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TRILL OAM MIB
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Abstract

This document specifies the Management Information Base (MIB) for the IETF TRILL (Transparent Interconnection of Lots of Links) OAM (Operations, Administration, and Maintenance) objects.

Status of this Memo

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

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This Internet-Draft will expire on April 14, 2016.

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1. Introduction

Overall, TRILL OAM (Operations, Administration, and Maintenance) meets the requirements given in [RFC6905]. The general framework for TRILL OAM is specified in [RFC7174]. The details of the Fault Management (FM) solution, conforming to that framework, are presented in [RFC7455]. The solution leverages the message format defined in Ethernet Connectivity Fault Management (CFM) [802.1Q] as the basis for the TRILL OAM message channel.

This document uses the CFM MIB modules defined in [802.1Q] as the basis for TRILL OAM MIB and augments the existing tables to add new TRILL managed objects required by TRILL. This document further specifies a new table with associated managed objects for TRILL OAM specific capabilities.

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 RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

3. Conventions

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].

Acronyms used in the document include the following:

MTVM - Multi-destination Tree Verification Message [RFC7455]

MTVR - Multi-destination Tree Verification Reply [RFC7455]

PTM - Path Trace Message [RFC7455]

PTR - Path Trace Reply [RFC7455]

MEP - Maintenance End Point [RFC7174] [802.1Q]

MIP - Maintenance Intermediate Point [RFC7174] [802.1Q]

MP - Maintenance Point [RFC7174]

CCM - Continuity Check Message [802.1Q]

FGL - Fine-Grained Label

LBM - Loopback Message [802.1Q]

LBR - Loopback Reply [802.1Q]

TRILL - Transparent Interconnection of Lots of Links [RFC6325]

4. Overview

The TRILL-OAM-MIB module provides an overall framework for managing TRILL OAM. It leverages the IEEE8021-CFM-MIB and IEEE8021-CFM-V2-MIB modules defined in [802.1Q], and augments the Maintenance End Point (MEP) and MEP Db entries. It also adds a new table for TRILL OAM specific messages.

5. Structure of the MIB module

Objects in this MIB module are arranged into subtrees. Each subtree is organized as a set of related objects. The various subtrees are shown below, supplemented with the required elements of the IEEE8021-CFM-MIB module.

5.1. Textual Conventions

Textual conventions are defined to represent object types relevant to the TRILL OAM MIB.

5.2. The TRILL OAM MIB Subtree

TRILL-OAM MIB Tree describe below consists of trilloamNotifications (Traps) and trillOamMibObjects. The trilloamNotifications are sent to the management entity whenever a MEP loses/restores contact with its peer Flow MEPs.

The TRILL OAM MIB Per MEP Objects are defined in the trillOamMepTable. The trillOamMepTable augments the dot1agCfmMepEntry (please see section 6.1) defined in IEEE8021-CFM-MIB. It includes objects that are locally defined for an individual MEP and its associated Flow.

```
TRILL-OAM-MIB

  |--trillOamNotifications          (trillOamMib 0}

     |--trillOamFaultAlarm

  |--trillOamMibObjects             {trillOamMib 1}

     |--trillOamMep                 {trillOamMibObjects 1}

        |--trillOamMepTable         {trillOamMep 1}  - Local TRLL config

        |--trillOamMepFlowCfgTable

        |--trillOamPtrTable

        |--trillOamMtvrTable

        |--trillOamMepDbTable
```

5.3.1. The Notifications Subtree

Notifications (fault alarms) are sent to the management entity with the OID of the MEP that has detected the fault. Notifications are generated whenever MEP loses/restores contact with its peer Flow MEPs.

5.3.2. The Table Structures

The TRILL OAM MIB Per MEP Objects are defined in the trillOamMepTable. The trillOamMepTable augments the dot1agCfmMepEntry (please see section 6.1) defined in IEEE8021-CFM-MIB. It includes objects that are locally defined for an individual MEP and its associated Flow.

5.3.2.1. trillOamMepTable Objects

This table is an extension of the dot1agCfmMepTable. Rows are automatically added or deleted from this table based upon row creation and destruction of the dot1agCfmMepTable.

This table represents the local MEP TRILL OAM configuration table. The primary purpose of this table is provide local parameters for the TRILL OAM function found in [RFC7455] and instantiated at a MEP.

5.3.2.2. trillOamMepFlowCfgTable Objects

Each row in this table represents a Flow Configuration Entry for the associated MEP. This table uses four indices. The first three indices are the indices of the Maintenance Domain, MaNet, and MEP tables. The fourth index is the specific Flow Configuration Entry on the selected MEP. Some write-able objects in this table are only applicable in certain cases (as described under each object below), and attempts to write values for them in other cases will be ignored.

5.3.2.3. trillOamPtrTable Objects

Each row in this table represents a Path Trace reply Entry for the Defined MEP and Transaction. This table uses four indices. The first three indices identify the MEP and the fourth index specifies the transaction identifier. This transaction identifier uniquely identifies the response for a MEP, which can have multiple flow.

5.3.2.4. trillOamMtvrTable Objects

This table includes managed objects for the Multi-Destination Reply. Each row in the table represents a Multi-destination Reply Entry for the defined MEP and Transaction. This table uses the following five indices: 1) Maintenance Domain, 2) MANET, 3) MEP tables, 4) Transaction identifier of selected MEP, and 5) receive order of Multi-destination replies.

Some write-able objects in this table are only applicable in certain cases (as described under each object below), and attempts to write a value for them in other cases will be ignored.

5.3.2.5. trillOamMepDbTable Objects

This table is an augmentation of the dot1agCfmMepDbTable, and rows are automatically added or deleted from this table based upon row creation and destruction of the dot1agCfmMepDbTable.

6. Relationship to other MIB modules

The IEEE8021-CFM-MIB, and LLDP-MIB contain objects that are relevant to the TRILL OAM MIB. Management objects contained in these modules are not duplicated here, to reduce overlap to the extent possible. From the IEEE8021-CFM-MIB following objects are imported

- dot1agCfmMdIndex
- dot1agCfmMaIndex
- dot1agCfmMepIdentifier
- dot1agCfmMepEntry
- dot1agCfmMepDbEntry
- Dot1agCfmIngressActionFieldValue
- Dot1agCfmEgressActionFieldValue
- Dot1agCfmRemoteMepState

From the LLDP-MIB following objects are imported

- LldpChassisId
- LldpChassisIdSubtype
- LldpPortId

6.1. Relationship to the IEEE8021-TC-MIB

In TRILL, traffic labeling can be done using either a 12-bit VLAN or a 24-bit fine grain label [RFC7172].

The IEEE8021-TC-MIB definition of IEEE8021ServiceSelectorType includes the following two values:

- 1 representing a vlanId, and

- 2 representing a 24-bit isid

We have chosen to use value 2 for TRILL's fine grain label. As such, TRILL-OAM-MIB will import IEEE8021ServiceSelectorType, IEEE8021ServiceSelectorValueOrNone, and IEEE8021ServiceSelectorValue from IEEE8021-TC-MIB.

6.2. Relationship to the IEEE8021-CFM-MIB

trillOamMepTable augments dot1agCfmMepEntry. Implementation of IEEE8021-CFM-MIB is required as we are augmenting the IEEE-CFM-MIB Table. Objects/Tables that are not applicable to a TRILL implementation have to be handled by the TRILL implementation back end and appropriate default values, as described in IEEE8021-CFM-MIB, have to be returned.

The TRILL OAM implementation doesn't support the Link Trace Message or Link Trace Reply since, as described in RFC7455, the Path Trace Message and Reply for unicast traffic and Multi-destination Tree verification Message and Reply for multicast traffic have been substituted for them. Statistics for these messages should default as per IEEE8021-CFM-MIB.

6.3. MIB modules required for IMPORTS

The following MIB module IMPORTS objects from SNMPv2-SMI [RFC2578], SNMPv2-TC [RFC2579], SNMPv2-CONF [RFC2580], IEEE-8021-CFM-MIB, LLDP-MIB.

7. Definitions

```
TRILL-OAM-MIB DEFINITIONS ::= BEGIN

IMPORTS

    MODULE-IDENTITY,
    OBJECT-TYPE,
    Counter32,
    Unsigned32,
    Integer32,
    mib-2,
    NOTIFICATION-TYPE
       FROM SNMPv2-SMI
    RowStatus,
    TruthValue,
    TimeStamp,
    MacAddress
        FROM SNMPv2-TC
    OBJECT-GROUP,
    NOTIFICATION-GROUP,
    MODULE-COMPLIANCE
        FROM SNMPv2-CONF
    dot1agCfmMdIndex,
    dot1agCfmMaIndex,
    dot1agCfmMepIdentifier,
```

```
      dot1agCfmMepEntry,
      dot1agCfmMepDbEntry,
      Dot1agCfmIngressActionFieldValue,
      Dot1agCfmEgressActionFieldValue,
      Dot1agCfmRemoteMepState
          FROM IEEE8021-CFM-MIB
      LldpChassisId,
      LldpChassisIdSubtype,
      LldpPortId,
      LldpPortIdSubtype
          FROM LLDP-MIB;

   trillOamMib MODULE-IDENTITY
      LAST-UPDATED    "201508231200Z"
      ORGANIZATION    "IETF TRILL WG"
      CONTACT-INFO
              "E-mail: trill@ietf.org"
      DESCRIPTION
          "This MIB module contains the management objects for the
          management of TRILL Services Operations, Administration
          and Maintenance.
          Initial version. Published as RFC xxxx.

          -------------------------------------------------------------
          Reference Overview

          A number of base documents have been used to create the
          Textual Conventions MIB. The following are the
          abbreviations for the baseline documents:

          [CFM] refers to 'Connectivity Fault Management',
          IEEE 802.1Q-2014, December 2014
          [Q.840.1] refers to 'ITU-T Requirements and analysis for
          NMS-EMS management interface of Ethernet over Transport and
          Metro Ethernet Network (EoT/MEN)', March 2007
          [Y.1731] refers to ITU-T Y.1731 'OAM functions and mechanisms
          for Ethernet based networks', February 2011
          -------------------------------------------------------------


          Abbreviations Used

          Term         Definition
          CCM          Continuity Check Message
          CFM          Connectivity Fault Management
          CoS          Class of Service
          IEEE         Institute of Electrical and Electronics
                       Engineers
```

IETF	Internet Engineering Task Force
ITU-T	International Telecommunication Union - Telecommunication Standardization Bureau
MAC	Media Access Control
MA	Maintenance Association (equivalent to a MEG)
MD	Maintenance Domain (equivalent to a OAM Domain in MEF 17)
MD Level	Maintenance Domain Level (equivalent to a MEG level)
ME	Maintenance Entity
MEG	Maintenance Entity Group (equivalent to a MA)
MEG Level	Maintenance Entity Group Level (equivalent to MD Level)
MEP	Maintenance Association End Point or MEG End Point
MIB	Management Information Base
MIP	Maintenance Domain Intermediate Point or MEG Intermediate Point
MP	Maintenance Point. One of either a MEP or a MIP
OAM	Operations, Administration, and Maintenance On-Demand OAM actions that are initiated via manual intervention for a limited time to carry out diagnostics. On-Demand OAM can result in singular or periodic OAM actions during the diagnostic time interval
PDU	Protocol Data Unit
RFC	Request for Comment
SNMP	Simple Network Management Protocol
SNMP Agent	An SNMP entity containing one or more command responder and/or notification originator applications(along with their associated SNMP engine). Typically implemented in Network Element.
SNMP Manager	An SNMP entity containing one or more command generator and/or notification receiver applications (along with their associated SNMP engine). Typically implemented in an EMS or NMS.
TLV	Type Length Value, a method of encoding Objects
UTC	Coordinated Universal Time
UNI	User-to-Network Interface
VLAN	Virtual LAN
PTR	Path Trace Reply
PTM	Path Trace Message
MTVR	Multi-destination Tree Verification Reply
MTVM	Multi-destination Tree Verification Message"

```
    REVISION        "201508231200Z"
```

```
        DESCRIPTION
            "Initial version. Published as RFC xxxx."
        ::= { mib-2 12000 }


    -- RFC Ed.: assigned by IANA, see section 9 for details
    --
    -- ************************************************************
    -- Object definitions in the TRILL OAM MIB Module
    -- ************************************************************

    trillOamNotifications  OBJECT IDENTIFIER
        ::= { trillOamMib 0 }

    trillOamMibObjects  OBJECT IDENTIFIER
        ::= { trillOamMib 1 }

    trillOamMibConformance  OBJECT IDENTIFIER
        ::= { trillOamMib 2 }

    -- ************************************************************
    -- Groups in the TRILL OAM MIB Module
    -- ************************************************************

    trillOamMep  OBJECT IDENTIFIER
        ::= { trillOamMibObjects 1 }


    -- ************************************************************
    -- TRILL OAM MEP Configuration
    -- ************************************************************

    trillOamMepTable OBJECT-TYPE
        SYNTAX          SEQUENCE OF TrillOamMepEntry
        MAX-ACCESS      not-accessible
        STATUS          current
        DESCRIPTION
            "This table is an extension of the dot1agCfmMepTable and
             rows are automatically added or deleted from this table
             based upon row creation and destruction of the
             dot1agCfmMepTable.

            This table represents the local MEP TRILL OAM
            configuration table. The primary purpose of this table
            is provide local parameters for the TRILL OAM function
            found in RFC 7455 and instantiated at a MEP."
        REFERENCE       "RFC 7455"
        ::= { trillOamMep 1 }
```

```
   trillOamMepEntry OBJECT-TYPE
       SYNTAX          TrillOamMepEntry
       MAX-ACCESS      not-accessible
       STATUS          current
       DESCRIPTION
           "The conceptual row of trillOamMepTable."
       AUGMENTS           { dot1agCfmMepEntry  }
       ::= { trillOamMepTable 1 }

   TrillOamMepEntry ::= SEQUENCE {
           trillOamMepRName               Unsigned32,
           trillOamMepNextPtmTId          Counter32,
           trillOamMepNextMtvmTId         Counter32,
           trillOamMepPtrIn               Counter32,
           trillOamMepPtrInOutofOrder     Counter32,
           trillOamMepPtrOut              Counter32,
           trillOamMepMtvrIn              Counter32,
           trillOamMepMtvrInOutofOrder    Counter32,
           trillOamMepMtvrOut             Counter32,
           trillOamMepTxLbmDestRName      Unsigned32,
           trillOamMepTxLbmHC             Unsigned32,
           trillOamMepTxLbmReplyModeOob   TruthValue,
           trillOamMepTransmitLbmReplyIp  OCTET STRING,
           trillOamMepTxLbmFlowEntropy    OCTET STRING,
           trillOamMepTxPtmDestRName      Unsigned32,
           trillOamMepTxPtmHC             Unsigned32,
           trillOamMepTxPtmReplyModeOob   TruthValue,
           trillOamMepTransmitPtmReplyIp  OCTET STRING,
           trillOamMepTxPtmFlowEntropy    OCTET STRING,
           trillOamMepTxPtmStatus         TruthValue,
           trillOamMepTxPtmResultOK       TruthValue,
           trillOamMepTxPtmSeqNumber      Unsigned32,
           trillOamMepTxPtmMessages       Integer32,
           trillOamMepTxMtvmTree          Unsigned32,
           trillOamMepTxMtvmHC            Unsigned32,
           trillOamMepTxMtvmReplyModeOob  TruthValue,
           trillOamMepTransmitMtvmReplyIp OCTET STRING,
           trillOamMepTxMtvmFlowEntropy   OCTET STRING,
           trillOamMepTxMtvmStatus        TruthValue,
           trillOamMepTxMtvmResultOK      TruthValue,
           trillOamMepTxMtvmMessages      Integer32,
           trillOamMepTxMtvmSeqNumber     Unsigned32,
           trillOamMepTxMtvmScopeList     OCTET STRING,
           trillOamMepDiscontinuityTime   TimeStamp
   }

   trillOamMepRName OBJECT-TYPE
       SYNTAX          Unsigned32 (0..65471)
```

```
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "This object contains the Rbridge NickName of the TRILL
            Rbridge as defined in RFC 6325 section 3.7."
        REFERENCE "RFC 7455 and RFC 6325 section 3.7"
        ::= { trillOamMepEntry 1 }

    trillOamMepNextPtmTId OBJECT-TYPE
        SYNTAX          Counter32
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Next sequence number/transaction identifier to be sent in a
             Multi-destination message. This sequence number can be zero
             because it wraps around. Implementation of this identifier
             should be should provide a unique code value in order to
             identify the Transaction ID for a MEP with multiple flows."
        REFERENCE "RFC 7455 10.1.1"
        ::= { trillOamMepEntry 2 }

    trillOamMepNextMtvmTId OBJECT-TYPE
        SYNTAX          Counter32
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Next sequence number/transaction identifier to be sent in a
            Multi-destination message. This sequence number can be zero
            because it wraps around. Implementation should be unique to
            identify Transaction ID for a MEP with multiple flows."
        REFERENCE "RFC 7455 11.2.1"
        ::= { trillOamMepEntry 3 }

    trillOamMepPtrIn OBJECT-TYPE
        SYNTAX          Counter32
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Total number of valid, in-order Path Trace Replies
             received."
        REFERENCE "RFC 7455 section 10"
        ::= { trillOamMepEntry 4 }

    trillOamMepPtrInOutofOrder OBJECT-TYPE
        SYNTAX          Counter32
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
```

```
            "Total number of valid, out-of-order Path Trace Replies
             received."
        REFERENCE "RFC 7455 section 10"
        ::= { trillOamMepEntry 5 }

    trillOamMepPtrOut OBJECT-TYPE
        SYNTAX          Counter32
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Total number of valid, Path Trace Replies
             transmitted."
        REFERENCE "RFC 7455 section 10"
        ::= { trillOamMepEntry 6 }

    trillOamMepMtvrIn OBJECT-TYPE
        SYNTAX          Counter32
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Total number of valid, in-order Multi-destination
             Replies received."
        REFERENCE "RFC 7455 section 11"
        ::= { trillOamMepEntry 7 }

    trillOamMepMtvrInOutofOrder OBJECT-TYPE
        SYNTAX          Counter32
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Total number of valid, out-of-order Multi-destination
             Replies received."
        REFERENCE "RFC 7455 section 11"
        ::= { trillOamMepEntry 8 }

    trillOamMepMtvrOut OBJECT-TYPE
        SYNTAX          Counter32
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Total number of valid, Multi-destination Replies
            transmitted."
        REFERENCE "RFC 7455 section 11"
        ::= { trillOamMepEntry 9 }

    trillOamMepTxLbmDestRName OBJECT-TYPE
        SYNTAX          Unsigned32 (0..65471)
        MAX-ACCESS      read-create
```

```
        STATUS          current
        DESCRIPTION
            "The Target Destination Rbridge NickName Field, as
            defined in RFC 6325 section 3.7, to be transmitted."
        REFERENCE "RFC 7455 and RFC 6325 section 3.7"
        ::= { trillOamMepEntry 10 }

    trillOamMepTxLbmHC OBJECT-TYPE
        SYNTAX          Unsigned32(1..63)
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The Hop Count to be transmitted.
            "
        REFERENCE "RFC 7455 section 9 and 3"
        ::= { trillOamMepEntry 11 }

    trillOamMepTxLbmReplyModeOob OBJECT-TYPE
        SYNTAX          TruthValue
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "True indicates that the Reply to an LBM is out of
            band and out of band IP Address TLV is to be
            transmitted. False indicates that In band reply is
            transmitted."
        REFERENCE "RFC 7455 9.2.1"
        ::= { trillOamMepEntry 12 }

    trillOamMepTransmitLbmReplyIp OBJECT-TYPE
        SYNTAX          OCTET STRING (SIZE  (4..16))
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The IP address for an out of band IP Address TLV
             that is to be transmitted. Maximum length for IPv6
             is 16 OCTET and IPv4 is 4 OCTET."
        REFERENCE "RFC 7455 section 3"
        ::= { trillOamMepEntry 13 }

    trillOamMepTxLbmFlowEntropy OBJECT-TYPE
        SYNTAX          OCTET STRING (SIZE  (96))
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "96 Byte Flow Entropy, as defined in RFC 7455, to
             be transmitted."
        REFERENCE "RFC 7455 section 3"
```

```
        ::= { trillOamMepEntry 14 }

    trillOamMepTxPtmDestRName OBJECT-TYPE
        SYNTAX          Unsigned32 (0..65471)
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The Target Destination Rbridge NickName Field,
            as defined in RFC 6325 section 3.7, to be transmitted."
        REFERENCE "RFC 7455 and RFC 6325 section 3.7"
        ::= { trillOamMepEntry 15 }

    trillOamMepTxPtmHC OBJECT-TYPE
        SYNTAX          Unsigned32 (1..63)
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The Hop Count field to be transmitted."
        REFERENCE "RFC 7455 section 3"
        ::= { trillOamMepEntry 16 }

    trillOamMepTxPtmReplyModeOob OBJECT-TYPE
        SYNTAX          TruthValue
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "True indicates that a Reply to a PTM will be
             out of band and the out of band IP Address TLV
             is to be transmitted. False indicates that an
             in band reply  is transmitted."
        REFERENCE "RFC 7455 section 10"
        DEFVAL          { false }
        ::= { trillOamMepEntry 17 }

    trillOamMepTransmitPtmReplyIp OBJECT-TYPE
        SYNTAX          OCTET STRING (SIZE  (4..16))
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The IP address for an out of band IP Address TLV
             to be Transmitted.  The  maximum length for an
             IPv6 address is 16 Octets.  The maximum length
             for an  IPv4 address is 4 octets."
        REFERENCE "RFC 7455 section 3 and 10"
        ::= { trillOamMepEntry 18 }

    trillOamMepTxPtmFlowEntropy OBJECT-TYPE
        SYNTAX          OCTET STRING (SIZE  (96))
```

```
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "96 Byte Flow Entropy, as defined in RFC 7455, to be
             transmitted."
        REFERENCE "RFC 7455 section 3"
        ::= { trillOamMepEntry 19 }

    trillOamMepTxPtmStatus OBJECT-TYPE
        SYNTAX          TruthValue
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "A Boolean flag set to true by the MEP Path Trace Initiator
            State Machine or a MIB manager to indicate that another PTM is
            being transmitted.  This is Reset to false by the MEP
            Initiator State Machine.  The PTM managed objects in the MEP
            table are used in a manner similar to that described for LBM
            transmission in dot1agCfmMepTable. As per RFC7455 section 10,
            Operation of the Path Trace Message is identical to the
            Loopback Message except that it is first transmitted with a
            TRILL Header Hop count field value of 1 and then retransmitted
            with an incrementeing Hop count until a response is received
            from the destination RBridge, or the Hop Count reaches a
            configured maximum value.  trillOamMepTxPtmStatus Status is
            reset to FALSE by initiator when last PTM is transmitted."
        REFERENCE "RFC 7455 section 10"
        DEFVAL          { false }
        ::= { trillOamMepEntry 20 }

    trillOamMepTxPtmResultOK OBJECT-TYPE
        SYNTAX          TruthValue
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "Indicates the following results of the operation:
            - true  The Path Trace Message(s) will be (or has been)
              sent.
            - false The Path Trace Message(s) will not be sent."
        REFERENCE "RFC 7455 section 10"
        DEFVAL          { true }
        ::= { trillOamMepEntry 21 }

    trillOamMepTxPtmSeqNumber OBJECT-TYPE
        SYNTAX          Unsigned32
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
```

```
            "The Path Trace Transaction Identifier of the first
             PTM (to be) sent. The value returned is
             undefined if trillOamMepTxPtmResultOK is false."
        REFERENCE "RFC 7455 section 10"
        ::= { trillOamMepEntry 22 }

    trillOamMepTxPtmMessages OBJECT-TYPE
        SYNTAX          Integer32 (1..1024)
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The number of Path Trace messages to be transmitted.
             As per RFC 7455 section 10, the first Path Trace
             Message is transmitted with a Hop count of 1 and an
             RBridge may continue to retransmit the request at
             periodic intervals with an incrementing Hop Count
             until a response is received from the destination
             Rbridge, or the Hop Count reaches a configured
             maximum value. The event of the Destination
             response being received or the Hop count reaching
             its maximum is treated as a single Counter
             increment of this object."
        REFERENCE "RFC 7455 section 10"
        ::= { trillOamMepEntry 23 }

    trillOamMepTxMtvmTree OBJECT-TYPE
        SYNTAX          Unsigned32
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The Multi-destination Tree identifier, as
             defined in RFC6325, for an MTVM."
        ::= { trillOamMepEntry 24 }

    trillOamMepTxMtvmHC OBJECT-TYPE
        SYNTAX          Unsigned32(1..63)
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The Hop Count field to be transmitted.
            "
        REFERENCE "RFC 7455 section 3, RFC 6325 section 3"
        ::= { trillOamMepEntry 25 }

    trillOamMepTxMtvmReplyModeOob OBJECT-TYPE
        SYNTAX          TruthValue
        MAX-ACCESS      read-create
        STATUS          current
```

```
        DESCRIPTION
            "True Indicates that the reply to an MTVM is out of
            band and this out of band IP Address TLV is where the
            reply is to be transmitted.
            False indicates that an in band reply is transmitted."
        REFERENCE "RFC 7455 section 11"
        ::= { trillOamMepEntry 26 }

    trillOamMepTransmitMtvmReplyIp OBJECT-TYPE
        SYNTAX          OCTET STRING (SIZE  (4..16))
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "IP address for an out of band IP Address TLV that is
             to be transmitted. The Maximum length for IPv6 is 16
             OCTET and IPv4 is 4 OCTET."
        REFERENCE "RFC 7455 section 11"
        ::= { trillOamMepEntry 27 }

    trillOamMepTxMtvmFlowEntropy OBJECT-TYPE
        SYNTAX          OCTET STRING (SIZE  (96))
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "96 Byte Flow Entropy, as defined in RFC 7455, to be
             transmitted."
        REFERENCE "RFC 7455 section 3"
        ::= { trillOamMepEntry 28 }

    trillOamMepTxMtvmStatus OBJECT-TYPE
        SYNTAX          TruthValue
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "A Boolean flag set to true by the MEP Multi Destination
            Initiator State Machine or a MIB manager to indicate
            that another MTVM is being transmitted.
            Reset to false by the MEP Initiator State Machine.
            The MTVM managed objects in the MEP table are used
            in a manner similar to that described for LBM
            transmission in dot1agCfmMepTable. As per RFC7455
            section 11, operation of the MTVM Message is
            identical to the Loopback Message except that it is
            first transmitted with a TRILL Header Hop count
            field value of 1 and it is retransmitted incrementing
            the Hop count until a response is received from the
            destination RBridge or the Hop Count reaches a
            configured maximum value. trillOamMepTxMtvmStatus
```

```
            Status is reset to FALSE by the initiator when the last
            MTVM is transmitted."
        REFERENCE "RFC 7455 section 11"
        DEFVAL          { false }
        ::= { trillOamMepEntry 29 }

    trillOamMepTxMtvmResultOK OBJECT-TYPE
        SYNTAX          TruthValue
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "Indicates the result of the operation in
             the following way:
            - true  The Multi-destination Message(s) will be
              (or has been) sent.
            - false The Multi-destination Message(s) will not be sent."
        REFERENCE "RFC 7455 section 11"
        DEFVAL          { true }
        ::= { trillOamMepEntry 30 }

    trillOamMepTxMtvmMessages OBJECT-TYPE
        SYNTAX          Integer32 (1..1024)
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The number of Multi Destination messages to be transmitted.
             The Rbridge transmit the Multi Destination message
             incrementing the session Identification Number at periodic
             interval until this count expires."
        REFERENCE "RFC 7455 section 11"
        ::= { trillOamMepEntry 31 }

    trillOamMepTxMtvmSeqNumber OBJECT-TYPE
        SYNTAX          Unsigned32
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The Multi-destination Transaction Identifier of the
            first MTVM (to be)
            sent. The value returned is undefined if
            trillOamMepTxMtvmResultOK is false."
        REFERENCE "RFC 7455 section 11"
        ::= { trillOamMepEntry 32 }

    trillOamMepTxMtvmScopeList OBJECT-TYPE
        SYNTAX          OCTET STRING
        MAX-ACCESS      read-create
        STATUS          current
```

```
        DESCRIPTION
            "The Multi-destination Rbridge Scope list, which
               requires 2 octets per Rbridge."
        REFERENCE "RFC 7455 section 11"
        ::= { trillOamMepEntry 33 }

    trillOamMepDiscontinuityTime OBJECT-TYPE
        SYNTAX          TimeStamp
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Snapshot of the value of the sysUpTime object at the
             beginning of the latest period of continuity of the
             statistical counters associated with this MEP."
        ::= { trillOamMepEntry 34 }


    -- ****************************************************************
    -- TRILL OAM Tx Measurement Configuration Table
    -- ****************************************************************

    trillOamMepFlowCfgTable OBJECT-TYPE
        SYNTAX          SEQUENCE OF TrillOamMepFlowCfgEntry
        MAX-ACCESS      not-accessible
        STATUS          current
        DESCRIPTION
            "This table includes configuration objects and operations
             for the TRILL OAM RFC 7455.

             Each row in the table represents a Flow configuration
             Entry for the defined MEP. This table uses four indices.
             The first three indices are the indices of the Maintenance
             Domain, MaNet, and MEP tables. The fourth index is the
             specific flow configuration Entry on the selected MEP.

            Some writable objects in this table are only applicable in
            certain cases (as described under each object), and
            attempts to write values for them in other cases
            will be ignored."
        REFERENCE       "RFC 7455"
        ::= { trillOamMep 2 }

    trillOamMepFlowCfgEntry OBJECT-TYPE
        SYNTAX          TrillOamMepFlowCfgEntry
        MAX-ACCESS      not-accessible
        STATUS          current
        DESCRIPTION
            "The conceptual row of trillOamMepFlowCfgTable."
```

```
        INDEX           {
                            dot1agCfmMdIndex,
                            dot1agCfmMaIndex,
                            dot1agCfmMepIdentifier,
                            trillOamMepFlowCfgIndex
                        }
        ::= { trillOamMepFlowCfgTable 1 }

    TrillOamMepFlowCfgEntry ::= SEQUENCE {
            trillOamMepFlowCfgIndex       Unsigned32,
            trillOamMepFlowCfgFlowEntropy OCTET STRING,
            trillOamMepFlowCfgDestRName   Unsigned32,
            trillOamMepFlowCfgFlowHC      Unsigned32,
            trillOamMepFlowCfgRowStatus   RowStatus
            }

    trillOamMepFlowCfgIndex OBJECT-TYPE
        SYNTAX          Unsigned32 (1..65535)
        MAX-ACCESS      not-accessible
        STATUS          current
        DESCRIPTION
            "An index to the TRILL OAM MEP Flow Configuration table which
            indicates the specific Flow for the MEP.

            The index is never reused for other flow sessions on the
            same MEP while this session is active.  The index value
            keeps increasing until it wraps to 0. This value can also be
            used in Flow-identifier TLV RFC 7455."
        REFERENCE "RFC 7455"
        ::= { trillOamMepFlowCfgEntry 1 }

    trillOamMepFlowCfgFlowEntropy OBJECT-TYPE
        SYNTAX          OCTET STRING (SIZE  (96))
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "This is 96 byte of Flow Entropy as described in
            TRILL OAM RFC 7455."
        REFERENCE "RFC 7455 section 3"
        ::= { trillOamMepFlowCfgEntry 2 }

    trillOamMepFlowCfgDestRName OBJECT-TYPE
        SYNTAX          Unsigned32 (0..65471)
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The Target Destination Rbridge NickName Field, as
            defined in RFC 6325 section 3.7, to be transmitted."
```

```
        REFERENCE "RFC 7455 section 3 and RFC 6325 section 3.7"
        ::= { trillOamMepFlowCfgEntry 3 }

    trillOamMepFlowCfgFlowHC OBJECT-TYPE
        SYNTAX          Unsigned32 (1..63)
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The Time to Live field to be transmitted."
        REFERENCE "RFC 7455 section 3 and RFC 6325 section 3.7"
        ::= { trillOamMepFlowCfgEntry 4 }

    trillOamMepFlowCfgRowStatus OBJECT-TYPE
        SYNTAX          RowStatus
        MAX-ACCESS      read-create
        STATUS          current
        DESCRIPTION
            "The status of the row.

            The writable columns in a row cannot be changed if the row
            is active. All columns MUST have a valid value before a row
            can be activated."
        ::= { trillOamMepFlowCfgEntry 5 }


    -- ****************************************************************
    -- TRILL OAM Path Trace Reply Table
    -- ****************************************************************

    trillOamPtrTable OBJECT-TYPE
        SYNTAX          SEQUENCE OF TrillOamPtrEntry
        MAX-ACCESS      not-accessible
        STATUS          current
        DESCRIPTION
            "This table includes Path Trace Reply objects and
             operations for TRILL OAM as described in RFC 7455.

            Each row in the table represents a Path Trace Reply Entry for
            the defined MEP and Transaction. This table uses four
            indices. The first three indices are the indices of the
            Maintenance Domain,
            MaNet, and MEP tables. The fourth index is the specific
            Transaction Identifier on the selected MEP.

            Some writable objects in this table are only applicable in
            certain cases (as described under each object),
            and attempts to
            write values for them in other cases will be ignored."
```

```
        REFERENCE       "RFC 7455"
        ::= { trillOamMep 3 }

    trillOamPtrEntry OBJECT-TYPE
        SYNTAX          TrillOamPtrEntry
        MAX-ACCESS      not-accessible
        STATUS          current
        DESCRIPTION
            "The conceptual row of trillOamPtrTable."
        INDEX           {
                            dot1agCfmMdIndex,
                            dot1agCfmMaIndex,
                            dot1agCfmMepIdentifier,
                            trillOamMepPtrTransactionId
                        }
        ::= { trillOamPtrTable 1 }

    TrillOamPtrEntry ::= SEQUENCE {
            trillOamMepPtrTransactionId          Unsigned32,
            trillOamMepPtrHC                     Unsigned32,
            trillOamMepPtrFlag                   Unsigned32,
            trillOamMepPtrErrorCode              Unsigned32,
            trillOamMepPtrTerminalMep            TruthValue,
            trillOamMepPtrLastEgressId           Unsigned32,
            trillOamMepPtrIngress       Dot1agCfmIngressActionFieldValue,
            trillOamMepPtrIngressMac             MacAddress,
            trillOamMepPtrIngressPortIdSubtype   LldpPortIdSubtype,
            trillOamMepPtrIngressPortId          LldpPortId,
            trillOamMepPtrEgress        Dot1agCfmEgressActionFieldValue,
            trillOamMepPtrEgressMac              MacAddress,
            trillOamMepPtrEgressPortIdSubtype    LldpPortIdSubtype,
            trillOamMepPtrEgressPortId           LldpPortId,
            trillOamMepPtrChassisIdSubtype       LldpChassisIdSubtype,
            trillOamMepPtrChassisId              LldpChassisId,
            trillOamMepPtrOrganizationSpecificTlv OCTET STRING,
            trillOamMepPtrNextHopNicknames       OCTET STRING
    }

    trillOamMepPtrTransactionId OBJECT-TYPE
        SYNTAX          Unsigned32 (0..4294967295)
        MAX-ACCESS      not-accessible
        STATUS          current
        DESCRIPTION
            "Transaction identifier/sequence number returned by a
             previous transmit path trace message command,
             indicating which PTM's response is going to be returned."
        REFERENCE       "RFC 7455 section 10"
        ::= { trillOamPtrEntry 1 }
```

```
   trillOamMepPtrHC  OBJECT-TYPE
       SYNTAX          Unsigned32 (1..63)
       MAX-ACCESS      read-only
       STATUS          current
       DESCRIPTION
           "Hop Count field value for a returned PTR."
       REFERENCE       "RFC 7455"
       ::= { trillOamPtrEntry 2 }

   trillOamMepPtrFlag OBJECT-TYPE
       SYNTAX          Unsigned32 (0..15)
       MAX-ACCESS      read-only
       STATUS          current
       DESCRIPTION
           "FCOI (TRILL OAM Message TLV) field value for a
            returned PTR."
       REFERENCE       "RFC 7455, 8.4.3"
       ::= { trillOamPtrEntry 3 }

   trillOamMepPtrErrorCode OBJECT-TYPE
       SYNTAX          Unsigned32 (0..65535)
       MAX-ACCESS      read-only
       STATUS          current
       DESCRIPTION
           "Return Code and Return Sub code value for a returned PTR."
       REFERENCE       "RFC 7455, 8.4.3"
       ::= { trillOamPtrEntry 4 }

   trillOamMepPtrTerminalMep OBJECT-TYPE
       SYNTAX          TruthValue
       MAX-ACCESS      read-only
       STATUS          current
       DESCRIPTION
           "A boolean value stating whether the forwarded PTM reached a
           MEP enclosing its MA, as returned in the Terminal MEP flag of
           the Flags field."
       REFERENCE       "RFC 7455"
       ::= { trillOamPtrEntry 5 }

   trillOamMepPtrLastEgressId OBJECT-TYPE
       SYNTAX          Unsigned32 (0..65535)
       MAX-ACCESS      read-only
       STATUS          current
       DESCRIPTION
           "An Integer field holding the Last Egress Identifier returned
           in the PTR Upstream Rbridge nickname TLV of the PTR.
           The Last Egress Identifier identifies the Upstream Nickname."
       REFERENCE       "RFC 7455 8.4.1"
```

```
        ::= { trillOamPtrEntry 6 }

    trillOamMepPtrIngress OBJECT-TYPE
        SYNTAX          Dot1agCfmIngressActionFieldValue
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "The value returned in the Ingress Action Field of the PTR.
            The value ingNoTlv(0) indicates that no Reply Ingress TLV was
            returned in the PTM."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamPtrEntry 7 }

    trillOamMepPtrIngressMac OBJECT-TYPE
        SYNTAX          MacAddress
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "MAC address returned in the ingress MAC address field."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamPtrEntry 8 }

    trillOamMepPtrIngressPortIdSubtype OBJECT-TYPE
        SYNTAX          LldpPortIdSubtype
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Ingress Port ID. The format of this object is determined by
            the value of the trillOamMepPtrIngressPortIdSubtype object."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamPtrEntry 9 }

    trillOamMepPtrIngressPortId OBJECT-TYPE
        SYNTAX          LldpPortId
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Ingress Port ID. The format of this object is determined by
            the value of the trillOamMepPtrIngressPortId object."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamPtrEntry 10 }

    trillOamMepPtrEgress OBJECT-TYPE
        SYNTAX          Dot1agCfmEgressActionFieldValue
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "The value returned in the Egress Action Field of the PTR.
```

```
            The value ingNoTlv(0) indicates that no Reply Egress TLV was
            returned in the PTM."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamPtrEntry 11 }

    trillOamMepPtrEgressMac OBJECT-TYPE
        SYNTAX          MacAddress
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "MAC address returned in the egress MAC address field."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamPtrEntry 12 }

    trillOamMepPtrEgressPortIdSubtype OBJECT-TYPE
        SYNTAX          LldpPortIdSubtype
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Egress Port ID. The format of this object is determined by
            the value of the trillOamMepPtrEgressPortIdSubtype object."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamPtrEntry 13 }

    trillOamMepPtrEgressPortId OBJECT-TYPE
        SYNTAX          LldpPortId
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Egress Port ID. The format of this object is determined by
            the value of the trillOamMepPtrEgressPortId object."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamPtrEntry 14 }

    trillOamMepPtrChassisIdSubtype OBJECT-TYPE
        SYNTAX          LldpChassisIdSubtype
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "This object specifies the format of the Chassis ID returned
            in the Sender ID TLV of the PTR, if any.  This value is
            meaningless if the trillOamMepPtrChassisId
            has a length of 0."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamPtrEntry 15 }

    trillOamMepPtrChassisId OBJECT-TYPE
        SYNTAX          LldpChassisId
```

```
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "The Chassis ID returned in the Sender ID TLV of the PTR, if
            any. The format of this object is determined by the
            value of the trillOamMepPtrChassisIdSubtype object."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamPtrEntry 16 }

    trillOamMepPtrOrganizationSpecificTlv OBJECT-TYPE
        SYNTAX          OCTET STRING (SIZE  (0 | 4..1500))
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "All Organization specific TLVs returned in the PTR, if
            any.  Includes all octets including and following the TLV
            Length field of each TLV, concatenated together."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamPtrEntry 17 }

    trillOamMepPtrNextHopNicknames OBJECT-TYPE
        SYNTAX          OCTET STRING (SIZE  (0 | 4..1500))
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Next hop Rbridge List TLV returned in the PTR, if
            any.  Includes all octets including and following the TLV
            Length field of each TLV, concatenated together."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamPtrEntry 18 }


    -- ****************************************************************
    -- TRILL OAM Multi Destination Reply Table
    -- ****************************************************************

    trillOamMtvrTable OBJECT-TYPE
        SYNTAX          SEQUENCE OF TrillOamMtvrEntry
        MAX-ACCESS      not-accessible
        STATUS          current
        DESCRIPTION
            "This table includes Multi-destination Reply objects and
             operations for the TRILL OAM described in RFC 7455.

            Each row in the table represents a Multi-destination Reply
            Entry for the defined MEP and Transaction.  This table uses
            five indices.  The first three indices are the indices of the
            Maintenance Domain, MaNet, and MEP tables. The fourth index
```

```
            is the specific Transaction Identifier on the selected MEP.
            The fifth index is the receive order of Multi-destination
            replies.

            Some writable objects in this table are only applicable in
            certain cases (as described under each object), and attempts
            to write values for them in other cases will be ignored."
        REFERENCE       "RFC 7455"
        ::= { trillOamMep 4 }

    trillOamMtvrEntry OBJECT-TYPE
        SYNTAX          TrillOamMtvrEntry
        MAX-ACCESS      not-accessible
        STATUS          current
        DESCRIPTION
            "The conceptual row of trillOamMtvrTable."
        INDEX           {
                            dot1agCfmMdIndex,
                            dot1agCfmMaIndex,
                            dot1agCfmMepIdentifier,
                            trillOamMepPtrTransactionId,
                            trillOamMepMtvrReceiveOrder
                        }
        ::= { trillOamMtvrTable 1 }

    TrillOamMtvrEntry ::= SEQUENCE {
            trillOamMepMtvrTransactionId           Unsigned32,
            trillOamMepMtvrReceiveOrder            Unsigned32,
            trillOamMepMtvrFlag                    Unsigned32,
            trillOamMepMtvrErrorCode               Unsigned32,
            trillOamMepMtvrLastEgressId            Unsigned32,
            trillOamMepMtvrIngress    Dot1agCfmIngressActionFieldValue,
            trillOamMepMtvrIngressMac              MacAddress,
            trillOamMepMtvrIngressPortIdSubtype    LldpPortIdSubtype,
            trillOamMepMtvrIngressPortId           LldpPortId,
            trillOamMepMtvrEgress     Dot1agCfmEgressActionFieldValue,
            trillOamMepMtvrEgressMac               MacAddress,
            trillOamMepMtvrEgressPortIdSubtype     LldpPortIdSubtype,
            trillOamMepMtvrEgressPortId            LldpPortId,
            trillOamMepMtvrChassisIdSubtype        LldpChassisIdSubtype,
            trillOamMepMtvrChassisId               LldpChassisId,
            trillOamMepMtvrOrganizationSpecificTlv OCTET STRING,
            trillOamMepMtvrNextHopNicknames        OCTET STRING,
            trillOamMepMtvrReceiverAvailability    TruthValue,
            trillOamMepMtvrReceiverCount           TruthValue
    }

    trillOamMepMtvrTransactionId OBJECT-TYPE
```

```
        SYNTAX          Unsigned32 (0..4294967295)
        MAX-ACCESS      not-accessible
        STATUS          current
        DESCRIPTION
            "Transaction identifier/sequence number returned by a
            previous transmit Multi-destination message command
            indicating which MTVM's response is going to be returned."
        REFERENCE       "RFC 7455 section 11"
        ::= { trillOamMtvrEntry 1 }

    trillOamMepMtvrReceiveOrder OBJECT-TYPE
        SYNTAX          Unsigned32 (1..4294967295)
        MAX-ACCESS      not-accessible
        STATUS          current
        DESCRIPTION
            "An index to distinguish among multiple MTVR with same MTVR
             Transaction Identifier field value.
             trillOamMepMtvrReceiveOrder is assigned sequentially from 1,
             in the order that the Multi-destination Tree Initiator
             received the MTVRs."
        REFERENCE   "RFC 7455 section 11"
        ::= { trillOamMtvrEntry 2 }

    trillOamMepMtvrFlag OBJECT-TYPE
        SYNTAX          Unsigned32 (0..15)
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "FCOI (TRILL OAM Message TLV) field value for a
             returned MTVR."
        REFERENCE       "RFC 7455, 8.4.2"
        ::= { trillOamMtvrEntry 3 }

    trillOamMepMtvrErrorCode OBJECT-TYPE
        SYNTAX          Unsigned32 (0..65535)
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Return Code and Return Sub code value for a returned MTVR."
        REFERENCE       "RFC 7455, 8.4.2"
        ::= { trillOamMtvrEntry 4 }

    trillOamMepMtvrLastEgressId OBJECT-TYPE
        SYNTAX          Unsigned32 (0..65535)
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "An Integer field holding the Last Egress Identifier returned
```

```
            in the MTVR Upstream Rbridge Nickname TLV of the MTVR.  The
            Last Egress Identifier identifies the Upstream Nickname."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamMtvrEntry 5 }

    trillOamMepMtvrIngress OBJECT-TYPE
        SYNTAX          Dot1agCfmIngressActionFieldValue
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "The value returned in the Ingress Action Field of
            the MTVR. The value ingNoTlv(0) indicates that no
            Reply Ingress TLV was returned in the MTVM."
        REFERENCE       "RFC 7455 11.2.3"
        ::= { trillOamMtvrEntry 6 }

    trillOamMepMtvrIngressMac OBJECT-TYPE
        SYNTAX          MacAddress
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "MAC address returned in the ingress MAC address field."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamMtvrEntry 7 }

    trillOamMepMtvrIngressPortIdSubtype OBJECT-TYPE
        SYNTAX          LldpPortIdSubtype
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Ingress Port ID. The format of this object is
            determined by the value of the
            trillOamMepMtvrIngressPortIdSubtype object."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamMtvrEntry 8 }

    trillOamMepMtvrIngressPortId OBJECT-TYPE
        SYNTAX          LldpPortId
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Ingress Port ID. The format of this object is determined by
            the value of the trillOamMepMtvrIngressPortId object."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamMtvrEntry 9 }

    trillOamMepMtvrEgress OBJECT-TYPE
        SYNTAX          Dot1agCfmEgressActionFieldValue
```

```
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "The value returned in the Egress Action Field of the MTVR.
            The value ingNoTlv(0) indicates that no Reply Egress TLV was
            returned in the MTVR."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamMtvrEntry 10 }

    trillOamMepMtvrEgressMac OBJECT-TYPE
        SYNTAX          MacAddress
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "MAC address returned in the egress MAC address field."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamMtvrEntry 11 }

    trillOamMepMtvrEgressPortIdSubtype OBJECT-TYPE
        SYNTAX          LldpPortIdSubtype
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Egress Port ID. The format of this object is determined by
            the value of the trillOamMepMtvrEgressPortIdSubtype object."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamMtvrEntry 12 }

    trillOamMepMtvrEgressPortId OBJECT-TYPE
        SYNTAX          LldpPortId
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Egress Port ID. The format of this object is determined by
            the value of the trillOamMepMtvrEgressPortId object."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamMtvrEntry 13 }

    trillOamMepMtvrChassisIdSubtype OBJECT-TYPE
        SYNTAX          LldpChassisIdSubtype
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "This object specifies the format of the Chassis ID returned
            in the Sender ID TLV of the MTVR, if any.  This value is
            meaningless if the trillOamMepMtvrChassisId has a
            length of 0."
        REFERENCE       "RFC 7455 8.4.1"
```

```
        ::= { trillOamMtvrEntry 14 }

    trillOamMepMtvrChassisId OBJECT-TYPE
        SYNTAX          LldpChassisId
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "The Chassis ID returned in the Sender ID TLV of the MTVR, if
            any. The format of this object is determined by the
            value of the trillOamMepMtvrChassisIdSubtype object."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamMtvrEntry 15 }

    trillOamMepMtvrOrganizationSpecificTlv OBJECT-TYPE
        SYNTAX          OCTET STRING (SIZE  (0 | 4..1500))
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "All Organization specific TLVs returned in the MTVR, if
            any. Includes all octets including and following the TLV
            Length field of each TLV, concatenated together."
        REFERENCE       "RFC 7455 8.4.1"
        ::= { trillOamMtvrEntry 16 }

    trillOamMepMtvrNextHopNicknames OBJECT-TYPE
        SYNTAX          OCTET STRING (SIZE  (0 | 4..1500))
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "Next hop Rbridge List TLV returned in the PTR, if
            any. Includes all octets including and following the TLV
            Length field of each TLV, concatenated together."
        REFERENCE       "RFC 7455 8.4.3"
        ::= { trillOamMtvrEntry 17 }

    trillOamMepMtvrReceiverAvailability OBJECT-TYPE
        SYNTAX          TruthValue
        MAX-ACCESS      read-only
        STATUS          current
        DESCRIPTION
            "True value indicates that MTVR response contained
            Multicast receiver availability TLV."
        REFERENCE       "RFC 7455 8.4.10"
        ::= { trillOamMtvrEntry 18 }

    trillOamMepMtvrReceiverCount OBJECT-TYPE
        SYNTAX          TruthValue
        MAX-ACCESS      read-only
```

```
        STATUS          current
        DESCRIPTION
            "Indicates the number of Multicast receivers available on
            responding RBridge on the VLAN specified by the
            diagnostic VLAN."
        REFERENCE       "RFC 7455 8.4.10"
        ::= { trillOamMtvrEntry 19 }

    -- ****************************************************************
    -- TRILL OAM MEP Database Table
    -- ****************************************************************

    trillOamMepDbTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF TrillOamMepDbEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
           "This table is an extension of the dot1agCfmMepDbTable
            and rows are automatically added to or deleted from
            this table based upon row creation and destruction of the
            dot1agCfmMepDbTable."
        REFERENCE
           "RFC 7455"
        ::= { trillOamMep 5 }

    trillOamMepDbEntry OBJECT-TYPE
        SYNTAX      TrillOamMepDbEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
           "The conceptual row of trillOamMepDbTable."
        AUGMENTS {
                 dot1agCfmMepDbEntry
                 }
        ::= { trillOamMepDbTable 1 }

    TrillOamMepDbEntry ::= SEQUENCE {
          trillOamMepDbFlowIndex         Unsigned32,
          trillOamMepDbFlowEntropy       OCTET STRING,
          trillOamMepDbFlowState         Dot1agCfmRemoteMepState,
          trillOamMepDbFlowFailedOkTime  TimeStamp,
          trillOamMepDbRbridgeName       Unsigned32,
          trillOamMepDbLastGoodSeqNum    Counter32
        }

    trillOamMepDbFlowIndex OBJECT-TYPE
        SYNTAX        Unsigned32 (1..65535)
        MAX-ACCESS    read-only
```

```
        STATUS        current
        DESCRIPTION
          "This object identifies the Flow. If Flow Identifier TLV
           is received than index received can also be used."
        REFERENCE "RFC 7455"
        ::= {trillOamMepDbEntry 1 }

    trillOamMepDbFlowEntropy OBJECT-TYPE
        SYNTAX        OCTET STRING (SIZE  (96))
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
          "96 byte Flow Entropy."
        REFERENCE "RFC 7455 section 3."
        ::= {trillOamMepDbEntry 2 }

    trillOamMepDbFlowState OBJECT-TYPE
        SYNTAX       Dot1agCfmRemoteMepState
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
            "The operational state of the remote MEP (flow based)
             IFF State machines. State Machine is running now per
             flow."
        REFERENCE "RFC 7455"
        ::= {trillOamMepDbEntry 3 }

     trillOamMepDbFlowFailedOkTime OBJECT-TYPE
        SYNTAX        TimeStamp
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
            "The Time (sysUpTime) at which the Remote MEP Flow state
             machine last entered either the RMEP_FAILED or RMEP_OK
             state."
        REFERENCE "RFC 7455"
        ::= {trillOamMepDbEntry 4 }

    trillOamMepDbRbridgeName OBJECT-TYPE
        SYNTAX        Unsigned32(0..65471)
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
             "Remote MEP Rbridge Nickname."
        REFERENCE "RFC 7455 RFC 6325 section 3"
        ::= {trillOamMepDbEntry 5 }

    trillOamMepDbLastGoodSeqNum OBJECT-TYPE
```

```
        SYNTAX        Counter32
        MAX-ACCESS    read-only
        STATUS        current
        DESCRIPTION
             "Last Sequence Number received."
        REFERENCE "RFC 7455 13.1"
        ::= {trillOamMepDbEntry 6}

    -- ****************************************************************
    -- TRILL OAM MIB NOTIFICATIONS (TRAPS)
    -- This notification is sent to management entity whenever a
    -- MEP loses/restores
    -- contact with its peer Flow Meps
    -- ****************************************************************
    trillOamFaultAlarm NOTIFICATION-TYPE
        OBJECTS         { trillOamMepDbFlowState }
        STATUS          current
        DESCRIPTION
            "A MEP Flow has a persistent defect condition.
             A notification (fault alarm) is sent to the management
             entity with the OID of the Flow that has detected the fault.

            The management entity receiving the notification can identify
            the system from the network source address of the
            notification, and can identify the Flow reporting the defect
            by the indices in the OID of the trillOamMepFlowIndex, and
            trillOamFlowDefect variable in the notification:

               dot1agCfmMdIndex - Also the index of the MEP's
                                  Maintenance Domain table entry
                                  (dot1agCfmMdTable).
               dot1agCfmMaIndex - Also an index (with the MD table index)
                                  of the MEP's Maintenance Association
                                  network table entry
                                  (dot1agCfmMaNetTable), and (with the MD
                                  table index and component ID) of the
                                  MEP's MA component table entry
                                  (dot1agCfmMaCompTable).
               dot1agCfmMepIdentifier - MEP Identifier and final index
                                  into the MEP table (dot1agCfmMepTable).
               trillOamMepFlowCfgIndex - Index identifies
                                  indicates the specific Flow for
                                  the MEP"
        REFERENCE       "RFC 7455"
       ::= { trillOamNotifications 1 }

    -- ****************************************************************
    -- TRILL OAM MIB Module - Conformance Information
```

```
   -- ****************************************************************

   trillOamMibCompliances  OBJECT IDENTIFIER
       ::= { trillOamMibConformance 1 }

   trillOamMibGroups  OBJECT IDENTIFIER
       ::= { trillOamMibConformance 2 }


   -- ****************************************************************
   -- TRILL OAM MIB Units of conformance
   -- ****************************************************************

   trillOamMepMandatoryGroup OBJECT-GROUP
       OBJECTS         {
                           trillOamMepRName,
                           trillOamMepNextPtmTId,
                           trillOamMepNextMtvmTId,
                           trillOamMepPtrIn,
                           trillOamMepPtrInOutofOrder,
                           trillOamMepPtrOut,
                           trillOamMepMtvrIn,
                           trillOamMepMtvrInOutofOrder,
                           trillOamMepMtvrOut,
                           trillOamMepTxLbmDestRName,
                           trillOamMepTxLbmHC,
                           trillOamMepTxLbmReplyModeOob,
                           trillOamMepTransmitLbmReplyIp,
                           trillOamMepTxLbmFlowEntropy,
                           trillOamMepTxPtmDestRName,
                           trillOamMepTxPtmHC,
                           trillOamMepTxPtmReplyModeOob,
                           trillOamMepTransmitPtmReplyIp,
                           trillOamMepTxPtmFlowEntropy,
                           trillOamMepTxPtmStatus,
                           trillOamMepTxPtmResultOK,
                           trillOamMepTxPtmMessages,
                           trillOamMepTxPtmSeqNumber,
                           trillOamMepTxMtvmTree,
                           trillOamMepTxMtvmHC,
                           trillOamMepTxMtvmReplyModeOob,
                           trillOamMepTransmitMtvmReplyIp,
                           trillOamMepTxMtvmFlowEntropy,
                           trillOamMepTxMtvmStatus,
                           trillOamMepTxMtvmResultOK,
                           trillOamMepTxMtvmMessages,
                           trillOamMepTxMtvmSeqNumber,
                           trillOamMepTxMtvmScopeList,
```

```
                        trillOamMepDiscontinuityTime
                    }
        STATUS          current
        DESCRIPTION
            "Mandatory objects for the TRILL OAM MEP group."
        ::= { trillOamMibGroups 1 }

    trillOamMepFlowCfgTableGroup OBJECT-GROUP
        OBJECTS         {
                        trillOamMepFlowCfgFlowEntropy,
                        trillOamMepFlowCfgDestRName,
                        trillOamMepFlowCfgFlowHC,
                        trillOamMepFlowCfgRowStatus
                    }
        STATUS          current
        DESCRIPTION
            "TRILL OAM MEP Flow Configuration objects group."
        ::= { trillOamMibGroups 2 }

    trillOamPtrTableGroup OBJECT-GROUP
        OBJECTS         {
                        trillOamMepPtrHC,
                        trillOamMepPtrFlag,
                        trillOamMepPtrErrorCode,
                        trillOamMepPtrTerminalMep,
                        trillOamMepPtrLastEgressId,
                        trillOamMepPtrIngress,
                        trillOamMepPtrIngressMac,
                        trillOamMepPtrIngressPortIdSubtype,
                        trillOamMepPtrIngressPortId,
                        trillOamMepPtrEgress,
                        trillOamMepPtrEgressMac,
                        trillOamMepPtrEgressPortIdSubtype,
                        trillOamMepPtrEgressPortId,
                        trillOamMepPtrChassisIdSubtype,
                        trillOamMepPtrChassisId,
                        trillOamMepPtrOrganizationSpecificTlv,
                        trillOamMepPtrNextHopNicknames
                    }
        STATUS          current
        DESCRIPTION
            "TRILL OAM MEP PTR objects group."
        ::= { trillOamMibGroups 3 }

    trillOamMtvrTableGroup OBJECT-GROUP
        OBJECTS         {
                        trillOamMepMtvrFlag,
                        trillOamMepMtvrErrorCode,
```

```
                        trillOamMepMtvrLastEgressId,
                        trillOamMepMtvrIngress,
                        trillOamMepMtvrIngressMac,
                        trillOamMepMtvrIngressPortIdSubtype,
                        trillOamMepMtvrIngressPortId,
                        trillOamMepMtvrEgress,
                        trillOamMepMtvrEgressMac,
                        trillOamMepMtvrEgressPortIdSubtype,
                        trillOamMepMtvrEgressPortId,
                        trillOamMepMtvrChassisIdSubtype,
                        trillOamMepMtvrChassisId,
                        trillOamMepMtvrOrganizationSpecificTlv,
                        trillOamMepMtvrNextHopNicknames,
                        trillOamMepMtvrReceiverAvailability,
                        trillOamMepMtvrReceiverCount
                    }
    STATUS          current
    DESCRIPTION
        "TRILL OAM MEP MTVR objects group."
    ::= { trillOamMibGroups 4 }

trillOamMepDbGroup  OBJECT-GROUP
    OBJECTS   {
      trillOamMepDbFlowIndex,
      trillOamMepDbFlowEntropy,
      trillOamMepDbFlowState,
      trillOamMepDbFlowFailedOkTime,
      trillOamMepDbRbridgeName,
      trillOamMepDbLastGoodSeqNum
    }

    STATUS      current
    DESCRIPTION
       "TRILL OAM MEP DB objects group."
    ::= { trillOamMibGroups 5 }

trillOamNotificationGroup NOTIFICATION-GROUP
    NOTIFICATIONS  { trillOamFaultAlarm }
    STATUS current
    DESCRIPTION
        "A collection of objects describing notifications(traps)."
    ::= { trillOamMibGroups 6 }

-- ****************************************************************
-- TRILL OAM MIB Module Compliance statements
-- ****************************************************************

trillOamMibCompliance MODULE-COMPLIANCE
```

```
        STATUS          current
        DESCRIPTION
            "The compliance statement for the TRILL OAM MIB."
        MODULE          -- this module
        MANDATORY-GROUPS {
                            trillOamMepMandatoryGroup,
                            trillOamMepFlowCfgTableGroup,
                            trillOamPtrTableGroup,
                            trillOamMtvrTableGroup,
                            trillOamMepDbGroup,
                            trillOamNotificationGroup
                        }
        ::= { trillOamMibCompliances 1 }

    -- Compliance requirement for read-only implementation.

    trillOamMibReadOnlyCompliance MODULE-COMPLIANCE
        STATUS current
        DESCRIPTION
            "Compliance requirement for implementation that only
             provide read-only support for TRILL-OAM-MIB.
             Such devices can be monitored but cannot be configured
             using this MIB module."
        MODULE -- this module
        MANDATORY-GROUPS {
                            trillOamMepMandatoryGroup,
                            trillOamMepFlowCfgTableGroup,
                            trillOamPtrTableGroup,
                            trillOamMtvrTableGroup,
                            trillOamMepDbGroup,
                            trillOamNotificationGroup
                          }
        -- trillOamMepTable

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

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

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

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

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

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

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

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

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

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

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

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

        OBJECT trillOamMepTxPtmMessages
        MIN-ACCESS  read-only
             DESCRIPTION
```

```
            "Write access is not required."

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

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

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

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

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

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

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

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

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

        OBJECT trillOamMepTxMtvmSeqNumber
```

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

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


    -- trillOamMepFlowCfgTable

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

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

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

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


        ::= { trillOamMibCompliances 2 }


    END
```

8. Security Considerations

This MIB relates to a system that will provide network connectivity and packet forwarding services. 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 number of management objects defined in this MIB module

with a MAX-ACCESS clause of read-create. Such objects may be considered sensitive or vulnerable in some network environments. Support for SET operations in a non-secure environment without proper protection can have negative effect on sensitivity/vulnerability:

The following table and objects in the TRILL-OAM-MIB can be manipulated to interfere with the operation of RBridges by causing cpu use spikes:

o trillOamMepTransmitLbmReplyIp allows the reply from a Loopback message to be transmitted to an IP address in the TLV thus allowing replies to be sent to any system to cause Denial of Service.

o trillOamMepTransmitPtmReplyIp allows the reply from a Path Trace message to be transmitted to an IP address in the TLV and thus allowing replies to be sent to any system to cause Denial of Service.

o trillOamMepTxPtmMessages allows the generation of PTM Messages and can be used to generate lots of cpu driven traffic.

o trillOamMepTransmitMtvmReplyIp allows from reply from an MTV message to be transmitted to an IP address in the TLV and thus allowing replies to be sent to any system to cause Denial of Service.

o trillOamMepTxMtvmMessages allows the generation of MTV Messages and can be used to generate lots of cpu driven traffic.

The following objects in the TRILL-OAM-MIB are read-create and can be manipulated to interfere with the OAM operations of RBridges. If the number of OAM frames generated in the network is high, this can cause a cpu spike on destination Rbridges if Control plane policing is not properly implemented or configured on destination Rbridges.

o trillOamMepTxLbmHC is used to set the Maximum Hop count for the LBM message. As OAM frame don't leak out of the TRILL network, it has no side effects.

o trillOamMepTxLbmReplyModeOob is used to indicate whether the reply is in-band or out-of-band. This object's vulnerability is covered as part of trillOamMepTransmitLbmReplyIp.

o trillOamMepTxLbmFlowEntropy is used to indicate the customer flow and find the exact path in the network. The creation of valid flows is its intended purpose. If invalid flows are created on vulnerable system they will be dropped in forwarding.

o trillOamMepTxLbmDestRName is read-create but it's not vulnerable as

invalid-name routes won't be present and will be rejected by the OAM application as part of normal processing.

o trillOamMepTxPtmHC is used to set the Maximum Hop count for the PTM message. As OAM frame don't leak out of the TRILL network, it has no side effect.

o trillOamMepTxPtmReplyModeOob is used to indicate whether the reply is in-band or out-of-band. This object's vulnerability is covered as part of trillOamMepTransmitPtmReplyIp.

o trillOamMepTxPtmFlowEntropy is used to indicate the customer flow and find the exact path in the network. Creation of valid flows is its intended purpose. If invalid flows are created on vulnerable systems they will be dropped in forwarding.

o trillOamMepTxPtmDestRName is read-create but it's not vulnerable as invalid-name routes won't be present and will be rejected by the OAM application as part of normal processing.

o trillOamMepTxPtmStatus is required for normal PTM operation.

o trillOamMepTxPtmResultOK is required for normal PTM operation.

o trillOamMepTxPtmSeqNumber is required for normal PTM operation.

o trillOamMepTxPtmMessages is required for normal PTM operation.

o trillOamMepTxMtvmTree is required for normal MTVM operation.

o trillOamMepTxMtvmHC is used to set the Maximum Hop count for the MTVM message. As OAM frame don't leak out of the TRILL network, it has no side effect

o trillOamMepTxMtvmReplyModeOob is used to indicate whether the reply is in-band or out-of-band. This object's vulnerability is covered as part of trillOamMepTransmitMtmReplyIp

o trillOamMepTxMtvmFlowEntropy is used to indicate the customer flow and find the exact path in the network. Creation of valid flows is its intended purpose. If invalid flows are created on vulnerable systems they will be dropped in forwarding.

o trillOamMepTxMtvmStatus is required for normal MTVM operation.

o trillOamMepTxMtvmResultOK, trillOamMepTxMtvmMessages, trillOamMepTxMtvmSeqNumber, and trillOamMepTxMtvmScopeList is required for normal MTVM operation.

trillOamMepTransmitLbmReplyIp, trillOamMepTransmitPtmReplyIp, and trillOamMepTransmitMtvmReplyIp allow setting of the IP address to which reports are sent and thus it can be used for Denial of Service for that IP.

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 GET and/or NOTIFY access to these objects and possibly to encrypt the values of these objects when sending them over the network via SNMP. For example, Path Trace messages expose the unicast topology of the network and Multi-destination Tree Verification Messages expose the multicast tree topology of the network. This information should not be available to all users of the network.

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.

Implementation should provide the security features described by 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, deployment of SNMPv3 with cryptographic security enabled is RECOMMENDED. 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 only those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) access to the objects.

9. IANA Considerations

The MIB module in this document uses the following IANA-assigned OBJECT IDENTIFIER value recorded in the SMI Numbers registry:

```
Descriptor   OBJECT   IDENTIFIER  value
----------------------------------------
trillOamMIB  { 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.

10. Contributors

We wish to thank members of the IETF TRILL WG and the MIB-Doctor for their comments and suggestions. Detailed comments were provided by Sam Aldrin, Donald Eastlake, Tom Taylor, and Harrie Hazewinkel.

11. References

11.1. Normative References

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