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IP Tunnel MIB

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Abstract

This memo defines a Management Information Base (MIB) 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 MIBs may be designed for managing protocol-specific objects. Likewise, extension MIBs may be designed for managing security-specific objects. This MIB does not support tunnels over non-IP networks. Management of such tunnels may be supported by other MIBs.

1. Introduction

Over the past several years, there have 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) used for managing tunnels of any type over IPv4 and IPv6 networks, including GRE [RFC1701,RFC1702], IP-in-IP [RFC2003], Minimal Encapsulation [RFC2004], L2TP [RFC2661], PPTP [RFC2637], L2F [RFC2341], UDP (e.g., [RFC1234]), ATMP [RFC2107], and IPv6-in-IPv4 [RFC2893] tunnels, among others.

Extension MIBs may be designed for managing protocol-specific objects. Likewise, extension MIBs 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.

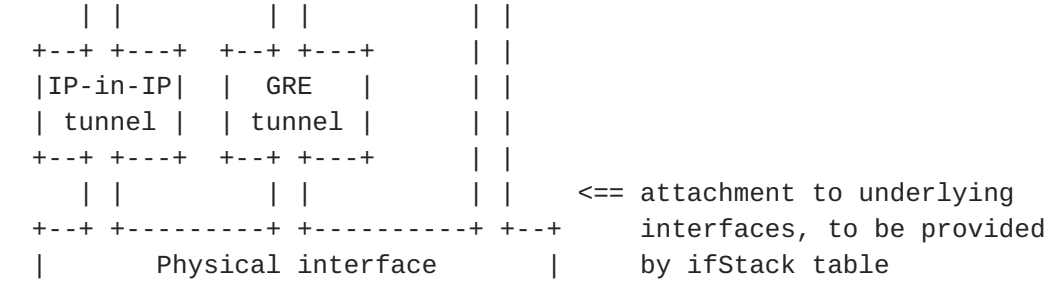
The version of this MIB that appeared in RFC 2667 contained the Tunnel Config Table, which mapped IPv4 endpoint addresses to interface indexes. It is now deprecated in favor of the Tunnel Inet Config Table.

3.1. Relationship to the Interfaces MIB

This section clarifies the relationship of this MIB 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 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 MIBs 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 MIBs 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 will exist for every ifEntry with this ifType. An implementation of the IP Tunnel MIB 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 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 which 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.

3.1.4. ifEntry

IfEntries are defined in the MIBs 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 will exist for every ifEntry with this ifType. An implementation of the IP Tunnel MIB 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.

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4. Definitions

```
TUNNEL-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, transmission,
    Integer32, IpAddress             FROM SNMPv2-SMI
    RowStatus, StorageType           FROM SNMPv2-TC
    MODULE-COMPLIANCE, OBJECT-GROUP  FROM SNMPv2-CONF
    InetAddressType, InetAddress     FROM INET-ADDRESS-MIB
    IPv6FlowLabelOrAny               FROM IPV6-FLOW-LABEL-MIB
    ifIndex, InterfaceIndexOrZero    FROM IF-MIB
    IANAtunnelType                   FROM IANAifType-MIB;

tunnelMIB MODULE-IDENTITY
    LAST-UPDATED "200401191200Z" -- January 19, 2003
    ORGANIZATION "IETF Interfaces MIB 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 (date).  This
            version of this MIB module is part of RFC yyyy;  see
            the RFC itself for full legal notices."
-- RFC Ed.: replace yyyy with actual RFC number & remove this note
    REVISION     "199908241200Z" -- August 24, 1999
    DESCRIPTION
            "Initial version, published as RFC 2667."
    REVISION     "200401191200Z" -- January 19, 2003
    DESCRIPTION
            "Added support for IPv6.  Published as RFC yyyy."
-- RFC Ed.: replace yyyy with actual RFC number & remove this note
    ::= { 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
}

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.  This object 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).  This object 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..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 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 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.  A
            value between 0 and 63 inclusive indicates that the
            bit field is set to the indicated value."
    ::= { 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 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."
    ::= { 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."
    ::= { tunnelIfEntry 10 }

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.  This table 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."
    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."
    ::= { tunnelConfigEntry 1 }

tunnelConfigRemoteAddress OBJECT-TYPE
    SYNTAX     IpAddress
    MAX-ACCESS not-accessible
    STATUS     deprecated
    DESCRIPTION
            "The address of the remote endpoint of the tunnel."
    ::= { tunnelConfigEntry 2 }

tunnelConfigEncapsMethod OBJECT-TYPE
    SYNTAX     IANAtunnelType
    MAX-ACCESS not-accessible
    STATUS     deprecated
    DESCRIPTION
            "The encapsulation method used by the tunnel."
    ::= { 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."
    ::= { 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."
    ::= { 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."
    ::= { 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.  In practice this
            is not expected to be a problem since IPv4 and IPv6
            addresses will not cause the limit to be reached.  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."
    MODULE  -- this module
    MANDATORY-GROUPS { tunnelMIBGroup }

        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 }

tunnelMIBInetReadWriteCompliance MODULE-COMPLIANCE
    STATUS  deprecated
    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."

        OBJECT       tunnelInetConfigStatus
        SYNTAX       RowStatus { active(1) }
        WRITE-SYNTAX RowStatus { createAndGo(4), destroy(6) }
        DESCRIPTION
            "Support for createAndWait and notInService is not
```

```
            required."
   ::= { tunnelMIBCompliances 2 }

tunnelMIBInetReadOnlyCompliance MODULE-COMPLIANCE
    STATUS  deprecated
    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      tunnelInetConfigStatus
        SYNTAX      RowStatus { active(1) }
        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

tunnelMIBGroup 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."
    ::= { tunnelMIBGroups 1 }

tunnelMIBInetGroup OBJECT-GROUP
    OBJECTS { tunnelIfAddressType, tunnelIfLocalInetAddress,
       tunnelIfRemoteInetAddress, tunnelIfEncapsMethod,
       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 is to be added to the IANAifType-MIB. 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 policy for assigning new IANAtunnelType values is First Come First Served, as defined in [RFC2434], just as it is for new IANAifTypes values. 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 which 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 should deprecate 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. Acknowledgements

This MIB module was updated based on feedback from the IETF's Interfaces MIB (IF-MIB) and Point-to-Point Protocol Extensions (PPPEXT) Working Groups.

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11. Appendix A: IANA Tunnel Type TC

This appendix defines the initial content of the IANAtunnelType textual convention which should appear 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."
    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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