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 BFD-STD-MIB and describes the managed objects for modeling Bidirectional Forwarding Detection (BFD) protocol for MPLS and MPLS-TP networks.
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1 Introduction

The current MIB for BFD as defined by BFD-STD-MIB 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 BFD-STD-MIB 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", "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 [BFD], [BFD-1HOP], [BFD-MH], [RFC5884], [RFC6428]. Unless otherwise stated, the mechanisms described therein will not be re-described here.
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 BFD-STD-MIB.

5.1. Extensions to the BFD session table (bfdSessionTable)

The BFD session table used to identify a BFD session between a pair of nodes, as defined in BFD-STD-MIB, 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 [BFD-STD-MIB] 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:

```plaintext
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 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 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

BFD-STD-MIB defines BFD Session Performance Table
(bfdSessionPerfTable), for collecting per-session BFD performance
counters, as an extension to the bfdSessionTable.

The bfdSessionPerfTable 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
   for this BFD session.
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;

bfdMplsMib MODULE-IDENTITY
LAST-UPDATED "201312260000Z" -- December 26 2013
ORGANIZATION "IETF Bidirectional Forwarding Detection Working Group"

CONTACT-INFO

"Sam Aldrin
Huawei Technologies
2330 Central Express Way,
Santa Clara, CA 95051, USA
Email: aldrin.ietf@gmail.com

Venkatesan Mahalingam
Dell Inc.
350 Holger Way,
San Jose, CA 95134, USA
Email: venkat.mahalingams@gmail.com

Kannan KV Sampath
Redeem Software
India
Email: kannankvs@gmail.com

Thomas D. Nadeau
Email: tnadeau@lucidvision.com"

DESCRIPTION

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This MIB module is an initial version containing objects to provide a proactive mechanism to detect faults using
BFD for MPLS and MPLS-TP networks.

**DESCRIPTION**

- RFC Ed.: RFC-editor pls fill in xxxx
- ::= { 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."
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
"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  
"1. RFC6428, Proactive Connectivity Verification, Continuity Check and Remote Defect Indication for MPLS Transport Profile."
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.

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].

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.

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
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.

- 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:

- 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", 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>bfdMplsMib</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.]

9. References

9.1 Normative References


9.2 Informative References


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11. Authors’ Addresses

Sam Aldrin
Huawei Technologies
2330 Central Express Way,
Santa Clara, CA 95051, USA
Email: aldrin.ietf@gmail.com

Venkatesan Mahalingam
Dell Inc.
350 Holger Way,
San Jose, CA 95134, USA
Email: venkat.mahalingams@gmail.com

Kannan KV Sampath
Redeem Software
India
Email: kannankvs@gmail.com

Thomas D. Nadeau
Email: tnadeau@lucidvision.com