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IP Tunnel MIB

Status of This Memo

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Abstract

This memo defines a Management Information Base (MIB) module for use with network management protocols in the Internet community. In particular, it describes managed objects used for managing tunnels of any type over IPv4 and IPv6 networks. Extension MIB modules may be designed for managing protocol-specific objects. Likewise, extension MIB modules may be designed for managing security-specific objects. This MIB module does not support tunnels over non-IP networks. Management of such tunnels may be supported by other MIB modules. This memo obsoletes RFC 2667.

1. Introduction

Over the past several years, there has been a number of "tunneling" protocols specified by the IETF (see [RFC1241] for an early discussion of the model and examples). This document describes a Management Information Base (MIB) module used for managing tunnels of any type over IPv4 and IPv6 networks, including Generic Routing Encapsulation (GRE) [RFC1701,RFC1702], IP-in-IP [RFC2003], Minimal Encapsulation [RFC2004], Layer 2 Tunneling Protocol (L2TP) [RFC2661], Point-to-Point Tunneling Protocol (PPTP) [RFC2637], Layer 2 Forwarding (L2F) [RFC2341], UDP (e.g., [RFC1234]), Ascend Tunnel Management Protocol (ATMP) [RFC2107], and IPv6-in-IPv4 [RFC2893] tunnels, among others.

Extension MIB modules may be designed for managing protocol-specific objects. Likewise, extension MIB modules may be designed for managing security-specific objects (e.g., IPsec [RFC2401]), and traffic conditioner [RFC2474] objects.

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. Overview

This MIB module contains two current tables and one deprecated table. The current tables are:

- the Tunnel Interface Table, containing information on the tunnels known to a router; and
- the Tunnel Inet Config Table, which can be used for dynamic creation of tunnels, and also provides a mapping from endpoint addresses to the current interface index value.

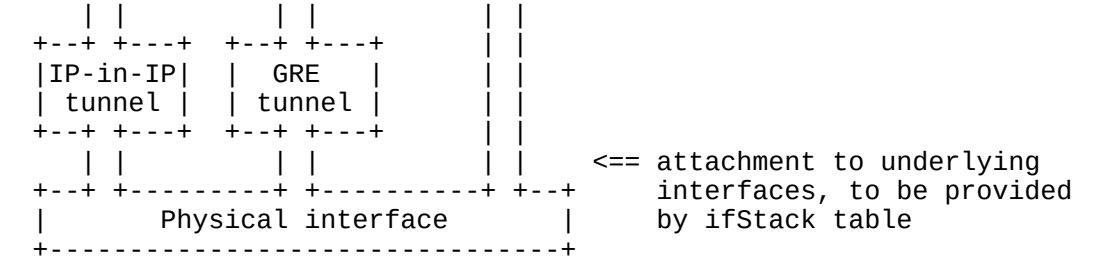
The version of this MIB module that appeared in RFC 2667 contained the Tunnel Config Table, which mapped IPv4 endpoint addresses to interface indexes. It is now deprecated in favor of the Tunnel Inet Config Table.

3.1. Relationship to the Interfaces MIB

This section clarifies the relationship of this MIB module to the Interfaces MIB [RFC2863]. Several areas of correlation are addressed in the following subsections. The implementor is referred to the Interfaces MIB document in order to understand the general intent of these areas.

3.1.1. Layering Model

Each logical interface (physical or virtual) has an ifEntry in the Interfaces MIB [RFC2863]. Tunnels are handled by creating a logical interface (ifEntry) for each tunnel. These are then correlated, using the ifStack table of the Interfaces MIB, to those interfaces on which the local IPv4 or IPv6 addresses of the tunnels are configured. The basic model, therefore, looks something like this (for example):



3.1.2. ifRcvAddressTable

The ifRcvAddressTable usage can be defined in the MIB modules defining the encapsulation below the network layer, and holds the local IP addresses on which decapsulation will occur. For example, if IP-in-IP encapsulation is being used, the ifRcvAddressTable can be defined by IP-in-IP. If it is not specified, the default is that one entry will exist for the tunnel interface, where ifRcvAddressAddress contains the local IP address used for encapsulation/decapsulation (i.e., tunnelIfLocalInetAddress in the Tunnel Interface Table).

3.1.3. ifEntry

IfEntries are defined in the MIB modules defining the encapsulation below the network layer. For example, if IP-in-IP encapsulation [20] is being used, the ifEntry is defined by IP-in-IP.

The ifType of a tunnel should be set to "tunnel" (131). An entry in the IP Tunnel MIB module will exist for every ifEntry with this ifType. An implementation of the IP Tunnel MIB module may allow ifEntries to be created via the tunnelConfigTable. Creating a tunnel will also add an entry in the ifTable and in the tunnelIfTable, and deleting a tunnel will likewise delete the entry in the ifTable and the tunnelIfTable.

The use of two different tables in this MIB module was an important design decision. Traditionally, ifIndex values are chosen by agents, and are permitted to change across restarts. Allowing row creation directly in the Tunnel Interface Table, indexed by ifIndex, would

complicate row creation and/or cause interoperability problems (if each agent had special restrictions on ifIndex). Instead, a separate table is used that is indexed only by objects over which the manager has control. Namely, these are the addresses of the tunnel endpoints and the encapsulation protocol. Finally, an additional manager-chosen ID is used in the index to support protocols such as L2F which allow multiple tunnels between the same endpoints.

4. Definitions

```
TUNNEL-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, transmission,
    Integer32, IpAddress    FROM SNMPv2-SMI          -- [RFC2578]

    RowStatus, StorageType  FROM SNMPv2-TC           -- [RFC2579]

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

    InetAddressType,
    InetAddress             FROM INET-ADDRESS-MIB    -- [RFC4001]

    IPv6FlowLabelOrAny      FROM IPV6-FLOW-LABEL-MIB -- [RFC3595]

    ifIndex,
    InterfaceIndexOrZero    FROM IF-MIB              -- [RFC2863]

    IANAtunnelType          FROM IANAifType-MIB;     -- [IFTYPE]

tunnelMIB MODULE-IDENTITY
    LAST-UPDATED "200505160000Z" -- May 16, 2005
    ORGANIZATION "IETF IP Version 6 (IPv6) Working Group"
    CONTACT-INFO
            " Dave Thaler
              Microsoft Corporation
              One Microsoft Way
              Redmond, WA  98052-6399
              EMail: dthaler@microsoft.com"
    DESCRIPTION
            "The MIB module for management of IP Tunnels,
            independent of the specific encapsulation scheme in
            use.

            Copyright (C) The Internet Society (2005).  This
            version of this MIB module is part of RFC 4087;  see
            the RFC itself for full legal notices."
```

```
        REVISION     "200505160000Z" -- May 16, 2005
        DESCRIPTION
                "IPv4-specific objects were deprecated, including
                tunnelIfLocalAddress, tunnelIfRemoteAddress, the
                tunnelConfigTable, and the tunnelMIBBasicGroup.

                Added IP version-agnostic objects that should be used
                instead, including tunnelIfAddressType,
                tunnelIfLocalInetAddress, tunnelIfRemoteInetAddress,
                the tunnelInetConfigTable, and the
                tunnelIMIBInetGroup.

                The new tunnelIfLocalInetAddress and
                tunnelIfRemoteInetAddress objects are read-write,
                rather than read-only.

                Updated DESCRIPTION clauses of existing version-
                agnostic objects (e.g., tunnelIfTOS) that contained
                IPv4-specific text to cover IPv6 as well.

                Added tunnelIfFlowLabel for tunnels over IPv6.

                The encapsulation method was previously an INTEGER
                type, and is now an IANA-maintained textual
                convention.

                Published as RFC 4087."
        REVISION     "199908241200Z" -- August 24, 1999
        DESCRIPTION
                "Initial version, published as RFC 2667."
        ::= { transmission 131 }

    tunnelMIBObjects OBJECT IDENTIFIER ::= { tunnelMIB 1 }

    tunnel      OBJECT IDENTIFIER ::= { tunnelMIBObjects 1 }

    -- the IP Tunnel MIB-Group
    --
    -- a collection of objects providing information about
    -- IP Tunnels

    tunnelIfTable OBJECT-TYPE
        SYNTAX     SEQUENCE OF TunnelIfEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "The (conceptual) table containing information on
                configured tunnels."
```

```
        ::= { tunnel 1 }

    tunnelIfEntry OBJECT-TYPE
        SYNTAX     TunnelIfEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "An entry (conceptual row) containing the information
                on a particular configured tunnel."
        INDEX      { ifIndex }
        ::= { tunnelIfTable 1 }

    TunnelIfEntry ::= SEQUENCE {
        tunnelIfLocalAddress            IpAddress,   -- deprecated
        tunnelIfRemoteAddress           IpAddress,   -- deprecated
        tunnelIfEncapsMethod            IANAtunnelType,
        tunnelIfHopLimit                Integer32,
        tunnelIfSecurity                INTEGER,
        tunnelIfTOS                     Integer32,
        tunnelIfFlowLabel               IPv6FlowLabelOrAny,
        tunnelIfAddressType             InetAddressType,
        tunnelIfLocalInetAddress        InetAddress,
        tunnelIfRemoteInetAddress       InetAddress,
        tunnelIfEncapsLimit             Integer32
    }

    tunnelIfLocalAddress OBJECT-TYPE
        SYNTAX     IpAddress
        MAX-ACCESS read-only
        STATUS     deprecated
        DESCRIPTION
                "The address of the local endpoint of the tunnel
                (i.e., the source address used in the outer IP
                header), or 0.0.0.0 if unknown or if the tunnel is
                over IPv6.

                Since this object does not support IPv6, it is
                deprecated in favor of tunnelIfLocalInetAddress."
        ::= { tunnelIfEntry 1 }

    tunnelIfRemoteAddress OBJECT-TYPE
        SYNTAX     IpAddress
        MAX-ACCESS read-only
        STATUS     deprecated
        DESCRIPTION
                "The address of the remote endpoint of the tunnel
                (i.e., the destination address used in the outer IP
                header), or 0.0.0.0 if unknown, or an IPv6 address, or
```

```
                the tunnel is not a point-to-point link (e.g., if it
                is a 6to4 tunnel).

                Since this object does not support IPv6, it is
                deprecated in favor of tunnelIfRemoteInetAddress."
        ::= { tunnelIfEntry 2 }

    tunnelIfEncapsMethod OBJECT-TYPE
        SYNTAX     IANAtunnelType
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The encapsulation method used by the tunnel."
        ::= { tunnelIfEntry 3 }

    tunnelIfHopLimit OBJECT-TYPE
        SYNTAX     Integer32 (0 | 1..255)
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "The IPv4 TTL or IPv6 Hop Limit to use in the outer IP
                header.  A value of 0 indicates that the value is
                copied from the payload's header."
        ::= { tunnelIfEntry 4 }

    tunnelIfSecurity OBJECT-TYPE
        SYNTAX     INTEGER {
                       none(1),   -- no security
                       ipsec(2),  -- IPsec security
                       other(3)
                   }
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "The method used by the tunnel to secure the outer IP
                header.  The value ipsec indicates that IPsec is used
                between the tunnel endpoints for authentication or
                encryption or both.  More specific security-related
                information may be available in a MIB module for the
                security protocol in use."
        ::= { tunnelIfEntry 5 }

    tunnelIfTOS OBJECT-TYPE
        SYNTAX     Integer32 (-2..63)
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "The method used to set the high 6 bits (the
```

```
                differentiated services codepoint) of the IPv4 TOS or
                IPv6 Traffic Class in the outer IP header.  A value of
                -1 indicates that the bits are copied from the
                payload's header.  A value of -2 indicates that a
                traffic conditioner is invoked and more information
                may be available in a traffic conditioner MIB module.
                A value between 0 and 63 inclusive indicates that the
                bit field is set to the indicated value.

                Note: instead of the name tunnelIfTOS, a better name
                would have been tunnelIfDSCPMethod, but the existing
                name appeared in RFC 2667 and existing objects cannot
                be renamed."
        ::= { tunnelIfEntry 6 }

    tunnelIfFlowLabel OBJECT-TYPE
        SYNTAX     IPv6FlowLabelOrAny
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "The method used to set the IPv6 Flow Label value.
                This object need not be present in rows where
                tunnelIfAddressType indicates the tunnel is not over
                IPv6.  A value of -1 indicates that a traffic
                conditioner is invoked and more information may be
                available in a traffic conditioner MIB.  Any other
                value indicates that the Flow Label field is set to
                the indicated value."
        ::= { tunnelIfEntry 7 }

    tunnelIfAddressType OBJECT-TYPE
        SYNTAX     InetAddressType
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "The type of address in the corresponding
                tunnelIfLocalInetAddress and tunnelIfRemoteInetAddress
                objects."
        ::= { tunnelIfEntry 8 }

    tunnelIfLocalInetAddress OBJECT-TYPE
        SYNTAX     InetAddress
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "The address of the local endpoint of the tunnel
                (i.e., the source address used in the outer IP
                header).  If the address is unknown, the value is
```

```
                0.0.0.0 for IPv4 or :: for IPv6.  The type of this
                object is given by tunnelIfAddressType."
        ::= { tunnelIfEntry 9 }

    tunnelIfRemoteInetAddress OBJECT-TYPE
        SYNTAX     InetAddress
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "The address of the remote endpoint of the tunnel
                (i.e., the destination address used in the outer IP
                header).  If the address is unknown or the tunnel is
                not a point-to-point link (e.g., if it is a 6to4
                tunnel), the value is 0.0.0.0 for tunnels over IPv4 or
                :: for tunnels over IPv6.  The type of this object is
                given by tunnelIfAddressType."
        ::= { tunnelIfEntry 10 }

    tunnelIfEncapsLimit OBJECT-TYPE
        SYNTAX     Integer32 (-1 | 0..255)
        MAX-ACCESS read-write
        STATUS     current
        DESCRIPTION
                "The maximum number of additional encapsulations
                permitted for packets undergoing encapsulation at this
                node.  A value of -1 indicates that no limit is
                present (except as a result of the packet size)."
        REFERENCE  "RFC 2473, section 4.1.1"
        ::= { tunnelIfEntry 11 }

    tunnelConfigTable OBJECT-TYPE
        SYNTAX     SEQUENCE OF TunnelConfigEntry
        MAX-ACCESS not-accessible
        STATUS     deprecated
        DESCRIPTION
                "The (conceptual) table containing information on
                configured tunnels.  This table can be used to map a
                set of tunnel endpoints to the associated ifIndex
                value.  It can also be used for row creation.  Note
                that every row in the tunnelIfTable with a fixed IPv4
                destination address should have a corresponding row in
                the tunnelConfigTable, regardless of whether it was
                created via SNMP.

                Since this table does not support IPv6, it is
                deprecated in favor of tunnelInetConfigTable."
        ::= { tunnel 2 }
```

```
   tunnelConfigEntry OBJECT-TYPE
       SYNTAX     TunnelConfigEntry
       MAX-ACCESS not-accessible
       STATUS     deprecated
       DESCRIPTION
               "An entry (conceptual row) containing the information
               on a particular configured tunnel.

               Since this entry does not support IPv6, it is
               deprecated in favor of tunnelInetConfigEntry."
       INDEX      { tunnelConfigLocalAddress,
                    tunnelConfigRemoteAddress,
                    tunnelConfigEncapsMethod,
                    tunnelConfigID }
       ::= { tunnelConfigTable 1 }

   TunnelConfigEntry ::= SEQUENCE {
       tunnelConfigLocalAddress            IpAddress,
       tunnelConfigRemoteAddress           IpAddress,
       tunnelConfigEncapsMethod            IANAtunnelType,
       tunnelConfigID                      Integer32,
       tunnelConfigIfIndex                 InterfaceIndexOrZero,
       tunnelConfigStatus                  RowStatus
   }

   tunnelConfigLocalAddress OBJECT-TYPE
       SYNTAX     IpAddress
       MAX-ACCESS not-accessible
       STATUS     deprecated
       DESCRIPTION
               "The address of the local endpoint of the tunnel, or
               0.0.0.0 if the device is free to choose any of its
               addresses at tunnel establishment time.

               Since this object does not support IPv6, it is
               deprecated in favor of tunnelInetConfigLocalAddress."
       ::= { tunnelConfigEntry 1 }

   tunnelConfigRemoteAddress OBJECT-TYPE
       SYNTAX     IpAddress
       MAX-ACCESS not-accessible
       STATUS     deprecated
       DESCRIPTION
               "The address of the remote endpoint of the tunnel.

               Since this object does not support IPv6, it is
               deprecated in favor of tunnelInetConfigRemoteAddress."
       ::= { tunnelConfigEntry 2 }
```

```
   tunnelConfigEncapsMethod OBJECT-TYPE
       SYNTAX     IANAtunnelType
       MAX-ACCESS not-accessible
       STATUS     deprecated
       DESCRIPTION
               "The encapsulation method used by the tunnel.

               Since this object does not support IPv6, it is
               deprecated in favor of tunnelInetConfigEncapsMethod."
       ::= { tunnelConfigEntry 3 }

   tunnelConfigID OBJECT-TYPE
       SYNTAX     Integer32 (1..2147483647)
       MAX-ACCESS not-accessible
       STATUS     deprecated
       DESCRIPTION
               "An identifier used to distinguish between multiple
               tunnels of the same encapsulation method, with the
               same endpoints.  If the encapsulation protocol only
               allows one tunnel per set of endpoint addresses (such
               as for GRE or IP-in-IP), the value of this object is
               1.  For encapsulation methods (such as L2F) which
               allow multiple parallel tunnels, the manager is
               responsible for choosing any ID which does not
               conflict with an existing row, such as choosing a
               random number.

               Since this object does not support IPv6, it is
               deprecated in favor of tunnelInetConfigID."
       ::= { tunnelConfigEntry 4 }

   tunnelConfigIfIndex OBJECT-TYPE
       SYNTAX     InterfaceIndexOrZero
       MAX-ACCESS read-only
       STATUS     deprecated
       DESCRIPTION
               "If the value of tunnelConfigStatus for this row is
               active, then this object contains the value of ifIndex
               corresponding to the tunnel interface.  A value of 0
               is not legal in the active state, and means that the
               interface index has not yet been assigned.

               Since this object does not support IPv6, it is
               deprecated in favor of tunnelInetConfigIfIndex."
       ::= { tunnelConfigEntry 5 }

   tunnelConfigStatus OBJECT-TYPE
       SYNTAX     RowStatus
```

```
        MAX-ACCESS read-create
        STATUS     deprecated
        DESCRIPTION
                "The status of this row, by which new entries may be
                created, or old entries deleted from this table.  The
                agent need not support setting this object to
                createAndWait or notInService since there are no other
                writable objects in this table, and writable objects
                in rows of corresponding tables such as the
                tunnelIfTable may be modified while this row is
                active.

                To create a row in this table for an encapsulation
                method which does not support multiple parallel
                tunnels with the same endpoints, the management
                station should simply use a tunnelConfigID of 1, and
                set tunnelConfigStatus to createAndGo.  For
                encapsulation methods such as L2F which allow multiple
                parallel tunnels, the management station may select a
                pseudo-random number to use as the tunnelConfigID and
                set tunnelConfigStatus to createAndGo.  In the event
                that this ID is already in use and an
                inconsistentValue is returned in response to the set
                operation, the management station should simply select
                a new pseudo-random number and retry the operation.

                Creating a row in this table will cause an interface
                index to be assigned by the agent in an
                implementation-dependent manner, and corresponding
                rows will be instantiated in the ifTable and the
                tunnelIfTable.  The status of this row will become
                active as soon as the agent assigns the interface
                index, regardless of whether the interface is
                operationally up.

                Deleting a row in this table will likewise delete the
                corresponding row in the ifTable and in the
                tunnelIfTable.

                Since this object does not support IPv6, it is
                deprecated in favor of tunnelInetConfigStatus."
        ::= { tunnelConfigEntry 6 }

    tunnelInetConfigTable OBJECT-TYPE
        SYNTAX     SEQUENCE OF TunnelInetConfigEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
```

```
            "The (conceptual) table containing information on
            configured tunnels.  This table can be used to map a
            set of tunnel endpoints to the associated ifIndex
            value.  It can also be used for row creation.  Note
            that every row in the tunnelIfTable with a fixed
            destination address should have a corresponding row in
            the tunnelInetConfigTable, regardless of whether it
            was created via SNMP."
        ::= { tunnel 3 }

    tunnelInetConfigEntry OBJECT-TYPE
        SYNTAX     TunnelInetConfigEntry
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
            "An entry (conceptual row) containing the information
            on a particular configured tunnel.  Note that there is
            a 128 subid maximum for object OIDs.  Implementers
            need to be aware that if the total number of octets in
            tunnelInetConfigLocalAddress and
            tunnelInetConfigRemoteAddress exceeds 110 then OIDs of
            column instances in this table will have more than 128
            sub-identifiers and cannot be accessed using SNMPv1,
            SNMPv2c, or SNMPv3.  In practice this is not expected
            to be a problem since IPv4 and IPv6 addresses will not
            cause the limit to be reached, but if other types are
            supported by an agent, care must be taken to ensure
            that the sum of the lengths do not cause the limit to
            be exceeded."
        INDEX      { tunnelInetConfigAddressType,
                     tunnelInetConfigLocalAddress,
                     tunnelInetConfigRemoteAddress,
                     tunnelInetConfigEncapsMethod,
                     tunnelInetConfigID }
        ::= { tunnelInetConfigTable 1 }

    TunnelInetConfigEntry ::= SEQUENCE {
        tunnelInetConfigAddressType         InetAddressType,
        tunnelInetConfigLocalAddress        InetAddress,
        tunnelInetConfigRemoteAddress       InetAddress,
        tunnelInetConfigEncapsMethod        IANAtunnelType,
        tunnelInetConfigID                  Integer32,
        tunnelInetConfigIfIndex             InterfaceIndexOrZero,
        tunnelInetConfigStatus              RowStatus,
        tunnelInetConfigStorageType         StorageType
    }

    tunnelInetConfigAddressType OBJECT-TYPE
```

```
        SYNTAX     InetAddressType
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "The address type over which the tunnel encapsulates
                packets."
        ::= { tunnelInetConfigEntry 1 }

    tunnelInetConfigLocalAddress OBJECT-TYPE
        SYNTAX     InetAddress
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "The address of the local endpoint of the tunnel, or
                0.0.0.0 (for IPv4) or :: (for IPv6) if the device is
                free to choose any of its addresses at tunnel
                establishment time."
        ::= { tunnelInetConfigEntry 2 }

    tunnelInetConfigRemoteAddress OBJECT-TYPE
        SYNTAX     InetAddress
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "The address of the remote endpoint of the tunnel."
        ::= { tunnelInetConfigEntry 3 }

    tunnelInetConfigEncapsMethod OBJECT-TYPE
        SYNTAX     IANAtunnelType
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "The encapsulation method used by the tunnel."
        ::= { tunnelInetConfigEntry 4 }

    tunnelInetConfigID OBJECT-TYPE
        SYNTAX     Integer32 (1..2147483647)
        MAX-ACCESS not-accessible
        STATUS     current
        DESCRIPTION
                "An identifier used to distinguish between multiple
                tunnels of the same encapsulation method, with the
                same endpoints.  If the encapsulation protocol only
                allows one tunnel per set of endpoint addresses (such
                as for GRE or IP-in-IP), the value of this object is
                1.  For encapsulation methods (such as L2F) which
                allow multiple parallel tunnels, the manager is
                responsible for choosing any ID which does not
```

```
                conflict with an existing row, such as choosing a
                random number."
        ::= { tunnelInetConfigEntry 5 }

    tunnelInetConfigIfIndex OBJECT-TYPE
        SYNTAX     InterfaceIndexOrZero
        MAX-ACCESS read-only
        STATUS     current
        DESCRIPTION
                "If the value of tunnelInetConfigStatus for this row
                is active, then this object contains the value of
                ifIndex corresponding to the tunnel interface.  A
                value of 0 is not legal in the active state, and means
                that the interface index has not yet been assigned."
        ::= { tunnelInetConfigEntry 6 }

    tunnelInetConfigStatus OBJECT-TYPE
        SYNTAX     RowStatus
        MAX-ACCESS read-create
        STATUS     current
        DESCRIPTION
                "The status of this row, by which new entries may be
                created, or old entries deleted from this table.  The
                agent need not support setting this object to
                createAndWait or notInService since there are no other
                writable objects in this table, and writable objects
                in rows of corresponding tables such as the
                tunnelIfTable may be modified while this row is
                active.

                To create a row in this table for an encapsulation
                method which does not support multiple parallel
                tunnels with the same endpoints, the management
                station should simply use a tunnelInetConfigID of 1,
                and set tunnelInetConfigStatus to createAndGo.  For
                encapsulation methods such as L2F which allow multiple
                parallel tunnels, the management station may select a
                pseudo-random number to use as the tunnelInetConfigID
                and set tunnelInetConfigStatus to createAndGo.  In the
                event that this ID is already in use and an
                inconsistentValue is returned in response to the set
                operation, the management station should simply select
                a new pseudo-random number and retry the operation.

                Creating a row in this table will cause an interface
                index to be assigned by the agent in an
                implementation-dependent manner, and corresponding
                rows will be instantiated in the ifTable and the
```

```
                tunnelIfTable.  The status of this row will become
                active as soon as the agent assigns the interface
                index, regardless of whether the interface is
                operationally up.

                Deleting a row in this table will likewise delete the
                corresponding row in the ifTable and in the
                tunnelIfTable."
        ::= { tunnelInetConfigEntry 7 }

    tunnelInetConfigStorageType OBJECT-TYPE
        SYNTAX     StorageType
        MAX-ACCESS read-create
        STATUS     current
        DESCRIPTION
                "The storage type of this row.  If the row is
                permanent(4), no objects in the row need be writable."
        ::= { tunnelInetConfigEntry 8 }

    -- conformance information

    tunnelMIBConformance
                        OBJECT IDENTIFIER ::= { tunnelMIB 2 }
    tunnelMIBCompliances
                        OBJECT IDENTIFIER ::= { tunnelMIBConformance 1 }
    tunnelMIBGroups  OBJECT IDENTIFIER ::= { tunnelMIBConformance 2 }

    -- compliance statements

    tunnelMIBCompliance MODULE-COMPLIANCE
        STATUS  deprecated
        DESCRIPTION
                "The (deprecated) IPv4-only compliance statement for
                the IP Tunnel MIB.

                This is deprecated in favor of
                tunnelMIBInetFullCompliance and
                tunnelMIBInetReadOnlyCompliance."
        MODULE  -- this module
        MANDATORY-GROUPS { tunnelMIBBasicGroup }

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

            OBJECT      tunnelIfTOS
            MIN-ACCESS  read-only
```

```
            DESCRIPTION
                "Write access is not required."

            OBJECT      tunnelConfigStatus
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required."
        ::= { tunnelMIBCompliances 1 }

    tunnelMIBInetFullCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
                "The full compliance statement for the IP Tunnel MIB."
        MODULE  -- this module
        MANDATORY-GROUPS { tunnelMIBInetGroup }

            OBJECT      tunnelIfAddressType
            SYNTAX      InetAddressType { ipv4(1), ipv6(2),
                                          ipv4z(3), ipv6z(4) }
            DESCRIPTION
                "An implementation is only required to support IPv4
                and/or IPv6 addresses.  An implementation only needs to
                support the addresses it actually supports on the
                device."
        ::= { tunnelMIBCompliances 2 }

    tunnelMIBInetReadOnlyCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
                "The read-only compliance statement for the IP Tunnel
                MIB."
        MODULE  -- this module
        MANDATORY-GROUPS { tunnelMIBInetGroup }

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

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

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

```
            OBJECT      tunnelIfAddressType
            SYNTAX      InetAddressType { ipv4(1), ipv6(2),
                                          ipv4z(3), ipv6z(4) }
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.

                An implementation is only required to support IPv4
                and/or IPv6 addresses.  An implementation only needs to
                support the addresses it actually supports on the
                device."

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

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

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

            OBJECT      tunnelInetConfigStatus
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required, and active is the only
                status that needs to be supported."

            OBJECT      tunnelInetConfigStorageType
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required."
        ::= { tunnelMIBCompliances 3 }

    -- units of conformance

    tunnelMIBBasicGroup OBJECT-GROUP
        OBJECTS { tunnelIfLocalAddress, tunnelIfRemoteAddress,
           tunnelIfEncapsMethod, tunnelIfHopLimit, tunnelIfTOS,
           tunnelIfSecurity, tunnelConfigIfIndex, tunnelConfigStatus }
        STATUS  deprecated
        DESCRIPTION
                "A collection of objects to support basic management
```

```
                of IPv4 Tunnels.  Since this group cannot support
                IPv6, it is deprecated in favor of
                tunnelMIBInetGroup."
        ::= { tunnelMIBGroups 1 }

    tunnelMIBInetGroup OBJECT-GROUP
        OBJECTS { tunnelIfAddressType, tunnelIfLocalInetAddress,
           tunnelIfRemoteInetAddress, tunnelIfEncapsMethod,
           tunnelIfEncapsLimit,
           tunnelIfHopLimit, tunnelIfTOS, tunnelIfFlowLabel,
           tunnelIfSecurity, tunnelInetConfigIfIndex,
           tunnelInetConfigStatus, tunnelInetConfigStorageType }
        STATUS  current
        DESCRIPTION
                "A collection of objects to support basic management
                of IPv4 and IPv6 Tunnels."
        ::= { tunnelMIBGroups 2 }

    END
```

5. IANA Considerations

This document introduces a new IANA-maintained textual convention (TC) which has been added to the IANAifType-MIB [IFTYPE]. The initial version of this IANAtunnelType TC can be found in Appendix A. The current version of the textual convention can be accessed at http://www.iana.org/assignments/ianaiftype-mib

The assignment policy for IANAtunnelType values should always be identical to the policy for assigning IANAifType values.

New types of tunnels over IPv4 or IPv6 should not be assigned IANAifType values. Instead, they should be assigned IANAtunnelType values and hence reuse the interface type tunnel(131). (Note this restriction does not apply to "tunnels" which are not over IPv4 or IPv6.)

Previously, tunnel types that were not point-to-point tunnels were problematic in that they could not be properly expressed in the tunnel MIB, and hence were assigned IANAifType values. This document now corrects this problem, and as a result, IANA has deprecated the sixToFour(215) IANAifType value in favor of the sixToFour(11) IANAtunnelType value.

6. Security Considerations

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

Unauthorized write access to any of the writable objects could cause unauthorized creation and/or manipulation of tunnels, resulting in a denial of service, or redirection of packets to an arbitrary destination.

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP.

Unauthorized read access to tunnelIfLocalInetAddress, tunnelIfRemoteInetAddress, tunnelIfLocalAddress, tunnelIfRemoteAddress, or any object in the tunnelConfigTable or tunnelInetConfigTable would reveal information about the tunnel topology.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPSec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module.

It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).

Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

7. Changes Since RFC 2667

IPv4-specific objects were deprecated, including tunnelIfLocalAddress, tunnelIfRemoteAddress, the tunnelConfigTable, and the tunnelMIBBasicGroup.

Added IP version-agnostic objects that should be used instead, including tunnelIfAddressType, tunnelIfLocalInetAddress, tunnelIfRemoteInetAddress, the tunnelInetConfigTable, and the tunnelIMIBInetGroup.

The new tunnelIfLocalInetAddress and tunnelIfRemoteInetAddress objects are read-write, rather than read-only.

Updated DESCRIPTION clauses of existing version-agnostic objects (e.g., tunnelIfTOS) that contained IPv4-specific text to cover IPv6 as well.

Added tunnelIfFlowLabel for tunnels over IPv6.

The encapsulation method was previously an INTEGER type, and is now an IANA-maintained textual convention.

8. Acknowledgements

This MIB module was updated based on feedback from the IETF's Interfaces MIB (IF-MIB), Point-to-Point Protocol Extensions (PPPEXT), and IPv6 Working Groups. Mike Heard and Ville Nuorvala also provided valuable MIB guidance on this version.

Appendix A: IANA Tunnel Type TC

This appendix defines the initial content of the IANAtunnelType textual convention. The most up-to-date and current version is maintained in the IANAifType-MIB.

```
IANAtunnelType ::= TEXTUAL-CONVENTION
    STATUS     current
    DESCRIPTION
            "The encapsulation method used by a tunnel.  The value
            direct indicates that a packet is encapsulated
            directly within a normal IP header, with no
            intermediate header, and unicast to the remote tunnel
            endpoint (e.g., an RFC 2003 IP-in-IP tunnel, or an RFC
            1933 IPv6-in-IPv4 tunnel).  The value minimal indicates
            that a Minimal Forwarding Header (RFC 2004) is
            inserted between the outer header and the payload
            packet.  The value UDP indicates that the payload
            packet is encapsulated within a normal UDP packet
            (e.g., RFC 1234).

            The values sixToFour, sixOverFour, and isatap
            indicates that an IPv6 packet is encapsulated directly
            within an IPv4 header, with no intermediate header,
            and unicast to the destination determined by the 6to4,
            6over4, or ISATAP protocol.

            The remaining protocol-specific values indicate that a
            header of the protocol of that name is inserted
            between the outer header and the payload header.

            The assignment policy for IANAtunnelType values is
            identical to the policy for assigning IANAifType
            values."
    SYNTAX     INTEGER {
                   other(1),        -- none of the following
                   direct(2),       -- no intermediate header
                   gre(3),          -- GRE encapsulation
                   minimal(4),      -- Minimal encapsulation
                   l2tp(5),         -- L2TP encapsulation
                   pptp(6),         -- PPTP encapsulation
                   l2f(7),          -- L2F encapsulation
                   udp(8),          -- UDP encapsulation
                   atmp(9),         -- ATMP encapsulation
                   msdp(10),        -- MSDP encapsulation
                   sixToFour(11),   -- 6to4 encapsulation
                   sixOverFour(12), -- 6over4 encapsulation
                   isatap(13),      -- ISATAP encapsulation
```

```
                    teredo(14)       -- Teredo encapsulation
                }
```

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