer, TruthValue, TEXTUAL-CONVENTION
FROM SNMPv2-TC -- [[RFC2579](#)]

MODULE-COMPLIANCE, OBJECT-GROUP
FROM SNMPv2-CONF -- [[RFC2580](#)]

bfdSessIndex
FROM BFD-STD-MIB; -- [[RFC7331](#)]

bfdMplsMib MODULE-IDENTITY
LAST-UPDATED "201504190000Z" -- April 19, 2015
ORGANIZATION "IETF Bidirectional Forwarding Detection
Working Group"

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DESCRIPTION

" Copyright (c) 2015 IETF Trust and the persons identified
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This MIB module is an initial version containing objects

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to provide a proactive mechanism to detect faults using
BFD for MPLS and MPLS-TP networks."

REVISION "201504190000Z" -- April 19, 2015

DESCRIPTION

"BFD MIB objects for MPLS paths"
-- RFC Ed.: RFC-editor pls fill in XXX
::= { mib-2 XXX } -- XXX to be replaced with correct value
-- RFC Ed.: assigned by IANA

-- -----
-- groups in the MIB
-- -----

bfdMplsObjects OBJECT IDENTIFIER ::= { bfdMplsMib 0 }
bfdMplsConformance OBJECT IDENTIFIER ::= { bfdMplsMib 1 }

-- -----
-- Textual Conventions
-- -----

SessionMapTypeTC ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"Used to indicate the type of MPLS or MPLS-TP path
associated to the session"

SYNTAX INTEGER {

 nonTeIpv4(1), -- mapping into LDP IPv4
 nonTeIpv6(2), -- mapping into LDP IPv6
 teIpv4(3), -- mapping into TE IPv4
 teIpv6(4), -- mapping into TE IPv6
 pw(5), -- mapping into Pseudowires
 mep(6) -- mapping into MEPs in MPLS-TP

```

    }

DefectActionTC ::= TEXTUAL-CONVENTION
    STATUS          current
    DESCRIPTION
        "The action to be taken when the mis-connectivity/loss of
        connectivity defect occurs in the MPLS or MPLS-TP
        path associated to the session"
    SYNTAX INTEGER {
        alarmOnly(1),      -- Alarm only
        alarmAndBlockData(2) -- Alarm and block the data
    }

-- -----
-- BFD session table extensions for MPLS and MPLS-TP BFD sessions
-- -----

```

```

-- bfdMplsSessTable - bfdSessTable Extension

bfdMplsSessTable  OBJECT-TYPE
    SYNTAX          SEQUENCE OF BfdMplsSessEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "This table is an extension to the bfdSessTable for
        configuring BFD sessions for MPLS or MPLS-TP paths."
    ::= { bfdMplsObjects 1 }

bfdMplsSessEntry  OBJECT-TYPE
    SYNTAX          BfdMplsSessEntry
    MAX-ACCESS      not-accessible
    STATUS          current
    DESCRIPTION
        "A row in this table extends a row in bfdSessTable
        and note that not all of the objects defined in
        bfdSessTable are used for MPLS BFD sessions."
    INDEX { bfdSessIndex }
    ::= { bfdMplsSessTable 1 }

BfdMplsSessEntry ::= SEQUENCE {
    bfdMplsSessRole          INTEGER,
    bfdMplsSessMode          INTEGER,

```

```

        bfdMplsSessTmrNegotiate      TruthValue,
        bfdMplsSessMapType           SessionMapTypeTC,
        bfdMplsSessMapPointer        RowPointer,
        bfdMplsSessMisConnectivityDefectAction DefectActionTC,
        bfdMplsSessLOCDefect DefectActionTC
    }

bfdMplsSessRole OBJECT-TYPE
    SYNTAX      INTEGER {
                    active(1),
                    passive(2)
                }
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object specifies whether the system is playing the
         active(1) role or the passive(2) role for this
         BFD session."
    REFERENCE
        "Bidirectional Forwarding Detection, RFC 5880,
         Section 6.1"
    DEFVAL { active }
    ::= { bfdMplsSessEntry 1 }

```

```

bfdMplsSessMode OBJECT-TYPE
    SYNTAX      INTEGER {
                    cc(1),
                    cv(2)
                }
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object specifies whether the BFD session is running
         in Continuity Check(CC) or the Connectivity
         Verification(CV) mode."
    REFERENCE
        "Proactive Connectivity Verification, Continuity Check
         and Remote Defect Indication for MPLS Transport Profile,
         RFC 6428."
    DEFVAL { cc }
    ::= { bfdMplsSessEntry 2 }

```

```

bfdMplsSessTmrNegotiate OBJECT-TYPE
    SYNTAX          TruthValue
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object specifies if timer negotiation is required for
        the BFD session. When set to false, timer negotiation is
        disabled."
    DEFVAL { true }
 ::= { bfdMplsSessEntry 3 }

bfdMplsSessMapType OBJECT-TYPE
    SYNTAX          SessionMapTypeTC
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "This object indicates the type of path being monitored
        by this BFD session entry."
    DEFVAL { nonTeIpv4 }
 ::= { bfdMplsSessEntry 4 }

bfdMplsSessMapPointer OBJECT-TYPE
    SYNTAX          RowPointer
    MAX-ACCESS      read-create
    STATUS          current
    DESCRIPTION
        "If bfdMplsSessMapType is nonTeIpv4(1) or nonTeIpv6(2),
        then this object MUST contain zeroDotZero or point to
        an instance of the mplsXCEntry indicating the LDP-based
        LSP associated with this BFD session."

```

If bfdMplsSessMapType is teIpv4(3) or teIpv6(4), then this object MUST contain zeroDotZero or point to an instance of the mplsTunnelEntry indicating the RSVP-based MPLS TE tunnel associated with this BFD session.

If bfdMplsSessMapType is pw(5), then this object MUST contain zeroDotZero or point to an instance of the pwEntry indicating the MPLS Pseudowire associated with this BFD session.

If bfdMplsSessMapType is mep(6). then this object MUST contain zeroDotZero or point to an instance identifying the mplsOamIdMeEntry configured for monitoring the MPLS-TP path associated with this BFD session.

If this object points to a conceptual row instance in a table consistent with bfdMplsSessMapType but this instance does not currently exist then no valid path is associated with this session entry.

If this object contains zeroDotZero then no valid path is associated with this BFD session entry till it is populated with a valid pointer consistent with the value of bfdMplsSessMapType as explained above.

When the bfdSessRowStatus is active, this object value change would lead to set failure and the bfdSessRowStatus should be in notReady or notInService state in order to change the value of this object.

"

REFERENCE

1. Multiprotocol Label Switching (MPLS) Traffic Engineering (TE) Management Information Base (MIB), [[RFC3812](#)].
2. Multiprotocol Label Switching (MPLS) Label Switching Router (LSR) Management Information Base (MIB), [[RFC3813](#)].
3. Pseudowire (PW) Management Information Base (MIB), [[RFC5601](#)].
4. MPLS-TP Operations, Administration, and Management (OAM) Identifiers Management Information Base (MIB), ID [draft-ietf-mpls-tp-oam-id-mib-04](#), December 2013."

DEFVAL { zeroDotZero }

::= { bfdMplsSessEntry 5 }

bfdMplsSessMisConnectivityDefectAction OBJECT-TYPE

SYNTAX DefectActionTC

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object indicates the action to be taken when


```

        the mis-connectivity defect is detected on
        this BFD session."
    DEFVAL { alarmOnly }
    ::= { bfdMplsSessEntry 6 }

bfdMplsSessLOCDefect OBJECT-TYPE
    SYNTAX          DefectActionTC
    MAX-ACCESS       read-create
    STATUS           current
    DESCRIPTION
        "This object indicates the action to be taken when
        the loss of continuity defect is detected on
        this BFD session."
    DEFVAL { alarmOnly }
    ::= { bfdMplsSessEntry 7 }

-- -----
-- BFD Objects for Session performance
-- -----
-- bfdMplsSessPerfTable - bfdSessPerfTable Extension

bfdMplsSessPerfTable      OBJECT-TYPE
    SYNTAX                SEQUENCE OF BfdMplsSessPerfEntry
    MAX-ACCESS             not-accessible
    STATUS                 current
    DESCRIPTION
        "This table is an extension to the bfdSessPerfTable"
    ::= { bfdMplsObjects 2 }

bfdMplsSessPerfEntry OBJECT-TYPE
    SYNTAX      BfdMplsSessPerfEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A row in this table extends the bfdSessPerfTable"
    INDEX { bfdSessIndex }
    ::= { bfdMplsSessPerfTable 1 }

BfdMplsSessPerfEntry ::= SEQUENCE {
    bfdMplsSessPerfMisDefCount    Counter32,
    bfdMplsSessPerfLocDefCount   Counter32,
    bfdMplsSessPerfRdiInCount    Counter32,
    bfdMplsSessPerfRdiOutCount   Counter32
}

```

bfdMplsSessPerfMisDefCount OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object gives a count of the mis-connectivity defects detected for the BFD session. For instance, this count will be incremented when the received BFD control packet carries an incorrect globally unique source MEP identifier."

::= { bfdMplsSessPerfEntry 1 }

bfdMplsSessPerfLocDefCount OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object gives a count of the Loss of continuity defects detected in MPLS and MPLS-TP paths"

::= { bfdMplsSessPerfEntry 2 }

bfdMplsSessPerfRdiInCount OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object gives a count of the Remote Defect Indications received for the BFD session."

::= { bfdMplsSessPerfEntry 3 }

bfdMplsSessPerfRdiOutCount OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"This object gives a count of the Remote Defect Indications sent by the BFD session"

::= { bfdMplsSessPerfEntry 4 }

-- Module compliance

bfdMplsGroups

OBJECT IDENTIFIER ::= { bfdMplsConformance 1 }

bfdMplsCompliances

OBJECT IDENTIFIER ::= { bfdMplsConformance 2 }

-- Compliance requirement for fully compliant implementations.

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```
bfdMplsModuleFullCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
"Compliance statement for agents that provide full
support for the BFD-EXT-STD-MIB module. "

MODULE -- This module.

MANDATORY-GROUPS {
    bfdSessionExtGroup,
    bfdSessionExtPerfGroup
}
::= { bfdMplsCompliances 1 }

-- Compliance requirement for read-only implementations.

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

MODULE -- This module.

MANDATORY-GROUPS {
    bfdSessionExtGroup,
    bfdSessionExtPerfGroup
}

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

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

OBJECT      bfdMplsSessTmrNegotiate
```

```

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

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

OBJECT        bfdMplsSessMapPointer

```

```

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

::= { bfdMplsCompliances 2 }

-- Units of conformance.

bfdSessionExtGroup OBJECT-GROUP
OBJECTS {
    bfdMplsSessRole,
    bfdMplsSessMode,
    bfdMplsSessTmrNegotiate,
    bfdMplsSessMapType,
    bfdMplsSessMapPointer,
    bfdMplsSessMisConnectivityDefectAction,
    bfdMplsSessLOCDefect
}
STATUS        current
DESCRIPTION   "Collection of objects needed for BFD monitoring for
               MPLS and MPLS-TP paths"
               ::= { bfdMplsGroups 1 }

bfdSessionExtPerfGroup OBJECT-GROUP
OBJECTS {
    bfdMplsSessPerfMisDefCount,
    bfdMplsSessPerfLocDefCount,
    bfdMplsSessPerfRdiInCount,
    bfdMplsSessPerfRdiOutCount
}
STATUS        current
DESCRIPTION

```

```
"Collection of objects needed to monitor the
performance of BFD sessions on MPLS and MPLS-TP
paths"
::= { bfdMplsGroups 2 }
```

END

7. Security Considerations

As BFD session for MPLS path may be tied into the stability of the MPLS network infrastructure, 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 configuration of the objects represented

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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.

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

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

Some of the readable objects in this MIB module (i.e., objects with a

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

- o The bfdSessPerfTable and bfdMplsSessPerfTable both allows access to the performance characteristics of BFD sessions for MPLS paths. 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 for MPLS paths. 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), there

is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

Implementations SHOULD provide the security features described by the SNMPv3 framework (see [[RFC3410](#)]), and implementations claiming compliance to the SNMPv3 standard MUST include full support for authentication and privacy via the User-based Security Model (USM) [[RFC3414](#)] with the AES cipher algorithm [[RFC3826](#)]. Implementations MAY also provide support for the Transport Security Model (TSM) [[RFC5591](#)] in combination with a secure transport such as SSH [[RFC5592](#)] or TLS/DTLS [[RFC6353](#)].

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:

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

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

9. References

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[10](#). Acknowledgments

The authors would like to thank Jeffrey Haas, Mukund Mani, Lavanya Srivatsa, Muly Ilan and John Salloway for their valuable comments.

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