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D. Zinman
D. Walker
J. Jiang

Management Information Base for Telephony Routing over IP (TRIP) <draft-ietf-iptel-trip-mib-09.txt>

Status of this Memo

Copyright Notice

Abstract

This memo defines a portion of the MIB (Management Information Base) module for use with network management protocols in the Internet community. In particular, it describes a set of managed objects that are used to manage TRIP (Telephony Routing over IP) devices.

Table of Contents

1. 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 module objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in this MIB module 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].

2. Introduction

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes a set of managed objects that are used to schedule management operations periodically or at specified dates and times. Since TRIP [RFC3219] is modeled after the Border Gateway Protocol (BGP-4) [RFC1771], the managed objects for TRIP are also modeled after RFC1657 - Definitions of Managed Objects for the Fourth Version of the Border Gateway Protocol (BGP-4) using SMIv2 [RFC1657].

3. 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 BCP-0014 [BCP0014].

4. Overview

This MIB module provides managed objects for TRIP devices defined in Telephony Routing over IP [RFC3219]. TRIP is an inter-domain application-layer control protocol that exchanges information between TRIP location servers (LS) to provide efficient IP telephony routing.

5. Structure of TRIP MIB

This MIB module utilizes the framework described in RFC 2788 [RFC2788] for management of multiple instances of TRIP from a single entity. The Network Services Monitoring MIB module applTable will be populated with entries corresponding to each TRIP Location Server in the system. Each TRIP Location Server will then have an applIndex associated with it. The value assigned to applIndex will represent the distinct instance of TRIP.

The TRIP MIB module contains the following groups of objects with each group as part of the management of a singular TRIP entity. Each group covers a section of functionality of TRIP:

- The tripConfigGroup contains the common configuration objects applicable to all TRIP applications referenced by the applIndex.
- The tripPeerTableConfigGroup contains the configuration objects applicable to all TRIP peers of the Location Server referenced by the applIndex.
- The tripRouteGroup contains the configuration objects related to the routes of all TRIBs of this Location Server.
- The tripItadTopologyGroup contains information about the topology of the TRIP ITADs concerning this Location Server.
- The tripPeerTableStatsGroup contains the statistical objects applicable to all TRIP peers of the Location Server referenced by the applIndex.
- The tripNotificationGroup contains notifications that the TRIP application can generate.
- The tripNotifObjectGroup contains the objects needed by one or more of the notifications.

5.1 Textual Conventions

The data types TripItad and TripId are used as textual conventions in this document. A TRIP ITAD (IP Telephony Administrative Domain) is described in [RFC3219]. A TRIP ID is used as a distinct identifier for a TRIP Location Server. A TripAppProtocol is used to identify an application protocol. A TripAddressFamily is used to define an address family. TripCommunityId is used as a distinct identifier for a TRIP community. TripProtocolVersion depicts the version number of the TRIP protocol. TripSendReceiveMode describes the operational mode of the TRIP application.

6. Definitions

6.1 TRIP Textual Conventions

```
TRIP-TC DEFINITIONS ::= BEGIN

    IMPORTS
        MODULE-IDENTITY,
        Unsigned32,
        Integer32,
        mib-2
            FROM SNMPv2-SMI

        TEXTUAL-CONVENTION
            FROM SNMPv2-TC;

    tripTC MODULE-IDENTITY
        LAST-UPDATED   "200310170000Z" -- Oct 17, 2003
```



```
        ORGANIZATION   "IETF IPTel Working Group.
            Mailing list: iptel@lists.bell-labs.com"
        CONTACT-INFO
           "Co-editor  David Zinman
            postal:    265 Ridley Blvd.
                       Toronto ON, M5M 4N8
                       Canada
            email:     dzinman@rogers.com
            phone:     +1 416 433 4298

            Co-editor  Dave Walker
                       SS8 Networks, Inc.
            postal:    495 March Road, Suite #500
                       Ottawa, ON, K2K 3G1
                       Canada
            email:     drwalker@ss8.com
            phone:     +1 613 592 2100

            Co-editor   Jianping Jiang
                        SGNT Technologies, Inc.
            postal:     5850 Keaton Crescent
                        Mississauga, ON L5R 3K2
                        Canada
            email:      jjiang@sgntt.com
            phone:      +1 905 290 1384
            "
        DESCRIPTION
            "Initial version of TRIP (Telephony Routing Over IP)
            MIB Textual Conventions module used by other
            TRIP-related MIB Modules.

            Copyright (C) The Internet Society (2003). This version of
```

```
            this MIB module is part of RFC xxxx, see the RFC itself
            for full legal notices."
        REVISION      "200310170000Z" -- Oct 17, 2003
        DESCRIPTION
            "The initial version, Published as RFC xxxx."
        ::= { mib-2 xxxx }  -- to be assigned by IANA

    --
    -- Textual Conventions
    --
    TripItad ::= TEXTUAL-CONVENTION
        STATUS current
        DESCRIPTION
           "The values for identifying the IP Telephony
           Administrative Domain (ITAD)."
        SYNTAX Unsigned32 (0..4294967295)

    TripId ::= TEXTUAL-CONVENTION
        STATUS current
        DESCRIPTION
```



```
           "The TRIP Identifier uniquely identifies a LS within its
           ITAD. It is a 4 octet unsigned integer that may, but not
           necessarily, represent the IPv4 address of a Location
           Server.  Where bytes 1-4 of the Unsigned32 represent
           1-4 bytes of the IPv4 address in network-byte order. For
           an IPv6 network, TripId will not represent the IPv6
           address."
        SYNTAX Unsigned32 (0..4294967295)

    TripAddressFamily ::= TEXTUAL-CONVENTION
        STATUS current
        DESCRIPTION
            "A type of address for a TRIP route. Address families
            defined within this MIB module are:

            Code              Address Family
            1                 Decimal Routing Numbers
            2                 PentaDecimal Routing Numbers
            3                 E.164 Numbers
            255               An other type of address family"

        SYNTAX INTEGER
            { decimal(1), pentadecimal(2), e164(3), other(255) }

    TripAppProtocol ::= TEXTUAL-CONVENTION
        STATUS current
```

```
        DESCRIPTION
            "The application protocol used for communication with TRIP
            Location Servers. Protocols defined in this MIB Module
            are:

            Code              Protocol
            1                 SIP
            2                 H.323-H.225.0-Q.931
            3                 H.323-H.225.0-RAS
            4                 H.323-H.225.0-Annex-G
            255               An other type of application protocol"

        SYNTAX INTEGER
            { sip(1), q931(2), ras(3), annexG(4), other(255) }

    TripCommunityId ::= TEXTUAL-CONVENTION
        STATUS current
        DESCRIPTION
           "The range of legal values for a TRIP Community
           Identifier."
        SYNTAX Unsigned32 (0..4294967295)

    TripProtocolVersion ::= TEXTUAL-CONVENTION
        STATUS current
        DESCRIPTION
           "The version number of the TRIP protocol."
```



```
        SYNTAX Integer32 (1..255)

    TripSendReceiveMode ::= TEXTUAL-CONVENTION
        STATUS current
        DESCRIPTION
           "The operational mode of the TRIP application. Possible
           values are:
              1 - Send Receive mode
              2 - Send only mode
              3 - Receive Only mode"
        SYNTAX INTEGER { sendReceive(1), sendOnly(2), receiveOnly(3) }

END
```

6.2 TRIP MIB

```
TRIP-MIB DEFINITIONS ::= BEGIN

    IMPORTS
        MODULE-IDENTITY,
        OBJECT-TYPE,
```

```
        NOTIFICATION-TYPE,
        Unsigned32,
        Integer32,
        Counter32,
        mib-2
            FROM SNMPv2-SMI

        DateAndTime,
        TimeInterval,
        TruthValue,
        TimeStamp,
        StorageType,
        RowStatus
            FROM SNMPv2-TC

        OBJECT-GROUP,
        MODULE-COMPLIANCE,
        NOTIFICATION-GROUP
            FROM SNMPv2-CONF

        InetAddressType,
        InetAddress,
        InetPortNumber
            FROM INET-ADDRESS-MIB

        applIndex,
        applRFC2788Group
            FROM NETWORK-SERVICES-MIB

        TripItad,
        TripId,
```



```
        TripAppProtocol,
        TripAddressFamily,
        TripCommunityId,
        TripProtocolVersion,
        TripSendReceiveMode
            FROM TRIP-TC;

    tripMIB MODULE-IDENTITY
       LAST-UPDATED "200310170000Z" -- Oct 17, 2003
           ORGANIZATION "IETF IPTel Working Group.
            Mailing list: iptel@lists.bell-labs.com"

       CONTACT-INFO
           "Co-editor  David Zinman
            postal:    265 Ridley Blvd.
                       Toronto ON, M5M 4N8
```

```
                    Canada
            email:  dzinman@rogers.com
            phone:  +1 416 433 4298

            Co-editor  Dave Walker
                       SS8 Networks, Inc.
            postal:    495 March Road, Suite #500
                       Ottawa, ON, K2K 3G1
                       Canada
            email:     drwalker@ss8.com
            phone:     +1 613 592 2100

            Co-editor   Jianping Jiang
                        SGNT Technologies, Inc.
            postal:     5850 Keaton Crescent
                        Mississauga, ON L5R 3K2
                        Canada
            email:      jjiang@sgntt.com
            phone:      +1 905 290 1384
            "
        DESCRIPTION
            "The MIB module describing Telephony Routing over IP
            (TRIP). TRIP is a policy driven inter-administrative
            domain protocol for advertising the reachability of
            telephony destinations between location servers (LS), and
            for advertising attributes of the routes to those
            destinations.

            Copyright (C) The Internet Society (2003). This version of
            this MIB module is part of RFC xxxx, see the RFC itself
            for full legal notices."
        REVISION      "200310170000Z" -- Oct 17, 2003
        DESCRIPTION
            "The initial version, Published as RFC xxxx."
    ::= { mib-2 xxxx } -- to be assigned by IANA


Zinman/Walker/Jiang                                                 8

Internet Draft                                          October 2003

        tripMIBNotifications OBJECT IDENTIFIER ::= { tripMIB 0 }
        tripMIBObjects       OBJECT IDENTIFIER ::= { tripMIB 1 }
        tripMIBConformance   OBJECT IDENTIFIER ::= { tripMIB 2 }
        tripMIBNotifObjects  OBJECT IDENTIFIER ::= { tripMIB 3 }

        tripMIBCompliance    OBJECT IDENTIFIER ::=
                                    { tripMIBConformance 1 }
        tripMIBGroups        OBJECT IDENTIFIER ::=
                                    { tripMIBConformance 2 }
```

```
   --
   -- tripCfgTable
   --
    tripCfgTable OBJECT-TYPE
        SYNTAX     SEQUENCE OF TripCfgEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
            "This table contains the common configuration objects
             applicable to all TRIP applications referenced by the
             applIndex.  Each row represents those objects for a
             particular TRIP LS present in this system. The
             instances of TRIP LS's are uniquely identified by the
             applIndex. The objects in this table SHOULD be
             nonVolatile and survive a reboot."
        ::= { tripMIBObjects 1 }

    tripCfgEntry OBJECT-TYPE
        SYNTAX     TripCfgEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
            "A row of common configuration."
        INDEX { applIndex }
        ::= { tripCfgTable 1 }

    TripCfgEntry ::=
        SEQUENCE {
           tripCfgProtocolVersion              TripProtocolVersion,
           tripCfgItad                         TripItad,
           tripCfgIdentifier                   TripId,
           tripCfgAdminStatus                  INTEGER,
           tripCfgOperStatus                   INTEGER,
           tripCfgAddrIAddrType                InetAddressType,
           tripCfgAddr                         InetAddress,
           tripCfgPort                         InetPortNumber,
           tripCfgMinItadOriginationInterval   Integer32,
           tripCfgMinRouteAdvertisementInterval Integer32,
           tripCfgMaxPurgeTime                 Integer32,
           tripCfgDisableTime                  Integer32,
           tripCfgSendReceiveMode              TripSendReceiveMode,
           tripCfgStorage                      StorageType
```



```
       }

    tripCfgProtocolVersion    OBJECT-TYPE
        SYNTAX     TripProtocolVersion
```

```
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
            "This object will reflect the version of TRIP
            supported by this system.  It follows the same
            format as TRIP version information contained
            in the TRIP messages generated by this TRIP entity."
        REFERENCE
            "RFC 3219, section 4.2."
        ::= { tripCfgEntry 1 }

    tripCfgItad   OBJECT-TYPE
        SYNTAX      TripItad
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The Internet Telephony Administrative domain (ITAD)
            of this LS."
        ::= { tripCfgEntry 2 }

    tripCfgIdentifier   OBJECT-TYPE
        SYNTAX      TripId
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The object that identifies this TRIP Client."
        ::= { tripCfgEntry 3 }

    tripCfgAdminStatus OBJECT-TYPE
        SYNTAX      INTEGER {
                        up(1),
                        down(2)
                    }
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The desired TRIP state.

             up(1)  : Set the application to normal operation.

             down(2): Set the application to a state where it will
                      not process TRIP messages.

             Setting this object should be reflected in
             tripCfgOperStatus. If an unkown error occurs
             tripCfgOperStatus will return unknown(0)."
        ::= { tripCfgEntry 4 }
```

```
    tripCfgOperStatus OBJECT-TYPE
        SYNTAX      INTEGER {
                        unknown(0),
                        up(1),
                        down(2),
                        faulty(3)
                    }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The current operational state of the TRIP protocol.

             unknown(0): The operating status of the application is
                         unknown.

             up(1):      The application is operating normally, and
                         is ready to process (receive and issue) TRIP
                         requests and responses.

             down(2):    The application is currently not processing
                         TRIP messages. This occurs if the TRIP
                         application is in an initialization state or
                         if tripCfgAdminStatus is set to down(2).

             faulty(3):  The application is not operating normally due
                         to a fault in the system.

            If tripCfgAdminStatus is down(2) then tripOperStatus SHOULD
            be down(2). If tripAdminStatus is changed to up(1) then
            tripOperStatus SHOULD change to up(1) if there is no
            fault that prevents the TRIP protocol from moving to the
            up(1) state."
        ::= { tripCfgEntry 5 }

    tripCfgAddrIAddrType OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The type of Inet Address of the tripAddr."
        REFERENCE
            "RFC 3291, section 3."
        ::= { tripCfgEntry 6 }

    tripCfgAddr OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
```

```
            "The network address of the local LS that the peer
            connects to. The type of address depends on the object
            tripCfgAddrIAddrType."
```



```
        REFERENCE
            "RFC 3291, section 3."
        ::= { tripCfgEntry 7 }

    tripCfgPort OBJECT-TYPE
        SYNTAX      InetPortNumber
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The local tcp/udp port on the local LS that the peer
            connects to."
        ::= { tripCfgEntry 8 }

    tripCfgMinItadOriginationInterval OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        UNITS       "Seconds"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "The minimum amount of time that MUST elapse between
            advertisement of the update message that reports changes
            within the LS's own ITAD."
        DEFVAL { 30 }
        ::= { tripCfgEntry 9 }

    tripCfgMinRouteAdvertisementInterval OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        UNITS       "Seconds"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "Specifies minimal interval between successive
            advertisements to a particular destination from an LS."
        DEFVAL { 30 }
        ::= { tripCfgEntry 10 }

    tripCfgMaxPurgeTime OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        UNITS       "Seconds"
        MAX-ACCESS  read-write
        STATUS      current
        DESCRIPTION
            "Indicates the interval that the LS MUST maintain routes
```

```
            marked as withdrawn in its database."
        DEFVAL { 10 }
        ::= { tripCfgEntry 11 }

    tripCfgDisableTime OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        UNITS       "Seconds"
        MAX-ACCESS  read-write
        STATUS      current
```



```
        DESCRIPTION
            "Indicates the interval that the TRIP module of the
            LS MUST be disabled while routes originated by this
            LS with high sequence numbers can be removed."
        DEFVAL { 180 }
        ::= { tripCfgEntry 12 }

    tripCfgSendReceiveMode OBJECT-TYPE
        SYNTAX TripSendReceiveMode
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The operational mode of the TRIP entity running on this
            system."
        ::= { tripCfgEntry 13 }

    tripCfgStorage OBJECT-TYPE
        SYNTAX       StorageType
        MAX-ACCESS   read-write
        STATUS       current
        DESCRIPTION
           "The storage type for this conceptual row. Conceptual rows
           having the value 'permanent' need not allow write-access
           to any columnar objects in the row."
        DEFVAL { nonVolatile }
        ::= { tripCfgEntry 14 }

 --
 -- TripRouteTypeTable
 --

    tripRouteTypeTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF TripRouteTypeEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The TRIP peer Route Type table contains one entry per
```

```
            supported protocol - address family pair.  The objects in
            this table are volatile and are refreshed after a reboot."
        ::= { tripMIBObjects 2 }

    tripRouteTypeEntry OBJECT-TYPE
        SYNTAX      TripRouteTypeEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "An entry containing information about the route type
            that a particular TRIP entity supports. Each entry
            represents information about either the local or a remote
            LS peer.  The object tripRouteTypePeer is used to
            distinguish this.  In the case of a local LS, the
            address/port information will reflect the values
```



```
            configured in tripCfgTable.  In the case of a remote
            peer, the address/port information will reflect the
            values of an entry in the tripPeerTable.

            Implementation need to be aware that if the size of
            tripRouteTypeAddr exceeds 111 sub-IDs, then OIDs of column
            instances in this table will have more than 128 sub-IDs
            and cannot be accessed using SNMPv1, SNMPv2c, or snmpv3."
        INDEX { applIndex,
                tripRouteTypeAddrInetType,
                tripRouteTypeAddr,
                tripRouteTypePort,
                tripRouteTypeProtocolId,
                tripRouteTypeAddrFamilyId }
          ::= { tripRouteTypeTable 1 }

    TripRouteTypeEntry ::= SEQUENCE {
        tripRouteTypeAddrInetType       InetAddressType,
        tripRouteTypeAddr               InetAddress,
        tripRouteTypePort               InetPortNumber,
        tripRouteTypeProtocolId         TripAppProtocol,
        tripRouteTypeAddrFamilyId       TripAddressFamily,
        tripRouteTypePeer               INTEGER
    }

    tripRouteTypeAddrInetType OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The type of Inet Address of the tripRouteTypeAddr."
```

```
        REFERENCE
            "RFC 3291, section 3."
        ::= { tripRouteTypeEntry 1 }

    tripRouteTypeAddr OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The network address of this entry's TRIP peer LS."
        REFERENCE
            "RFC 3291, section 3."
        ::= { tripRouteTypeEntry 2 }

    tripRouteTypePort OBJECT-TYPE
        SYNTAX      InetPortNumber
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The port for the TCP connection between this and
            an associated TRIP peer."
```



```
        ::= { tripRouteTypeEntry 3 }

    tripRouteTypeProtocolId OBJECT-TYPE
        SYNTAX      TripAppProtocol
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The object identifier of a protocol that the associated
            peer is using."
        ::= { tripRouteTypeEntry 4 }

    tripRouteTypeAddrFamilyId OBJECT-TYPE
        SYNTAX      TripAddressFamily
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The object identifier of an address family that the
            associated peer belongs to."
        ::= { tripRouteTypeEntry 5 }

    tripRouteTypePeer OBJECT-TYPE
        SYNTAX      INTEGER { local(1), remote(2) }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
```

```
            "This object identifies whether this entry is
            associated with a 'local' or 'remote' LS peer."
        ::= { tripRouteTypeEntry 6 }

 --
 -- tripSupportedCommunityTable
 --

    tripSupportedCommunityTable   OBJECT-TYPE
        SYNTAX      SEQUENCE OF TripSupportedCommunityEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The list of TRIP communities that this LS supports. A
            TRIP community is a group of destinations that share
            common properties.

            The TRIP Supported Communities entry is used to group
            destinations so that the routing decision can be based
            on the identity of the group."
        REFERENCE
            "RFC 3219, section 5.9"
        ::= { tripMIBObjects 3 }

    tripSupportedCommunityEntry OBJECT-TYPE
        SYNTAX      TripSupportedCommunityEntry
        MAX-ACCESS  not-accessible
```



```
        STATUS      current
        DESCRIPTION
            "Entry containing information about a community. A TRIP
            community is a group of destinations that share some
            common property. This attribute is used so that routing
            decisions can be based on the identity of the group."
        INDEX { applIndex, tripSupportedCommunityId }
        ::= { tripSupportedCommunityTable 1 }

    TripSupportedCommunityEntry ::= SEQUENCE {
        tripSupportedCommunityId         TripCommunityId,
        tripSupportedCommunityItad       TripItad,
        tripSupportedCommunityStorage    StorageType,
        tripSupportedCommunityRowStatus  RowStatus
    }

    tripSupportedCommunityId OBJECT-TYPE
        SYNTAX      TripCommunityId
        MAX-ACCESS  not-accessible
```

```
        STATUS      current
        DESCRIPTION
            "The identifier of the supported Community."
        ::= { tripSupportedCommunityEntry 1 }

    tripSupportedCommunityItad OBJECT-TYPE
        SYNTAX      TripItad
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The ITAD of the community."
        ::= { tripSupportedCommunityEntry 2 }

   tripSupportedCommunityStorage OBJECT-TYPE
       SYNTAX       StorageType
       MAX-ACCESS   read-create
       STATUS       current
       DESCRIPTION
          "The storage type for this conceptual row.  Conceptual
          rows having the value 'permanent' need not allow write-
          access to any columnar objects in the row. It is not a
          requirement that this storage be non volatile."
       DEFVAL { nonVolatile }
       ::= { tripSupportedCommunityEntry 3 }

    tripSupportedCommunityRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The row status of the entry. This object is REQUIRED
            to create or delete rows by a manager. A value for
            tripSupportedCommunityItad MUST be set for row creation
```



```
            to be successful. If the instance already exists for a
            particular applIndex, the row create operation will
            fail.

            The value of this object has no effect on whether
            other objects in this conceptual row can be modified."
        ::= { tripSupportedCommunityEntry 4 }

 --
 -- TripPeerTable
 --
    tripPeerTable   OBJECT-TYPE
        SYNTAX      SEQUENCE OF TripPeerEntry
```

```
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The TRIP peer table. This table contains one entry per
            TRIP peer, and information about the connection with
            the peer."
        ::= { tripMIBObjects 4 }

    tripPeerEntry OBJECT-TYPE
        SYNTAX      TripPeerEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Entry containing information about the connection with
            a TRIP peer.

            Implementation need to be aware that if the size of
            tripPeerRemoteAddr exceeds 113 sub-IDs, then OIDs of
            column instances in this table will have more than 128
            sub-IDs and cannot be accessed using SNMPv1, SNMPv2c, or
            snmpv3."
        INDEX { applIndex,
                tripPeerRemoteAddrInetType,
                tripPeerRemoteAddr,
                tripPeerRemotePort }
          ::= {tripPeerTable 1}

    TripPeerEntry ::= SEQUENCE {
        tripPeerRemoteAddrInetType           InetAddressType,
        tripPeerRemoteAddr                   InetAddress,
        tripPeerRemotePort                   InetPortNumber,
        tripPeerIdentifier                   TripId,
        tripPeerState                        INTEGER,
        tripPeerAdminStatus                  INTEGER,
        tripPeerNegotiatedVersion            TripProtocolVersion,
        tripPeerSendReceiveMode              TripSendReceiveMode,
        tripPeerRemoteItad                   TripItad,
        tripPeerConnectRetryInterval         Integer32,
        tripPeerMaxRetryInterval             Integer32,
```



```
        tripPeerHoldTime                     Integer32,
        tripPeerKeepAlive                    Integer32,
        tripPeerHoldTimeConfigured           Integer32,
        tripPeerKeepAliveConfigured          Integer32,
        tripPeerMaxPurgeTime                 Integer32,
        tripPeerDisableTime                  Integer32,
        tripPeerLearned                      TruthValue,
```

```
        tripPeerStorage                         StorageType,
        tripPeerRowStatus                       RowStatus
    }

    tripPeerRemoteAddrInetType OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The type of Inet Address of the tripPeerRemoteAddr."
        REFERENCE
            "RFC 3291, section 3."
        ::= { tripPeerEntry 1 }

    tripPeerRemoteAddr OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The IP address of this entry's TRIP peer LS."
        REFERENCE
            "RFC 3291, section 3."
        ::= { tripPeerEntry 2 }

    tripPeerRemotePort OBJECT-TYPE
        SYNTAX      InetPortNumber
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The remote port for the TCP connection between the
            TRIP peers."
        ::= { tripPeerEntry 3 }

    tripPeerIdentifier OBJECT-TYPE
        SYNTAX      TripId
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "TRIP identifier of the peer."
        ::= { tripPeerEntry 4 }

    tripPeerState OBJECT-TYPE
        SYNTAX      INTEGER {
                        idle(1),
                        connect(2),
```



```
                        active(3),
```

```
                    openSent(4),
                    openConfirm(5),
                    established(6)
                }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "TRIP Peer Finite State Machine state.

        idle(1)       : The initial state. Local LS refuses all
                        incoming connections. No application
                        resources are allocated to processing
                        information about the remote peer.

        connect(2)    : Local LS waiting for a transport
                        protocol connection to be completed to
                        the peer, and is listening for inbound
                        transport connections from the peer.

        active(3)     : Local LS is listening for an inbound
                        connection from the peer, but is not in
                        the process of initiating a connection
                        to the remote peer.

        openSent(4)   : Local LS has sent an OPEN message to its
                        peer and is waiting for an OPEN message
                        from the remote peer.

        openConfirm(5): Local LS has sent an OPEN message to the
                        remote peer, received an OPEN message from
                        the remote peer, and sent a KEEPALIVE
                        message in response to the OPEN. The local
                        LS is now waiting for a KEEPALIVE message
                        or a NOTIFICATION message in response to
                        its OPEN message.

        established(6): LS can exchange UPDATE, NOTIFICATION, and
                        KEEPALIVE messages with its peer."
    ::= { tripPeerEntry 5 }

tripPeerAdminStatus OBJECT-TYPE
    SYNTAX      INTEGER {
                    up(1),
                    down(2)
                }
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object is used to affect the TRIP connection
        state.
```

```
            up(1)   : Allow a connection with the peer LS.

            down(2) : disconnect the connection from the peer LS and
                      do not allow any further connections to this
                      peer.

            If this value is set to down(2) then tripPeerState will
            have the value of idle(1)."
        DEFVAL      { up }
        ::= { tripPeerEntry 6 }

    tripPeerNegotiatedVersion OBJECT-TYPE
        SYNTAX      TripProtocolVersion
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The negotiated version of TRIP running between this
            local entity and this peer."
        ::= { tripPeerEntry 7 }

    tripPeerSendReceiveMode OBJECT-TYPE
        SYNTAX      TripSendReceiveMode
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The operational mode of this peer."
        ::= { tripPeerEntry 8 }

    tripPeerRemoteItad OBJECT-TYPE
        SYNTAX      TripItad
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The Internet Telephony Administrative domain of
            this peer."
        ::= { tripPeerEntry 9 }

    tripPeerConnectRetryInterval OBJECT-TYPE
        SYNTAX      Integer32 (0..2147483647)
        UNITS       "Seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Specifies the initial amount of time that will elapse
            between connection retry. This value SHOULD double
            after each attempt up to the value of
```

```
            tripPeerMaxRetryInterval. This value MUST always be less
            than or equal to the value of tripPeerMaxRetryInterval.
            Attempts to set this value higher than the max retry
            will not be allowed."
        DEFVAL      { 120 }
        ::= { tripPeerEntry 10 }
```



```
    tripPeerMaxRetryInterval OBJECT-TYPE
        SYNTAX      Integer32 (0..2147483647)
        UNITS       "Seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Specifies the maximum amount of time that will elapse
            between connection retries. Once the value of
            tripPeerConnectRetryInterval has reached this value, no
            more retries will be attempted. Attempts to set this
            value lower than the retry interval SHOULD not be
            allowed."
        DEFVAL      { 360 }
        ::= { tripPeerEntry 11 }

    tripPeerHoldTime OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        UNITS       "Seconds"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The time interval in seconds for the hold timer that
            is established with the peer. The value of this object
            is the smaller of the values in
            tripPeerHoldTimeConfigured and the hold time received
            in the open message."
        ::= { tripPeerEntry 12 }

    tripPeerKeepAlive OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        UNITS       "Seconds"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Specifies the amount of time that MUST elapse between
            keep alive messages. This value is negotiated with the
            remote when a connection is established."
        ::= { tripPeerEntry 13 }
```

```
    tripPeerHoldTimeConfigured OBJECT-TYPE
        SYNTAX      Integer32 (0 | 3..65535)
        UNITS       "Seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Specifies the maximum time that MAY elapse between the
            receipt of successive keepalive or update message. A value
            of 0 means that keepalive or update messages will not be
            sent."
        DEFVAL { 240 }
        ::= { tripPeerEntry 14 }
```



```
    tripPeerKeepAliveConfigured OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        UNITS       "Seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Specifies the amount of time that MUST elapse between
            keep alive messages."
        DEFVAL { 30 }
        ::= { tripPeerEntry 15 }

    tripPeerMaxPurgeTime OBJECT-TYPE
        SYNTAX      Integer32 (1..65535)
        UNITS       "Seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Indicates the interval that the LS MUST maintain routes
            marked as withdrawn in its database."
        DEFVAL { 10 }
        ::= { tripPeerEntry 16 }

    tripPeerDisableTime OBJECT-TYPE
        SYNTAX      Integer32 (1..65535)
        UNITS       "Seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Indicate the interval that the TRIP module of the remote
            peer LS MUST be disabled while routes originated by the
            local LS with high sequence numbers can be removed."
        DEFVAL { 180 }
        ::= { tripPeerEntry 17 }
```

```
    tripPeerLearned OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Indicates whether this entry was learned or
            configured."
        DEFVAL { false }
        ::= { tripPeerEntry 18 }

    tripPeerStorage OBJECT-TYPE
        SYNTAX       StorageType
        MAX-ACCESS   read-create
        STATUS       current
        DESCRIPTION
           "The storage type for this conceptual row.  Conceptual
           rows having the value 'permanent' need not allow write-
```



```
           access to any columnar objects in the row. It is not a
           requirement that this storage be non volatile."
        DEFVAL { nonVolatile }
        ::= { tripPeerEntry 19 }

    tripPeerRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The row status of the entry. This object is REQUIRED to
            create or delete rows remotely by a manager. If the
            instance already exists for a particular applIndex, the
            row create operation will fail.

            The value of this object has no effect on whether
            other objects in this conceptual row can be modified.

            Entries in this table can be learned by the TRIP
            application, or provisioned through this table."
        ::= { tripPeerEntry 20 }

 --
 -- TripPeerStatisticsTable
 --
    tripPeerStatisticsTable   OBJECT-TYPE
        SYNTAX      SEQUENCE OF TripPeerStatisticsEntry
        MAX-ACCESS  not-accessible
```

```
        STATUS      current
        DESCRIPTION
            "The TRIP peer stats table. This table contains one
            entry per remote TRIP peer, and statistics related to the
            connection with the remote peer. The objects in this
            table are volatile."
        ::= { tripMIBObjects 5 }

    tripPeerStatisticsEntry OBJECT-TYPE
        SYNTAX      TripPeerStatisticsEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Entry containing information about the connection with
            a TRIP peer."
        AUGMENTS { tripPeerEntry }
          ::= { tripPeerStatisticsTable 1 }

    TripPeerStatisticsEntry ::= SEQUENCE {
        tripPeerInUpdates                   Counter32,
        tripPeerOutUpdates                  Counter32,
        tripPeerInTotalMessages             Counter32,
        tripPeerOutTotalMessages            Counter32,
        tripPeerFsmEstablishedTransitions   Counter32,
```



```
        tripPeerFsmEstablishedTime          DateAndTime,
        tripPeerInUpdateElapsedTime         TimeInterval,
        tripPeerStateChangeTime             TimeStamp
    }

     tripPeerInUpdates OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of TRIP update messages received from this
            remote peer since the last restart of this location
            server."
        ::= { tripPeerStatisticsEntry 1 }

    tripPeerOutUpdates OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of TRIP update messages sent to this remote
            peer since the last restart of this LS."
```

```
        ::= { tripPeerStatisticsEntry 2 }

    tripPeerInTotalMessages OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The total number of TRIP messages received from the
            remote peer on this connection since the last restart
            of this LS."
        ::= { tripPeerStatisticsEntry 3 }

    tripPeerOutTotalMessages OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The total number of outgoing TRIP messages sent to the
            remote peer since the last restart of this LS."
        ::= { tripPeerStatisticsEntry 4 }

    tripPeerFsmEstablishedTransitions OBJECT-TYPE
        SYNTAX      Counter32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The number of times the remote peer has transitioned
            into the established state since the last restart of this
            LS."
        ::= { tripPeerStatisticsEntry 5 }
```



```
    tripPeerFsmEstablishedTime OBJECT-TYPE
        SYNTAX      DateAndTime
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Indicates the time and date that this remote peer entered
            the 'established' state."
        ::= { tripPeerStatisticsEntry 6 }

    tripPeerInUpdateElapsedTime OBJECT-TYPE
        SYNTAX      TimeInterval
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Elapsed time in hundredths of seconds since the last
```

```
            TRIP update message was received from this remote peer."
        ::= { tripPeerStatisticsEntry 7 }

    tripPeerStateChangeTime OBJECT-TYPE
        SYNTAX       TimeStamp
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
            "The value of sysUpTime when the last state change of
            tripPeerState took place."
        ::= { tripPeerStatisticsEntry 8 }

 -- TRIP Received Route Table.  This table contains
 -- all routes from all sources. Each entry consists
 -- of a route and its associated path attributes.

    tripRouteTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF TripRouteEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The TRIP route table containing information about
            reachable routes that are to be added to service by the
            receiving LS. The objects in this table are volatile
            and are refreshed when this LS rediscovers its route
            table."
        ::= { tripMIBObjects 6 }

    tripRouteEntry OBJECT-TYPE
        SYNTAX      TripRouteEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Information about a route to a called destination."
        INDEX { applIndex,
                tripRouteAppProtocol,
```



```
                tripRouteAddressFamily,
                tripRouteAddress,
                tripRoutePeer
                }
        ::= { tripRouteTable 1 }

    TripRouteEntry ::= SEQUENCE {
        tripRouteAppProtocol                TripAppProtocol,
        tripRouteAddressFamily              TripAddressFamily,
        tripRouteAddress                    OCTET STRING,
```

```
        tripRoutePeer                       TripId,
        tripRouteTRIBMask                   BITS,
        tripRouteAddressSequenceNumber      Integer32,
        tripRouteAddressOriginatorId        TripId,
        tripRouteNextHopServerIAddrType     InetAddressType,
        tripRouteNextHopServer              InetAddress,
        tripRouteNextHopServerPort          InetPortNumber,
        tripRouteNextHopServerItad          TripItad,
        tripRouteMultiExitDisc              Unsigned32,
        tripRouteLocalPref                  Unsigned32,
        tripRouteAdvertisementPath          OCTET STRING,
        tripRouteRoutedPath                 OCTET STRING,
        tripRouteAtomicAggregate            TruthValue,
        tripRouteUnknown                    OCTET STRING,
        tripRouteWithdrawn                  TruthValue,
        tripRouteConverted                  TruthValue,
        tripRouteReceivedTime               TimeStamp
        }

    tripRouteAppProtocol OBJECT-TYPE
        SYNTAX      TripAppProtocol
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The protocol for which this entry of the routing table
            is maintained."
        ::= { tripRouteEntry 1 }

    tripRouteAddressFamily OBJECT-TYPE
        SYNTAX      TripAddressFamily
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Specifies the type of address for the destination
            route."
        ::= { tripRouteEntry 2 }

    tripRouteAddress OBJECT-TYPE
        SYNTAX      OCTET STRING (SIZE(1..105))
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
```



```
            "This is the address (prefix) of the family type given
            by Address Family of the destination. It is the prefix
            of addresses reachable from this gateway via the next
            hop server. The SIZE value of 105 has been assigned due
```

```
            to the sub identifier of object types length limitation
            as defined in SMIv2."
        REFERENCE
            "RFC 3219, section 5.1.1.1."
        ::= { tripRouteEntry 3 }

    tripRoutePeer OBJECT-TYPE
        SYNTAX      TripId
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The identifier of the peer where the route information
            was learned."
        ::= { tripRouteEntry 4 }

     tripRouteTRIBMask OBJECT-TYPE
        SYNTAX      BITS {
                     adjTribIns(0),
                     extTrib(1),
                     locTrib(2),
                     adjTribOut(3)
                     }
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Indicates which Telephony Routing Information Base (TRIB)
            this entry belongs to. This is
            a bit-map of possible types. If the bit has a value of
            1, then the entry is a member of the corresponding TRIB
            type. If the bit has a value of 0 then the entry is not
            a member of the TRIP type. The various bit positions
            are:

            0    adjTribIns     The entry is of type adj-TRIBs-ins,
                                stores routing information that has
                                been learned from inbound UPDATE
                                messages.
            1    extTrib        The entry is of type ext-TRIB, the
                                best route for a given destination.
            2    locTrib        The entry is of type loc-TRIB contains
                                the local TRIP routing information
                                that the LS has selected.
            3    adjTribOut     The entry is of type adj-TRIBs-out,
                                stores the information that the local
                                LS has selected for advertisement to
                                its external peers."
        REFERENCE
            "RFC 3291, section 3.5."
```

```
        ::= { tripRouteEntry 5 }

    tripRouteAddressSequenceNumber OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Indicates the version of the destination route
            originated by the LS identified by
            tripRouteAddressOriginatorId intra-domain attribute."
        ::= { tripRouteEntry 6 }

    tripRouteAddressOriginatorId OBJECT-TYPE
        SYNTAX      TripId
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This is an intra-domain attribute indicating the
            internal LS that originated the route into the ITAD."
        ::= { tripRouteEntry 7 }

    tripRouteNextHopServerIAddrType OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The type of Inet Address of the
            tripRouteNextHopServer."
        REFERENCE
            "RFC 3291, section 3."
        ::= { tripRouteEntry 8 }

    tripRouteNextHopServer OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Indicates the next hop that messages of a given
            protocol destined for tripRouteAddress SHOULD
            be sent to."
        ::= { tripRouteEntry 9 }

    tripRouteNextHopServerPort OBJECT-TYPE
        SYNTAX      InetPortNumber
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The port of the next hop server that this route
            will use."
```

```
        ::= { tripRouteEntry 10 }

    tripRouteNextHopServerItad OBJECT-TYPE
```



```
        SYNTAX      TripItad
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Indicates the domain of the next hop."
        ::= { tripRouteEntry 11 }

    tripRouteMultiExitDisc OBJECT-TYPE
        SYNTAX      Unsigned32 (0..4294967295)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The Multiple Exit Discriminator allows an LS to
            discriminate between, and indicate preference for,
            otherwise similar routes to a neighbouring domain.
            A higher value represents a more preferred routing
            object."
        REFERENCE
            "RFC 3219, section 5.8"
        ::= { tripRouteEntry 12 }

    tripRouteLocalPref OBJECT-TYPE
        SYNTAX      Unsigned32 (0..4294967295)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Indicated the local LS's degree of preference for an
            advertised route destination."
        REFERENCE
            "RFC 3219, section 4.3.4.7"
        ::= { tripRouteEntry 13 }

    tripRouteAdvertisementPath OBJECT-TYPE
        SYNTAX      OCTET STRING (SIZE(4..252))
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Identifies the sequence of domains through which this
            advertisement has passed.

            This object is probably best represented as sequence of
            TripItads. For SMI compatibility, though, it is
            represented as an OCTET STRING. This object is a sequence
```

```
            of ITADs where each set of 4 octets corresponds to a TRIP
            ITAD in network byte order."
        REFERENCE
            "RFC 3219, section 4.3.4.4"
        ::= { tripRouteEntry 14 }

    tripRouteRoutedPath OBJECT-TYPE
        SYNTAX      OCTET STRING (SIZE(4..252))
        MAX-ACCESS  read-only
```



```
        STATUS      current
        DESCRIPTION
            "Identifies the ITADs through which messages sent using
            this route would pass. These are a subset of
            tripRouteAdvertisementPath.

            This object is probably best represented as sequence of
            TripItads. For SMI compatibility, though, it is
            represented as OCTET STRING.  This object is a sequence
            of ITADs where each set of 4 octets corresponds to a TRIP
            ITAD in network byte order."
        REFERENCE
            "RFC 3219, section 4.3.4.5"
        ::= { tripRouteEntry 15 }

    tripRouteAtomicAggregate OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Indicates that a route MAY traverse domains not listed
            in tripRouteRoutedPath. If an LS selects the less
            specific route from a set of overlapping routes, then
            this value returns TRUE."
        REFERENCE
            "RFC 3219, section 4.3.4.6"
        ::= { tripRouteEntry 16 }

    tripRouteUnknown OBJECT-TYPE
        SYNTAX      OCTET STRING (SIZE(0..255))
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object contains one or more attributes that were not
            understood, and because they were transitive, were dropped
            during aggregation. They take the format of a triple
            <attribute type, attribute length, attribute value>, of
```

```
            variable length. If no attributes were dropped, this
            returns an OCTET STRING of size 0."
        REFERENCE
            "RFC 3219, sections 4.3.1, 4.3.2.3"
        ::= { tripRouteEntry 17 }

    tripRouteWithdrawn OBJECT-TYPE
        SYNTAX      TruthValue
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Indicates if this route is to be removed from service
            by the receiving LS."
        ::= { tripRouteEntry 18 }
```



```
    tripRouteConverted OBJECT-TYPE
        SYNTAX TruthValue
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Indicates if this route has been converted to a
            different application protocol than it had originally."
        ::= { tripRouteEntry 19 }

    tripRouteReceivedTime OBJECT-TYPE
        SYNTAX       TimeStamp
        MAX-ACCESS   read-only
        STATUS       current
        DESCRIPTION
          "The value of sysUpTime when this route was received."
        ::= { tripRouteEntry 20 }

 --
 -- TRIP Received Route Community Table.
 --

    tripRouteCommunityTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF TripRouteCommunityEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "A table containing a list of TRIP communities associated
            with a route. Each instance of tripRouteTypeEntry that has
            the tripRouteTypePeer object set to remote(2) has an
            instance in the tripRouteTable as a parent. The objects
            in this table are volatile and are refreshed after a
```

```
            reboot."
        REFERENCE
            "RFC 3219, section 5.9."
        ::= { tripMIBObjects 7 }

    tripRouteCommunityEntry OBJECT-TYPE
        SYNTAX      TripRouteCommunityEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Information about communities associated with a route.
            An entry with a tripRouteAddress of 00 and a
            tripRoutePeer of 0 refers to the local LS."
        INDEX { applIndex,
                tripRouteAppProtocol,
                tripRouteAddressFamily,
                tripRouteAddress,
                tripRoutePeer,
                tripRouteCommunityId
              }
        ::= { tripRouteCommunityTable 1 }
```



```
    TripRouteCommunityEntry ::= SEQUENCE {
         tripRouteCommunityId    TripCommunityId,
         tripRouteCommunityItad  TripItad
         }

    tripRouteCommunityId OBJECT-TYPE
        SYNTAX      TripCommunityId
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The community identifier."
        ::= { tripRouteCommunityEntry 1 }

    tripRouteCommunityItad OBJECT-TYPE
        SYNTAX      TripItad
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The ITAD associated with this community."
        ::= { tripRouteCommunityEntry 2 }

 --
 -- tripItadTopologyTable
 --
```

```
    tripItadTopologyTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF TripItadTopologyEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The sequence of link connections between peers within an
            ITAD. The objects in this table are volatile and are
            refreshed after a reboot."
        ::= { tripMIBObjects 8 }

    tripItadTopologyEntry OBJECT-TYPE
        SYNTAX      TripItadTopologyEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Information about a peer of the LS identified by
            tripItadTopologyOrigId."
        INDEX { applIndex, tripItadTopologyOrigId }
        ::= { tripItadTopologyTable 1 }

    TripItadTopologyEntry ::= SEQUENCE {
                tripItadTopologyOrigId    TripId,
                tripItadTopologySeqNum    Unsigned32
            }

    tripItadTopologyOrigId OBJECT-TYPE
```



```
        SYNTAX      TripId
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Indicates the internal LS that originated the ITAD
            topology information into the ITAD."
        ::= { tripItadTopologyEntry 1 }

    tripItadTopologySeqNum OBJECT-TYPE
        SYNTAX      Unsigned32 (1..2147483647)
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Indicates the version of the ITAD topology originated
            by the LS identified by tripItadTopologyOrigId."
        ::= { tripItadTopologyEntry 2 }

 --
 -- tripItadTopologyIdTable
```

```
 --

    tripItadTopologyIdTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF TripItadTopologyIdEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "The list of other LS's within the ITAD domain that the
            LS identified by tripItadTopologyOrigId is currently
            peering. Each instance of tripItadTopologyIdEntry has an
            instance in the tripItadTopologyTable as a parent. The
            objects in this table are volatile and are refreshed
            after a reboot."
        ::= { tripMIBObjects 9 }

    tripItadTopologyIdEntry OBJECT-TYPE
        SYNTAX      TripItadTopologyIdEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Information about a peer to the LS identified by
            tripItadTopologyOrigId."
        INDEX { applIndex,
                tripItadTopologyOrigId,
                tripItadTopologyId }
        ::= { tripItadTopologyIdTable 1 }

    TripItadTopologyIdEntry ::= SEQUENCE {
                tripItadTopologyId            TripId
            }

    tripItadTopologyId OBJECT-TYPE
        SYNTAX      TripId
```



```
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The index into this entry. Indicates the other location
            servers within the ITAD domain that this LS identified
            by tripItadTopologyOrigId is currently peering."
        ::= { tripItadTopologyIdEntry 1 }

 --
 -- Notification objects
 --

    tripNotifApplIndex    OBJECT-TYPE
```

```
        SYNTAX     Integer32 (1..2147483647)
        MAX-ACCESS accessible-for-notify
        STATUS     current
        DESCRIPTION
             "This object contains the application Index. It is used
             to bind this notification with a specific instance of
             TRIP entity."
        REFERENCE
            "RFC 2788, section 3."
        ::= { tripMIBNotifObjects 1 }

    tripNotifPeerAddrInetType OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  accessible-for-notify
        STATUS      current
        DESCRIPTION
            "The type of Inet Address of the tripNotifPeerAddr."
        REFERENCE
            "RFC 3291, section 3."
        ::= { tripMIBNotifObjects 2 }

    tripNotifPeerAddr OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  accessible-for-notify
        STATUS      current
        DESCRIPTION
            "The IP address of this entry's TRIP peer LS. This object
            contains the value of tripPeerRemoteAddr."
        REFERENCE
            "RFC 3291, section 3."
        ::= { tripMIBNotifObjects 3 }

    tripNotifPeerErrCode OBJECT-TYPE
        SYNTAX      INTEGER {
                        messageHeader(1),
                        openMessage(2),
                        updateMessage(3),
                        holdTimerExpired(4),
                        finiteStateMachine(5),
```



```
                        cease(6),
                        tripNotification(7)
                    }
        MAX-ACCESS  accessible-for-notify
        STATUS      current
        DESCRIPTION
            "Notification message of TRIP error. The meaning of this
```

```
            value is applicable to the following functions:

            messageHeader(1)
             - All errors detected while processing the TRIP message
               header.

            openMessage(2)
             - All errors detected while processing the OPEN message.

            updateMessage(3)
             - All errors detected while processing the UPDATE
               message.

            holdTimerExpired(4)
             - A notification generated when the hold timer expires.

            finiteStateMachine(5)
             - All errors detected by the TRIP Finite State Machine.

            cease(6)
             - Any fatal error condition that the rest of the values
               do not cover.

            tripNotification(7)
             - Any error encountered while sending a notification
               message."
       ::= { tripMIBNotifObjects 4 }

    tripNotifPeerErrSubcode OBJECT-TYPE
        SYNTAX      Integer32 (1..2147483647)
        MAX-ACCESS  accessible-for-notify
        STATUS      current
        DESCRIPTION
            "The sub error code associated with error code. The
            meaning of this value is dependent on the value of
            tripNotifPeerErrCode.

            Message Header (1) Error Subcodes:
            1 - Bad Message Length.
            2 - Bad Message Type.

            OPEN Message (2) Error Subcodes:
            1 - Unsupported Version Number.
            2 - Bad Peer ITAD.
            3 - Bad TRIP Identifier.
```



```
            4 - Unsupported Optional Parameter.
            5 - Unacceptable Hold Time.
```

```
            6 - Unsupported Capability.
            7 - Capability Mismatch.

            UPDATE Message (3) Error Subcodes:
            1 - Malformed Attribute List.
            2 - Unrecognized Well-known Attribute.
            3 - Missing Well-known Mandatory Attribute.
            4 - Attribute Flags Error.
            5 - Attribute Length Error.
            6 - Invalid Attribute."
         ::= { tripMIBNotifObjects 5 }

--
-- Notifications
--
   tripConnectionEstablished NOTIFICATION-TYPE
       OBJECTS { tripNotifApplIndex,
                 tripNotifPeerAddrInetType,
                 tripNotifPeerAddr
               }
       STATUS  current
       DESCRIPTION
           "The TRIP Connection Established event is generated when
           the TRIP finite state machine enters the ESTABLISHED
           state."
       ::= { tripMIBNotifications 1 }

   tripConnectionDropped NOTIFICATION-TYPE
       OBJECTS { tripNotifApplIndex,
                 tripNotifPeerAddrInetType,
                 tripNotifPeerAddr
               }
       STATUS  current
       DESCRIPTION
           "The TRIP Connection Dropped event is generated when the
           TRIP finite state machine leaves the ESTABLISHED state."
       ::= { tripMIBNotifications 2 }

   tripFSM NOTIFICATION-TYPE
       OBJECTS { tripNotifApplIndex,
                 tripNotifPeerAddrInetType,
                 tripNotifPeerAddr,
                 tripNotifPeerErrCode,
                 tripNotifPeerErrSubcode,
                 tripPeerState
               }
       STATUS  current
       DESCRIPTION
           "The trip FSM Event is generated when any error is
           detected by the TRIP Finite State Machine."
```

```
        ::= { tripMIBNotifications 3 }

    tripOpenMessageError NOTIFICATION-TYPE
        OBJECTS { tripNotifApplIndex,
                  tripNotifPeerAddrInetType,
                  tripNotifPeerAddr,
                  tripNotifPeerErrCode,
                  tripNotifPeerErrSubcode,
                  tripPeerState
                }
        STATUS  current
        DESCRIPTION
            "Errors detected while processing the OPEN message."
        ::= { tripMIBNotifications 4 }

    tripUpdateMessageError NOTIFICATION-TYPE
        OBJECTS { tripNotifApplIndex,
                  tripNotifPeerAddrInetType,
                  tripNotifPeerAddr,
                  tripNotifPeerErrCode,
                  tripNotifPeerErrSubcode,
                  tripPeerState
                }
        STATUS  current
        DESCRIPTION
            "Errors detected while processing the UPDATE message."
        ::= { tripMIBNotifications 5 }

    tripHoldTimerExpired NOTIFICATION-TYPE
        OBJECTS { tripNotifApplIndex,
                  tripNotifPeerAddrInetType,
                  tripNotifPeerAddr,
                  tripNotifPeerErrCode,
                  tripNotifPeerErrSubcode,
                  tripPeerState
                }
        STATUS  current
        DESCRIPTION
            "The system does not receive successive messages within
            the period specified by the negotiated Hold Time."
        ::= { tripMIBNotifications 6 }

    tripConnectionCollision NOTIFICATION-TYPE
        OBJECTS { tripNotifApplIndex }
        STATUS  current
        DESCRIPTION
            "A pair of LSs tried to simultaneously to establish a
```

```
            transport connection to each other."
        ::= { tripMIBNotifications 7 }

    tripCease NOTIFICATION-TYPE
        OBJECTS { tripNotifApplIndex,
```



```
                  tripNotifPeerAddrInetType,
                  tripNotifPeerAddr,
                  tripNotifPeerErrCode,
                  tripNotifPeerErrSubcode,
                  tripPeerState
                }
        STATUS  current
        DESCRIPTION
            "A TRIP peer MAY choose at any given time to close its TRIP
            connection by sending this notification message. However,
            the Cease notification message MUST NOT be used when a
            fatal error occurs."

        ::= { tripMIBNotifications 8 }

    tripNotificationErr NOTIFICATION-TYPE
        OBJECTS { tripNotifApplIndex }
        STATUS  current
        DESCRIPTION
            "Generated if there is an error detected in a TRIP
            notification message sent with another cause. Note that
            the TRIP notification refered to in this object is not
            an SNMP notification, it is a specific message described
            in the TRIP specification."
        REFERENCE
            "RFC 3219, section  6.4."
        ::= { tripMIBNotifications 9 }

    --
    -- Compliance Statements
    --
    tripCompliance MODULE-COMPLIANCE
        STATUS     current
        DESCRIPTION
             "The compliance statement for TRIP entities."

        MODULE -- this module
             MANDATORY-GROUPS { tripConfigGroup,
                                tripPeerTableConfigGroup,
                                tripRouteGroup,
                                tripItadTopologyGroup,
```

```
                                tripPeerTableStatsGroup }

        GROUP tripNotificationGroup
        DESCRIPTION
            "This group is OPTIONAL. A TRIP entity can choose not to
            send any notifications. If this group is implemented,
            the tripNotifObjectGroup MUST also be implemented."

        GROUP tripNotifObjectGroup
        DESCRIPTION
            "This group is OPTIONAL. A TRIP entity can choose not to
```



```
            send any notifications. If this group is implemented,
            the tripNotificationGroup MUST also be implemented."

        MODULE NETWORK-SERVICES-MIB
             MANDATORY-GROUPS { applRFC2788Group }

        ::= { tripMIBCompliance 1 }

 --
 -- Object and event conformance groups
 --

    tripConfigGroup OBJECT-GROUP
        OBJECTS {
            tripCfgProtocolVersion,
            tripCfgItad,
            tripCfgIdentifier,
            tripCfgOperStatus,
            tripCfgAdminStatus,
            tripCfgAddrIAddrType,
            tripCfgAddr,
            tripCfgPort,
            tripCfgMinItadOriginationInterval,
            tripCfgMinRouteAdvertisementInterval,
            tripCfgMaxPurgeTime,
            tripCfgDisableTime,
            tripCfgSendReceiveMode,
            tripCfgStorage,
            tripSupportedCommunityItad,
            tripSupportedCommunityStorage,
            tripRouteTypePeer,
            tripSupportedCommunityRowStatus
        }
        STATUS current
        DESCRIPTION
```

```
            "The global objects for configuring trip."
        ::= { tripMIBGroups 1 }

    tripPeerTableConfigGroup OBJECT-GROUP
        OBJECTS {
            tripPeerIdentifier,
            tripPeerState,
            tripPeerAdminStatus,
            tripPeerNegotiatedVersion,
            tripPeerSendReceiveMode,
            tripPeerRemoteItad,
            tripPeerConnectRetryInterval,
            tripPeerMaxRetryInterval,
            tripPeerHoldTime,
            tripPeerKeepAlive,
            tripPeerHoldTimeConfigured,
            tripPeerKeepAliveConfigured,
```



```
            tripPeerMaxPurgeTime,
            tripPeerDisableTime,
            tripPeerLearned,
            tripPeerStorage,
            tripPeerRowStatus
            }

        STATUS current
        DESCRIPTION
            "The global objects for configuring the TRIP peer
            table."
        ::= { tripMIBGroups 2 }

    tripPeerTableStatsGroup OBJECT-GROUP
        OBJECTS {
            tripPeerInUpdates,
            tripPeerOutUpdates,
            tripPeerInTotalMessages,
            tripPeerOutTotalMessages,
            tripPeerFsmEstablishedTransitions,
            tripPeerFsmEstablishedTime,
            tripPeerInUpdateElapsedTime,
            tripPeerStateChangeTime
            }
        STATUS current
        DESCRIPTION
            "The global statistics the TRIP peer table."
        ::= { tripMIBGroups 3 }
```

```
    tripRouteGroup OBJECT-GROUP
        OBJECTS {
            tripRouteTRIBMask,
            tripRouteAddressSequenceNumber,
            tripRouteAddressOriginatorId,
            tripRouteNextHopServerIAddrType,
            tripRouteNextHopServer,
            tripRouteNextHopServerPort,
            tripRouteNextHopServerItad,
            tripRouteMultiExitDisc,
            tripRouteLocalPref,
            tripRouteAdvertisementPath,
            tripRouteRoutedPath,
            tripRouteAtomicAggregate,
            tripRouteUnknown,
            tripRouteWithdrawn,
            tripRouteConverted,
            tripRouteReceivedTime,
            tripRouteCommunityItad
            }

        STATUS current
        DESCRIPTION
```



```
            "The global objects for configuring route attribute."
        ::= { tripMIBGroups 4 }

    tripItadTopologyGroup OBJECT-GROUP
        OBJECTS {
            tripItadTopologySeqNum,
            tripItadTopologyId
            }
        STATUS current
        DESCRIPTION
            "The objects that define the TRIP ITAD topology."
        ::= { tripMIBGroups 5 }

    tripNotificationGroup NOTIFICATION-GROUP
        NOTIFICATIONS {
            tripConnectionEstablished,
            tripConnectionDropped,
            tripFSM,
            tripOpenMessageError,
            tripUpdateMessageError,
            tripHoldTimerExpired,
            tripConnectionCollision,
            tripCease,
```

```
            tripNotificationErr
        }
        STATUS  current
        DESCRIPTION
             "A collection of notifications defined for TRIP."
        ::= { tripMIBGroups 6 }

    tripNotifObjectGroup OBJECT-GROUP
        OBJECTS {
            tripNotifApplIndex,
            tripNotifPeerAddrInetType,
            tripNotifPeerAddr,
            tripNotifPeerErrCode,
            tripNotifPeerErrSubcode
            }
        STATUS current
        DESCRIPTION
            "The collection of objects that specify information for
            TRIP notifications."
        ::= { tripMIBGroups 7 }

END
```

7. Security Considerations

The managed objects in this MIB module contain sensitive information since, collectively, they allow tracing and influencing of connections in TRIP devices and provide information of their connection characteristics. As such, improper manipulation of the

objects represented by this MIB module MAY result in denial of service to a large number of availiable routes.

There are a number of management objects defined in this MIB module that have a MAX-ACCESS clause of read-write and/or read-create. Such objects MAY be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations. These objects include:

tripCfgItad:
Improper setting of tripCfgItad value can make all peer connections drop and not be re-established.

tripCfgAdminStatus:
Improper setting of tripCfgAdminStatus from up to down will cause the TRIP Location Server stop processing TRIP messages.

tripCfgPort:
Improper setting of tripCfgPort can cause the failure of a peer establishing a connection.

tripCfgMinItadOriginationInterval,
tripCfgMinRouteAdvertisementInterval:
Improper configuration of these values MAY adversely affect local and global convergence of the routes advertised by this TRIP Location Server.

tripPeerAdminStatus:
Improper setting of tripPeerAdminStatus from up to down can cause significant disruption of the connectivity to the destination via the applicable remote TRIP Location Server peer.

tripPeerConnectRetryInterval,tripPeerMaxRetryInterval:
Improper configuration of these values can cause connections to be disrupted for extremely long time periods when otherwise they would be restored in a relatively short period of time.

tripPeerHoldTimeConfigured, tripPeerKeepAliveConfigured:
Improper configuration of these value can make TRIP peer sessions more fragile and less resilient to denial of service attacks.

There are a number of managed objects in this MIB module that contain sensitive information regarding the operation of a network. For example, a TRIP Location Server peer's local and remote addresses might be sensitive for ISPs who want to keep interface addresses on TRIP Location Server confidential so as to prevent TRIP Location Server addresses used for a denial of service attack or address spoofing.

Therefore, it is thus important to control even GET access to these objects and possibly to even encrypt the values of these object when sending them over the network via SNMP. Not all versions of SNMP provide features for such a secure environment.

SNMPv1 by itself is not a secure environment. 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 this MIB module.

It is RECOMMENDED that the 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. Full Copyright Statement

9. Normative References

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13. Author's Addresses

David Zinman
Editor
265 Ridley Blvd
Toronto ON M5M 4N8
Canada
phone: +1 416 433 4298
email: dzinman@rogers.com

Dave Walker
SS8 Networks, Inc.
495 March Road, Suite #500
Ottawa, ON K2K 3G1
Canada
Phone: +1 613 592 2100
Email: drwalker@ss8.com

Jianping Jiang
SGNT Technologies, Inc.
5850 Keaton Crescent
Mississauga, ON L5R 3K2
Canada
Phone: +1 905 290 1384
Email: jjiang@sgntt.com